POLICY RESEARCH WORKING PAPER   10520

Revisiting the Distributive Impacts of Fiscal Policy in Colombia

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WORLD BANK GROUP
Poverty and Equity Global Practice
July 2023

Abstract

Colombia is one of the most unequal countries in the region and the world. Given the redistributive role of fiscal policy, this study uses recent data from the 2021 Integrated Household Survey to explore the impacts of taxes and spending on poverty and inequality in Colombia. The study introduces innovations to the literature on Colombia, including an update of the fiscal microsimulation model to reflect the most recent economic context; an introduction of new fiscal policy parameters, such as gasoline subsidies and carbon taxes; and methodological improvements. The results show positive redistributive impacts, but these are considerably lower than those seen in other counties members of the Organisation for Economic Co-operation and Development (OECD). Direct taxes and transfers reduce the Gini index from 0.543 to 0.505; and direct taxes, indirect taxes, subsidies, and monetary transfers reduce total poverty from 42.1 to 40.2 percent and extreme poverty from 16.1 to 11.7 percent. Direct taxes, transfers, and subsidies are progressive and contribute to poverty reduction, while indirect taxes such as the value-added tax or consumption tax are regressive and do not reduce poverty. This reflects a tax system that is progressive, but not progressive enough (with a low proportion of the population with high levels of income contributing), and cash transfer and subsidy programs that have room for improvement in their targeting.

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1. Introduction

The objective of this study is to analyze the distributive impact of fiscal policy in Colombia. In other words, it analyzes the impact of direct and indirect taxes, subsidies, and social spending on transfers to households, education, and health on poverty and inequality. It explores questions such as how much redistribution and poverty reduction is achieved through the tax system in Colombia? Who pays taxes and who receives benefits, and how equalizing and pro-poor are fiscal interventions? Although previous work has conducted similar analyses (see Lustig et al., 2014; Núñez et al., 2020), Colombia's socioeconomic context has changed significantly in recent years for various reasons, including the impact of the COVID-19 crisis, and changes in fiscal system parameters that have also been observed (with the introduction of new taxes and social programs, for example). These changes merit looking over previous findings. For example, Colombia has implemented various efforts to improve its social protection system, such as the introduction of new programs and the consolidation of a social registry. In the last ten years, Colombia has implemented seven tax reforms, the most recent presented in November 2022, which have been characterized by trying to counteract imbalances in the system (OECD, DIAN and MHCP, 2021; Bonilla et al., 2016).

The COVID-19 crisis severely affected Colombia. After a significant drop in monetary poverty from 2012 to 2019 (from 40.8 percent to 35.5 percent), the economy contracted by 6.8 percent in 2020 and the poverty rate increased by seven (7) percentage points, reaching 42.5 percent. Similarly, extreme poverty increased from 9.6 percent in 2019 to 15.1 percent in 2020, its highest level since 2012, resulting in 2.8 million new people in extreme poverty and unable to meet their basic needs. The arrival of the pandemic exacerbated Colombia's inequality landscape, raising its Gini coefficient from 0.526 in 2019 to 0.544 in 2020, driven by an increase in inequality in both rural and urban areas. Government emergency transfers mitigated about a quarter of the negative poverty impact of the COVID-19 crisis. In the absence of emergency transfers, poverty at the national level would have increased by a further 2.2 percentage points and by as much as 4.2 in rural areas.[2]

While economic recovery has been observed in 2021 and 2022, inequality remains high and persistent. Recovery in 2021, with an economic growth rate of 10.6 percent, led to a decline in poverty, although poverty levels remained 3.2 percentage points higher than they were before the pandemic (5.9 percentage points higher in extreme poverty). The recovery in living standards observed in 2021 did not reach Afro-descendant, indigenous, migrant, and rural groups. On the inequality side, although the Gini coefficient decreased to 0.523 in 2021, mainly due to a decrease in urban inequality and the partial recovery of employment levels, Colombia's rate persists as one of the highest in the region and the world.

To study the distributive impact of the fiscal system in Colombia and building on the methodology of Núñez et al. (2020), this study introduces innovations and updates to the literature.

First, for the first time in this type of analysis, the GEIH is used as the base data source for the analysis. The GEIH is the official annual source of household income data in Colombia, and periodically captures the dynamics of the labor market and household income and, thus, reports

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[2] DANE (Colombian National Statistics Institute) data.

annually on the level of poverty and inequality in the country. Therefore, aligning the model results with this information source not only enables more frequent updating of the models, but also provides synchronization with national poverty measurements. The GEIH is complemented in the analysis by other expenditure surveys (using imputation models) and sources of administrative and national accounts data. In addition, the study uses the 2021 GEIH as its base. GEIH information collection is monthly and periodic, which provides a much more recent context and shows the impact of the COVID-19 crisis and the nature of recovery.

Second, taking into account the high levels of inequality in Colombia and the persistent problem that higher income individuals are not observed in household surveys, this study models the upper part of the income distribution with data on taxpayers from the National Tax and Customs Agency (DIAN, as per the acronym in Spanish) following the methodology of Blanchet et al. (2022). This allows for a more accurate assessment of the impact of direct taxes.

Third, the study introduces new fiscal policy parameters. In particular, it models the redistributive impacts of the national carbon, gasoline and motor fuel oil or diesel (ACPM, as per the acronym in Spanish) tax, in addition to gasoline and ACPM subsidies, as well as emerging social programs such as *Ingreso Solidario* (unconditional cash transfer program introduced during the COVID-19 crisis as an emergency program and concluded in December 2022), and the VAT refund transfer. It also introduces new information on the targeting instrument used in Colombia to define eligibility for social programs. In particular, Sisbén IV (a unified vulnerability assessment and identification system for social assistance) was calculated based on the socioeconomic characteristics of households in 2021 GEIH, which improved the allocation of social programs in the model.

Fourth, since microsimulation models are inevitably based on assumptions, this paper presents different approaches to estimate certain parameters. For example, for income tax exemptions and deductions -a very important element of the Colombian tax system-, different sources of information are used, including both GEIH data to identify exemption and deduction criteria to inform microsimulations, and DIAN information at the level of milli-quantiles of gross income to capture heterogeneity across the income distribution. Additionally, following the most recent methodological recommendations on allocations of public spending on health and education, this paper does not rescale or adjust these transfers with reference to national accounts. However, comparative data are provided for both methods.

The main results show that Colombia's fiscal system contributes to reducing poverty and inequality but continues to do so in a limited fashion. The impact of the tax system, without health and education in-kind transfers, reduces the Gini from 0.543 to 0.508. Only by accounting for those (non-rescaled) in-kind transfers does its impact increase, going from 0.543 to 0.418. The tax system reduces total poverty from 42.1 percent to 40.1 percent, and extreme poverty from 16.1 percent to 11.9 percent. The net benefit of the tax system reaches those in income decile five. That said, Colombia's fiscal system has a low redistributive impact relative to other countries (see also World Bank, 2021). Income tax, although progressive in design, is not progressive enough and reduces inequality in a very limited way. It is observed that the richest 10 percent of the population pays 98 percent of this tax, even though the recent 2022 reform proposed advances in limiting the level of tax deductions and exemptions. As for cash transfers (which include social

programs implemented during the COVID-19 crisis such as VAT compensation and Ingreso Solidario) and subsidies, these have an important impact on reducing poverty and inequality, with a significant weight on those with lower incomes, but there is still room to improve the targeting of these resources at poor and vulnerable households. Finally, spending on education and health contributes significantly to reducing inequality. With regards to the methodology for capturing the redistributive magnitude of spending on health and education, there is room for improvement, as this does not capture the significant variation in the quality of these services received by the population, which depends, among other elements, on place of residence (World Bank, 2021).

The main contribution of this study is to offer relevant information for public policies, in a context of high inequality and in which equity has been placed at the heart of the development agenda. The 2022-2026 National Development Plan puts equity at the center of the policy agenda. One of the fundamental tools for reducing inequality in most countries is fiscal policy. Understanding the scope of the different elements of fiscal policy in Colombia can complement macroeconomic stability and economic efficiency analyses from the point of view of equity.

The rest of the paper is organized as follows. Following this introduction, section 2 describes Colombia's revenue and expenditure structure, and section 3 discusses the data and methodology employed. Section 4 analyzes redistributive impacts on poverty and inequality, and section 5 presents the impact of taxes and social spending in terms of progressivity. To understand the impact of the recently introduced 2022 tax reform, section 6 presents the impact of the taxes promoted by this reform. Finally, Section 7 contains the conclusion and discusses the results. The annexes provide much more detailed information on methodology, data, and assumptions.

2. Fiscal policies in Colombia: A description of the tax and social spending system

The distribution of the tax burden, the level of spending and its composition with regards to the beneficiary population to a large extent determine the impacts of fiscal policy on income distribution and poverty levels. Based on the year 2021, the following is a description of the tax and social spending system in Colombia, starting with direct and indirect taxes and continuing with public transfer programs and subsidies.

2.1 Tax revenues

Table 1 shows the structure of government revenues broken down by the main categories, highlighting the size with respect to GDP for the year 2021. The total amount collected by the government in 2021, considering central national government tax revenues and social security contributions, is equivalent to 229,652 billion pesos, which corresponds to 19.5 percent of GDP. Taxes were an important source of resources, representing 14.1 percent of GDP. Of tax revenue, 45 percent corresponds to income and complementary taxes, with collections amounting to 73,168 billion pesos, followed by internal VAT (27 percent), other external indirect taxes including external VAT (19 percent), financial transaction tax (6 percent), consumption tax (1 percent), fuel tax (1 percent), and temporary wealth tax (0.6 percent).

Table 1. Revenue structure of the Government of Colombia, 2021

	Fiscal accounts		Proportion of fiscal accounts analyzed		Integrated Household Survey (GEIH) Totals	GEIH and fiscal relationship
	In billions of pesos (1)	% of GDP (2)	In billions of pesos (3)	% of GDP (4)	In billions of pesos (5)	(%) (% of total in survey vs. fiscal accounts) (6)
Total revenues	229,652	19.5%	123,114	10.5%	71,685	31.2%
Tax revenues	165,510	14.1%	60,424	5.1%	21,465	13.0%
Income and complementary taxes	73,168	6.2%	12,083	1.0%		5.1%
Personal income tax	12,083	1.0%	12,083	1.0%	3,762	31.1%
Corporate income tax	61,085	5.2%				
Internal VAT	43,644	3.7%	43,644	3.7%	14,837	34.0%
National fuel tax	1,800	0.2%	1,800	0.2%	545	30.3%
National consumption tax	1,531	0.1%	1,531	0.1%	1,302	85.1%
National carbon tax	334	0.0%	334	0.0%	156	46.7%
Wealth tax*.	1,032	0.1%	1,032	0.1%	863	83.6%
Financial transaction tax	9,743	0.8%				
External VAT and tariffs	33,834	2.9%				
Other taxes	424	0.0%				
Social security	62,691	5.3%	62,691	5.3%	50,220	80.1%
Non-tax income and other	1,451	0.1%				

Source: Authors' estimates based on Ministry of Finance and Public Credit (MHCP, as per the acronym in Spanish), DANE, DIAN and UGPP.

Notes: Social security contributions correspond to UGPP reports in the social security dashboard for health, pension, and labor risks for 2021. Personal income tax corresponds to the total tax collected in 2020 and reported in DIAN form 210 from individuals not required to keep accounting records. The temporary wealth tax corresponds to 2021.

This study analyzes the income tax collection corresponding to individuals (16.4 percent of the total income tax collection), internal VAT, the national fuel, consumption, and carbon taxes, as well as the temporary wealth tax in 2021, and social security contributions. Thus, the portion analyzed, which includes only the taxes modeled in this paper, corresponds to 54 percent of total central government revenues, 10.5 percent of GDP (Table 1, column 4). The relationship between what the GEIH captures, and the fiscal accounts or administrative data is presented in column 6 of Table 1. This ratio will not equal 100 percent, because the household survey does not capture contributions from businesses, or governmental or non-governmental organizations, as the administrative data does. For example, comparing the value of disposable income from the household survey with final household consumption expenditure from the national accounts gives a ratio of 57 percent. A detailed macro-validation of each policy is shown in the annexes section. Nevertheless, in general terms, the model captures 31.2 percent of total collections and 58 percent of the analyzed collections.[3]

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[3] The proportion of results analyzed refer to column 5 as a proportion of column 3 taken from Table 1.

2.1.1 Direct taxes and social security contributions

The Personal Income Tax is paid by individuals whose annual gross income is equal to or greater than 1,400 UVTs (Tax Value Units) and whose gross net worth is equal to or greater than 4,500 UVTs. In 2021, the UVT was 36,308 pesos (22.2 USD PPP 2017). The tax statute defines the taxable income in accordance with the main sources of income by deducting income that does not constitute earned income (e.g., social security contributions) and current legal deductions and exemptions. Among the main tax exemptions are voluntary contributions to special savings Accounts for prospective homeowners (AFC, as per the acronym in Spanish), voluntary pension funds (FVP, as per the acronym in Spanish), and/or Voluntary Contractual Savings Accounts (AVC, as per the acronym in Spanish), deduction for economic dependents, deductions for 25 percent of labor income limited to 2,880 UVT per year, and deductions in interest on housing mortgage loans, among others. The tax statute defining income tax returns in 2021 considers Tax Law 2155 of 2021. The DIAN classifies the sources of income in a schedular system[4] to establish specific treatment rules.

Law 2010 of 2019 classified income in three schedules. The general schedule includes income from earned income, professional fees, capital, and unearned income, as well as schedules for pensions, dividends, and profit shares. While the same rates are applied to the general and pension income as defined by the tax statute, in 2021, the Colombian regulation included a differential rate for income from dividends and profit shares, as well as for non-recurring income. In 2021, 12,083 billion pesos were collected from personal income taxes; in turn, 61,083 billion pesos corresponded to taxes paid by legal entities or companies.

In contrast, the temporary wealth tax, as established by Law 1943 of 2018, is based on liquid assets,[5] which are estimated after deducting the associated debts and the first 13,500 UVT of the value of the house or apartment where taxpayer lives. Wealth tax revenue in 2021 amounted to 1,032 billion COP. As for contributions to the social security system, employers, employees, and pensioners all contribute to the system according to their payment capacity. Contributions are made in accordance with pension, health, and labor risk subsystems. It is important to note that, conceptually, in the structure of Colombian fiscal accounts, these are not part of the Colombia Government Budget (PGN, as per the acronym in Spanish); however, they are included in revenues in the present study for consistency with previous studies, as well as to illustrate the general panorama of fiscal revenues. Annex 9.2 shows the composition of personal income tax, wealth tax, and social security contributions. At the same time, its modeling is described.

2.1.2 Indirect taxes

The domestic VAT or value-added tax, which applies to household consumption, accounted for 3.7 percent of GDP in 2021, equivalent to 43,644 billion COP. Special taxes include the national

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[4] In terms of personal income taxes, the DIAN defines the schedules (or schedular income) as a classification of income to which specific rates and treatment rules apply. There are three schedules: the general category, which includes labor, non-labor, and capital income; the pension category, and the dividend category.
[5] Liquid or net wealth is the result of subtracting total liabilities from gross net wealth.

consumption tax; fuel taxes, mainly on gasoline and ACPM or diesel; the carbon tax; and the tax on alcoholic beverages and cigarettes. The national consumption tax applies a rate of 8 percent on the consumption of products in restaurants and consumption in bars or other establishments, as well as 4 percent on cellular phone services.

Regarding the fuel tax, Law 1819 of 2016 established a rate per gallon, which in 2021 was set at 586.25 pesos per gallon of regular motor gasoline and 561.12 per gallon of ACPM or diesel. The same Law 1819 of 2016 created the national carbon tax as part of the strategies defined to address international commitments to reduce greenhouse gas emissions during their combustion. This tax is levied on fossil fuels used for energy purposes for combustion such as gasoline, ACPM or diesel, jet fuel, kerosene, and fuel oil. This includes a specific tariff that considers the carbon dioxide emission factor as a unit of volume per energy unit. This study only considers the consumption tax on ordinary motor gasoline and ACPM or diesel, since these are those consumed directly by households, in addition to being captured in the household survey. Thus, the taxation rate per gallon of gasoline as of 2021 was 159 pesos, while the rate for ACPM was 179 pesos per gallon.

2.2 Public spending

In 2021, government spending stood at 353,582 billion pesos, this is equivalent to 30 percent of GDP (see Table 2). Nearly half of public spending is concentrated on social inclusion and protection, education, health, and subsidies. Education spending accounts for 17.3 percent of total spending (5.2 percent of GDP), followed by spending on social inclusion and protection with 16.4 percent (4.9 percent of GDP), which includes multiple conditional and unconditional transfer programs, as well as public spending on pensions. Health spending also has an important weight, accounting for 15.5 percent of total spending (4.6 percent of GDP). Approximately 15,841 billion pesos are allocated to public subsidies, net of contributions. This study analyzes 35.5 percent of the expenses reported in 2021, where all spending is on the aforementioned items. The following is a brief description of the expenses considered in the study.

2.2.1   Direct transfers

Direct transfers, both conditional and unconditional, represent about 0.75 percent of GDP, a proportion that, when pensions are added, amounts to 3.85 percent of GDP. The following is a description of the main direct transfer programs in force in Colombia through 2021.

Table 2. Structure of public spending in Colombia, 2021

	Fiscal accounts		Proportion of fiscal accounts analyzed		Integrated Household Survey (GEIH) Totals	GEIH and fiscal relationship
	In billions of pesos (1)	% of GDP (2)	In billions of pesos (2)	% of GDP (3)	In billions of pesos (4)	(%) (5)
Total expense	**353,582**	**30.0%**	**145,239**	**12.3%**	**125,478**	**35.5%**
Social inclusion and social protection	**57,904**	**4.9%**	**45,264**	**3.8%**	**42,866**	94.7%
Colombia Mayor ("Elderly Colombia")	2,535	0.2%	2,535	**0.2%**	2,533	99.9%
Más Familias en Acción ("More Families in Action")	1,338	0.1%	1,338	**0.1%**	1,397	104.4%
Jóvenes en Acción ("Youth in Action")	587	0.05%	587	**0.0%**	586	99.9%
Ingreso Solidario ("Solidarity Income")	4,052	0.3%	4,052	**0.3%**	4,050	99.9%
VAT refund	846	0.1%	846	**0.1%**	811	95.8%
Pensions	35,906	3.1%	35,906	**3.1%**	33,490	93.3%
Other social protection expenses	12,640	1.1%				
Education	**61,143**	**5.2%**	**40,937**	**3.5%**	**38,179**	**93%**
School Meals Program	2,420	0.2%	2,420	**0.2%**	2,301	95%
Primary and secondary education	31,644	2.7%	31,644	**2.7%**	29,245	92%
Higher education	6,873	0.6%	6,873	**0.6%**	6,633	97%
Other education expenses	20,206	1.7%				
Health	**54,628**	**4.6%**	**44,200**	**3.8%**	**37,386**	**84.6%**
Subsidized Regime	25,929	2.2%	25,929	**2.2%**	23,712	91.4%
Contributory Regime	26,869	2.3%	18,271	**1.6%**	13,674	74.8%
Other health expenses	1,830	0.2%				
Subsidies minus contributions	**15,841**	**1.3%**	**14,838**	**1.3%**	**7,047**	**47.5%**
Household utilities (SPD, as per the acronym in Spanish)	3,939	0.3%	3,438		3,566	103.7%
- Natural gas (s-c)	819	0.1%	819	**0.1%**	815	99.5%
Subsidy	958	0.1%	958	**0.1%**	950	99.2%
Contributions	138	0.0%	138	**0.0%**	135	97.6%
- Electricity (s-c)	2,618	0.2%	2,618	**0.2%**	2,751	105.1%
Subsidy	4,039	0.3%	4,039	**0.3%**	4,177	103.4%
Contributions	1,421	0.1%	1,421	**0.1%**	1,426	100.4%
Other household utilities (SPD, as per the acronym in Spanish) minus contributions	502	0.0%				
Gasoline and ACPM subsidies	11,400	1.0%	11,400	**1.0%**	3,481	30.5%
Other expenses	**164,066**	**13.9%**		**0.0%**		

Source: Authors' estimates based on Ministry of Finance and Public Credit (MHCP, as per the acronym in Spanish), DANE (Colombian National Statistics Institute), ADRES (General Social Security System Resources Administrator), SUI (Sole Information System), UGPP (Pension and Parafiscal Management Unit), and Ministry of Mines and Energy.

Notes: health expenditure corresponds to that reported in the Colombia Government Budget. The equivalent values for the contributory and subsidized regime are estimated according to information from the General Social Security System Resources Administrator (ADRES, as per the acronym in Spanish) regarding the share of the resources of the nation's contributions for 2021. The pension amount corresponds to the amount reported by Colpensiones in 2021 and includes contributions from the nation and social security contributions. The administrative amount of the School Meals Program (PAE, as per the acronym in Spanish) corresponds to the sum of national resources and co-financing of the certified regional entities (ETC, as per the acronym in Spanish) according to 2021 reports from the Ministry of National Education's (MEN, as per the acronym in Spanish) Special Administrative Unit for School Meals Spending on primary, middle, and secondary education is based on SGP distribution reports plus the regional entities' own resources. Higher education includes resources for the operation of universities (Article 86 of Law 30 of 1992), contributions for the financing of specific higher education institutions, strengthening of higher education institutions, and professional training in the National Apprenticeship System reported in the 2021 Colombia Government Budget. Other education expenditures include early childhood care.

Jóvenes en Acción (Conditional cash transfer for young people): a conditional cash transfer program that seeks to encourage educational continuity among young people who have

completed secondary education. Young people between 16 and 24 years of age in who live in poverty and vulnerability who are studying at a technical, technological, or university level at a higher education institution (HEI) or the National Learning Service (SENA, as per the acronym in Spanish) are eligible to participate in the program. Monetary incentives are paid on a bimonthly basis. In 2021, this program delivered incentives to nearly 495,000 young people with a total value of 587 billion pesos. The program cost is equivalent to about 0.05 percent of GDP.

Colombia Mayor (cash transfer for elderly people): seeks to increase protection for the elderly and is assigned to men over 59 years of age and women over 54 years of age who are in poverty, lack sufficient income to subsist and do not have a pension, who have resided in the country for the last 10 years and are in groups A (extreme poverty), B (poverty) and up to subgroup C1 (vulnerability) of the Sisbén IV (Colombian target instrument of social programs) scheme. In 2021, 1.7 million adults were targeted with a total transfer of 2,535 billion pesos, equivalent to 0.2 percent of GDP.

Más Familias en Acción (Conditional cash transfers for poor and vulnerable families): a conditional cash transfer program that seeks to promote the training of human capital for families with children and adolescents under 18 years of age who live in conditions of poverty and extreme poverty through a differentiated economic incentive conditional on school attendance and health care. While education transfers are allocated to students according to the level of education completed, whose class attendance exceeds 80 percent, and who has not repeated more than two years in a row, the health incentive is allocated to each family with children under six years of age. In 2021, about 2.1 million families were part of the program, totaling 1,338 billion pesos transferred, or 0.1 percent of GDP.

Ingreso Solidario (emergency unconditional cash transfer): implemented in 2020 as a measure to mitigate the economic impacts of the COVID-19 pandemic on the most vulnerable households. This program was maintained in 2021 prioritizing households in extreme poverty and excluding households that are beneficiaries of other cash transfer programs. This unconditional transfer reached more than 3.4 million households with a budget of 4,052 billion pesos, or 0.3 percent of GDP. This program ended in December 2022.

VAT refund or compensation: unconditional cash transfer to poor and vulnerable households in order to alleviate the impact of the value added tax (VAT) on these households. Beneficiaries of social programs such as Familias en Acción or Colombia Mayor are eligible to receive this transfer. In 2021, just over 2.8 million households received the transfer, representing 846 billion pesos, or 0.1 percent of GDP.

School Meals Program (PAE): administered by the Ministry of National Education, this program provides food supplements in kind to students enrolled in public schools. Its purpose is to reduce student attrition, as well as to offer nutrients that satisfy students' caloric needs. The program has multiple sources of financing, including resources from the General Revenue-Sharing System and the own resources of the certified regional entities (ETC). In 2021, its budget amounted to

2.42 billion COP, with a share of 0.2 percent of GDP. The per capita value of potential beneficiaries is assigned using administrative data reported by the program (see annex 9.3).

Pensions: The pension system in Colombia is divided into two schemes. The first of the two is the Public Pension Scheme (RPM, as per the acronym in Spanish), which is managed by Colpensiones. The RPM takes social security pension contributions to finance current pension payments together with the contributions from the Colombia Government Budget. The pension age is 57 for women and 62 for men, who must have made contributions to the system for at least 1,300 weeks. Those who do not meet the requirements may be subject to receiving substitute compensation. In addition, there is a support mechanism, as pensioners with a higher income level contribute an additional percentage to contribute to the subsidy for vulnerable groups.

Secondly, in the Private Pension Savings Scheme (RAIS, as per the acronym in Spanish), managed by the Private Pension Funds (AFP, as per the acronym in Spanish), the savings are allocated to an individual account that will finance an individual's pension once the same age requirements for the RPM are met, and at least 1,150 weeks or more of contributions have been paid. If contributors do not achieve a level of savings that allows them to retire and receive a pension equivalent to one legal minimum wage, the shortfall is covered with resources from the minimum pension guarantee fund financed with contributions from higher-income pension fund members, or when certain requirements are met, a refund of savings plus financial returns is obtained. In general, salaried workers contribute four (4) percent to the pension system, while employers contribute the equivalent of 14 percent of the employee's salary. Self-employed workers pay the full rate of 16 percent of their earned income.

2.2.2   Indirect subsidies: Household public utilities, and gasoline and ACPM

Subsidies refer to indirect transfers, where the government subsidizes some part of consumption by reducing the price of the service according to area of residence. Two types of subsidies are included: subsidies for residential public utilities and fuel subsidies. Together, these account for 1.3 percent of GDP, equivalent to about 4.5 percent of total spending or 15,841 billion COP in 2021. Fuel subsidies account for almost three-quarters of the total amount allocated to subsidies in Colombia, with 11.4 billion pesos, followed by electricity subsidies, which, without subtracting contributions made by residential and non-residential areas, was equivalent to 4,039 billion pesos in 2021.

Public utilities are targeted according to socioeconomic stratum, a measure of housing characteristics such as floor, house exterior, or wall materials, among others. The dwellings are classified into six socioeconomic strata or industrial (non-residential) zones. Law 142 of 1994 established a cross-subsidy, whereby households whose socioeconomic stratum is level 1, 2, and 3 are recipients of net subsidies of up to 70 percent, 40 percent, and 15 percent, depending on the type of residential public service, and socioeconomic strata. Strata 4 is not eligible for subsidies, and strata 5 and 6, as well as dwellings classified as industrial or non-residential, contribute a net amount of close to 20 percent on top of their real utility use. This paper analyzes the subsidies for home electricity and natural gas utilities.

On the gasoline and ACPM subsidies side, by means of Law 1151 of 2007, the government created a price smoothing mechanism through the Fuel Price Stabilization Fund (FEPC, as per the acronym in Spanish), where the income of the gasoline and ACPM (or Diesel) producer is fixed according to the evolution of international fuel prices, containing their persistent volatility. However, the smoothing rule has not always been followed. What's more, that the FEPC has fallen into deficit, which has meant that at times when the international price of oil is high the differential between the producer price set by the government and the international parity price of fuels has to be assumed by the government itself, leading to a subsidy equivalent to one (1) percent of GDP in 2021.

2.2.3 In-kind transfers

Both education and health are considered a fundamental right protected by the Constitution. These two items represent 33.5 percent of public spending, or 9.8 percent of GDP. The following is a description of the education and health insurance systems in Colombia.

Education

In Colombia, education is divided into five main levels. These are the initial and transition levels for children under five years of age; elementary school, where children from six to ten years of age complete five grades; junior high school, which consists of four academic grades; middle school, whose two levels define the end of high school; and finally, higher education, which is divided into technical education (generally two years), higher technical education (one additional year on top of the technical level), and university education. Private agents may provide public education services, subject to authorization by the Ministry of National Education (MEN, as per the acronym in Spanish).

The ETCs autonomously manage monetary resources, human resources, and other elements in the provision of public education services in transition, elementary, junior high, and high school.[6] Thus, the resources come from the General Revenue-Sharing System (SGP) and from the ETCs' own resources and/or royalty resources. Overall, transfer resources to primary and secondary education in 2021 reached 2.7 percent of GDP, equivalent to 31,644 billion COP. On the higher education side, higher education institutions (HEIs) may be public or private and, according to the type of programs offered and their academic and professional vocation, are divided into technical, professional, technological, universities, and university institutions. There are 316 HEIs in Colombia, 86 of which are public, funded by the SGP, in addition to receiving resources from local authorities. MEN transfers in 2021 amounted to 6,143 billion pesos, or 0.6 percent of GDP.

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[6] At present, the ETCs are made up of 32 departments, 58 municipalities, and five districts, for a total of 95 ETCs.

Health

The health system in Colombia is divided into two regimes. The first of the two is the subsidized regime, which includes people whose ability to pay is limited and who are registered in the Sisbén system. This system is financed by the resources of the Colombia Government Budget and the contributions of the territorial entities. The second of the two is the contributory regime, composed of formal employees and pensioners whose contribution to the system is based on their payment capacity. The general contribution is equivalent to 12.5 percent of the salary received; in the case of salaried workers, 8.5 percent is paid by the employer, while the employee contributes the remaining four (4) percent. In the case of independent and self-employed workers, they pay the full rate. Under both regimes, members of the system are also affiliated with health care promoting entities (EPS, as per the acronym in Spanish), which manage the financial and administrative risks of the health service. In general, the Ministry of Health ensures the financing of the system through the Capitation Payment Unit (UPC, as per the acronym in Spanish), which is an annual amount transferred to the EPSs, and differentiated by sex, gender, and area, for affiliates of both the subsidized and contributory systems.

3. Data, methodology, and assumptions

This study follows the *Commitment to Equity* methodology (Lustig, 2018) with the purpose of quantifying the redistributive impacts of fiscal policy on households in Colombia through taxes, direct transfers (also called social programs), and indirect subsidies. The main source of information is the 2021 GEIH. Since this survey does not contain information on the level of household expenditures, and this is essential to identify indirect taxes (VAT, consumption, and carbon taxes, among others), survey-to-survey imputation methods are carried out with microdata from the National Household Budget Survey (ENPH, as per the acronym in Spanish). In turn, given the limitations of household surveys in capturing the income level at the top of the distribution, techniques are employed to identify the top of the distribution using administrative data from the DIAN (National Tax and Customs Agency) used in Diaz-Bazan (2015) and the methodology proposed by Blanchet et al. (2022). The data and methodology used are described in detail below.

3.1 Data

Integrated Household Survey (GEIH)

The GEIH is the household survey collected by the Colombian National Statistics Institute (DANE) that captures the socioeconomic characteristics of the population, the main labor market indicators, the income level of households and individuals, as well as poverty and monetary inequality statistics in Colombia. The survey has been collected periodically (month to month) since 2006. This representation covers the national level, urban areas (23 main cities and other urban seats), populated centers and dispersed rural areas (rural areas), and 23 departments. Microdata from 2021, the most recent version of the publication, are used.

National Household Budget Survey (ENPH)

The ENPH, collected by DANE between 2016 and 2017, contains information on the level of household spending and income (81,438 respondents in urban areas and 5,736 in rural areas). The survey information is representative at the national level, for main cities, population centers, and dispersed rural areas, and for 32 main cities in the country's departments plus six prioritized municipalities.[7] It collects information on the qualitative and feature characteristics of dwellings, and household composition, as well as characteristics of household members such as their age, sex, educational level, and employment status. It also inquires about the acquisition of goods and services according to the level of frequency (more frequent and less frequent) in urban and rural households. Among the variables are the quantity of goods and services purchased, amounts spent, forms of acquisition, place of purchase, and frequency of purchases. About 87,201 households were interviewed.
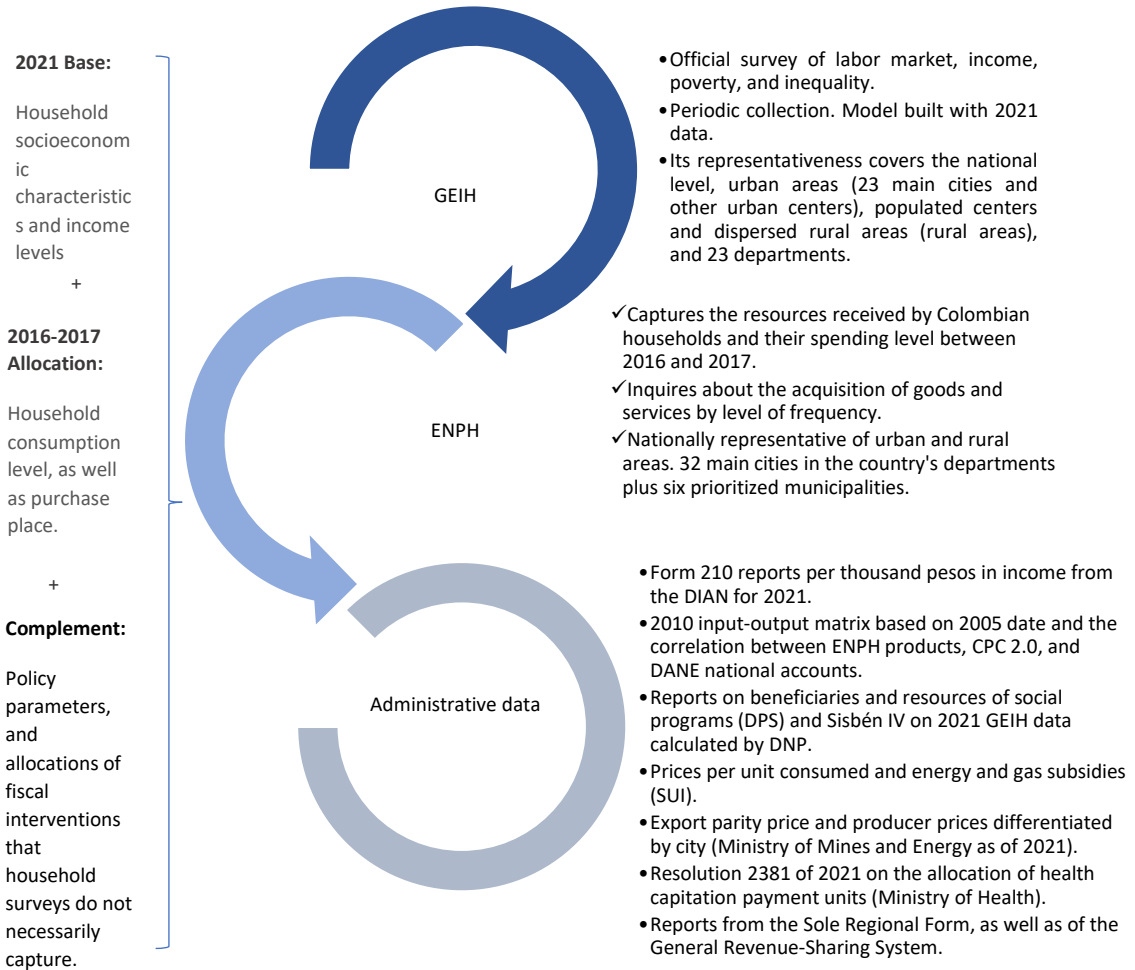
Administrative data

Administrative records allow for policy benchmarking, but also for allocations of fiscal interventions that are not necessarily captured by household surveys. For this purpose, DIAN administrative reports are used with the items of expenditure included on form 210 of the income tax return by gross income centile and the Colombian tax statute in force in 2021 with the content of the parameters of direct and indirect taxes (see annex 9.3). To capture the high end of the distribution, DIAN administrative microdata for 2010 taxpayers (the most recent available to the authors) are used. The 2010 input-output matrix is based on 2005 information and the correlation between products from the ENPH, CPC 2.0 (Central Product Classification 2.0), and DANE national accounts. To establish allocations in direct transfers, Department for Social Prosperity (DPS, as per the acronym in Spanish) social program reports were consulted (see annex 9.6).

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[7] The cities are Bogotá, Medellín, Cali, Bucaramanga, Barranquilla, Cartagena, Santa Marta, Valledupar, Pasto, Manizales, Pereira, Ibagué, Armenia, Neiva, Mocoa, Florencia, Villavicencio, Yopal, Sincelejo, Montería, Popayán, San Andrés, Arauca, Inírida, Cúcuta, Leticia, Mitú, Puerto Carreño, Quibdó, Tunja, Riohacha, San José del Guaviare, Rionegro, Soledad, Tumaco, Barrancabermeja, Buenaventura, and Yumbo.

Figure 1. Structure of the data used

2021 Base:

Household socioeconomic characteristics and income levels

+

2016-2017 Allocation:

Household consumption level, as well as purchase place.

+

Complement:

Policy parameters, and allocations of fiscal interventions that household surveys do not necessarily capture.

GEIH

- Official survey of labor market, income, poverty, and inequality.
- Periodic collection. Model built with 2021 data.
- Its representativeness covers the national level, urban areas (23 main cities and other urban centers), populated centers and dispersed rural areas (rural areas), and 23 departments.

ENPH

✓ Captures the resources received by Colombian households and their spending level between 2016 and 2017.
✓ Inquires about the acquisition of goods and services by level of frequency.
✓ Nationally representative of urban and rural areas. 32 main cities in the country's departments plus six prioritized municipalities.

Administrative data

- Form 210 reports per thousand pesos in income from the DIAN for 2021.
- 2010 input-output matrix based on 2005 date and the correlation between ENPH products, CPC 2.0, and DANE national accounts.
- Reports on beneficiaries and resources of social programs (DPS) and Sisbén IV on 2021 GEIH data calculated by DNP.
- Prices per unit consumed and energy and gas subsidies (SUI).
- Export parity price and producer prices differentiated by city (Ministry of Mines and Energy as of 2021).
- Resolution 2381 of 2021 on the allocation of health capitation payment units (Ministry of Health).
- Reports from the Sole Regional Form, as well as of the General Revenue-Sharing System.

Source: own preparation.

In the case of public utilities, data from the Unified Public Utilities Information System (SUI, as per the acronym in Spanish) are used with values of prices per unit consumed and energy and gas subsidies (see annex 9.7). To model subsidies and taxes on gasoline and ACPM, we have information on the export parity price, as well as producer prices differentiated by main cities as reported by the Ministry of Mines and Energy. On the in-kind transfers side, information from Resolution 2381 of 2021 was used on the allocation of health care capitation payment units and, in the case of education allocations, reports from the Regional Form (FUT, as per the acronym in Spanish), as well as from the SGP.

3.2 Methodology

According to the *Commitment to Equity* methodology developed by Lustig (2018), revenue concepts, which include a series of fiscal interventions (taxes, transfers, and subsidies), are included. The revenue structure is presented in Figure 2. First, market income is defined as the sum of household income without state intervention. This includes labor income from primary and secondary economic activity, capital income (interest or rent), private transfers from other households (such as remittances or other private aid), income from unemployed and economically inactive individuals, as well as income from dividends or non-recurring income.[8] Next, market income plus the income received by individuals from pensions, as reported in the household survey, after deducting pension contributions, is calculated. Thus, pension income is treated as pensions as deferred income (PDI) and not as a transfer.[9]

Net market income is obtained by subtracting payroll taxes or social contribution in health and labor risks (ARL, as per the acronym in Spanish), as well as the income tax for individuals with the rates, definitions of tax credits as of 2021 and rates of tax exemptions and deductions by source of income and breakdown by gross income centiles from market income plus pensions. Disposable income, in contrast, comes from adding direct transfers to net market income. This includes social programs such as Más Familias en Acción, Jóvenes en Acción, Colombia Mayor, the School Meals Program, and new programs implemented as of 2020 such as VAT compensation or refund and Ingreso Solidario. Due to discrepancies between the number of beneficiaries reported in the survey and in the administrative data for each program, imputations are made according to the programs' eligibility characteristics.

Consumable income is obtained by deducting from disposable income the indirect taxes that households must pay and adding the indirect subsidies they receive. ENPH microdata are used to impute household consumption aggregates to the GEIH. For this purpose, an imputation method described in the following section is used. Indirect taxes include VAT updated to 2021, consumption tax, taxes on cigarettes, alcohol, gasoline, and ACPM; and the national carbon tax. Both the direct and indirect effects of these taxes are calculated. The direct effects are equivalent to the difference observed in the final consumer price and the consumer price of the final taxed good. Meanwhile, indirect effects capture the reduction in the final consumer price of a good due to the impact on taxed inputs needed in its production process.
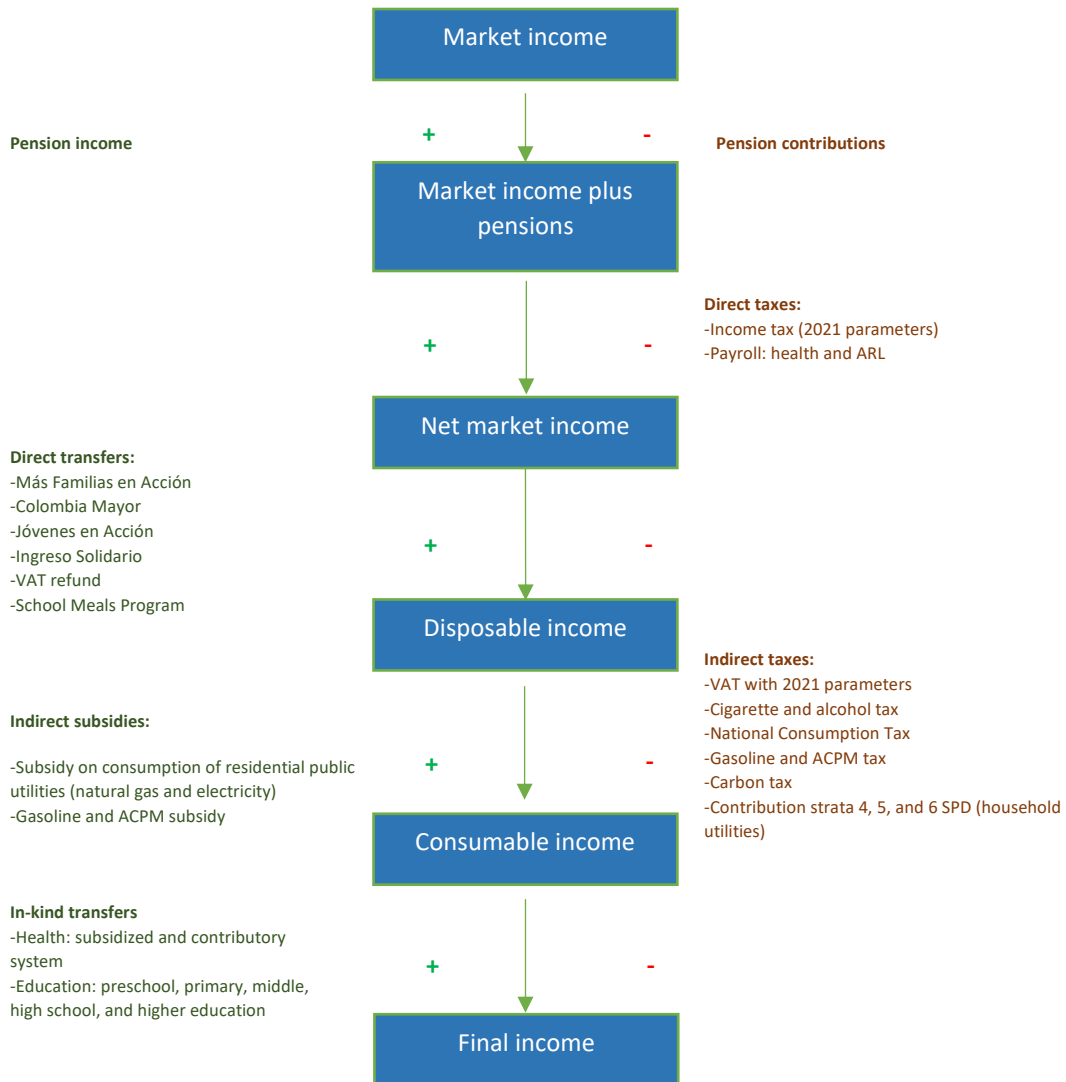
Subsidies include those related to household utilities (gas and electricity) and the subsidy on gasoline and ACPM. In-kind transfers, i.e., public spending per person on education and health, are added to final income.

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[8] Since in the income aggregate of the GEIH, capital income and dividends are part of the same concept, they are separated using the ratio between capital income and dividends reported in the DIAN administrative data as a parameter. In addition, non-recurring income, collected in the GEIH, is included in the income aggregate.

[9] It is not possible to differentiate between pension systems (public or private) in the survey. This follows the same trend as that seen in the previous version of the CEQ for Colombia as developed by Núñez et al. (2020), who also use pensions as deferred income in the main scenario, and also find a high relative and absolute concentration in the upper deciles, taking into account the regressive pension scheme.

Figure 2. Income concepts

Market income		
Pension income	+ −	Pension contributions
Market income plus pensions		
	+ −	**Direct taxes:** -Income tax (2021 parameters) -Payroll: health and ARL
Net market income		
Direct transfers: -Más Familias en Acción -Colombia Mayor -Jóvenes en Acción -Ingreso Solidario -VAT refund -School Meals Program	+ −	
Disposable income		
Indirect subsidies: -Subsidy on consumption of residential public utilities (natural gas and electricity) -Gasoline and ACPM subsidy	+ −	**Indirect taxes:** -VAT with 2021 parameters -Cigarette and alcohol tax -National Consumption Tax -Gasoline and ACPM tax -Carbon tax -Contribution strata 4, 5, and 6 SPD (household utilities)
Consumable income		
In-kind transfers -Health: subsidized and contributory system -Education: preschool, primary, middle, high school, and higher education	+ −	
Final income		

Source: own preparation based on Lustig (2018).

3.3 Assumptions

As for income taxes, only taxes on individuals are considered since it is not possible to model the tax on companies or legal entities from the household survey. It does not include tax evasion modeling, so, following Núñez et al. (2020), this is a de jure rather than a de facto exercise. There is also insufficient information to estimate the level of tax exemptions and deductions. However, three methodological scenarios are modeled to better capture the exemptions and deductions (see annex 9.2).

In the first scenario, which serves as the main scenario and is reported in the results of this paper to establish comparability with previous versions, the proportions of net taxable income over

gross income are assumed for each category and sub-category.[10] The information reported by the DIAN on the aggregates from form 210 on the 2020 income tax form for individuals is taken. In the second scenario, certain deductions, and exemptions identifiable in the GEIH are modeled in order to add flexibility to the model in identifying changes in particular deductions and exemptions.[11] This latter approach is used, for example, to simulate the changes introduced by the 2022 tax reform. The third scenario is an extension of the first scenario and considers different levels of exemptions and deductions throughout the distribution. For this purpose, the proportions of net income over gross income are taken with information disaggregated by milli-quantiles of gross income previously calculated by the DIAN for the 2020 taxable year. This is done for each tax schedular and sub- schedular income source. The methodological aspects of the scenarios are discussed in section 9.2 of the methodological annex.[12]

For payroll taxes, we used the legal parameters for social security contributions to health, pension, and labor risk insurance, differentiating between salaried and self-employed workers. In the case of salaried workers, when the social security contribution is shared with the employer, four (4) percent of health and pension contributions are paid by the employee, while the employer's contribution is 8.5 percent and 12 percent, respectively. In the case of self-employed workers, contributions of 12.5 percent in health, 16 percent in pensions and 0.52 percent in occupational risks are assumed. The lowest risk category is assumed.

In terms of government transfers, the main social programs identified in the main survey (GEIH) or whose values can be imputed from the ENPH were included. In general, it was observed that the number of beneficiaries is unreported in the survey (GEIH) when comparing to those indicated in the administrative reports.

Although there is no such link, beneficiaries are assumed to be those who report receiving benefits from any social program in the main survey and imputations are made to potential beneficiary households considering the eligibility conditions of each program until the number of individuals or beneficiary households reported in the administrative data is completed, to whom the per capita value of the cost of the program in 2021 is imputed. The eligibility conditions include demographic variables (age, educational level, number of children per household), membership or non-membership in other programs (as in the case of Ingreso Solidario or VAT refund) and Sisbén IV score, the main instrument for targeting social programs in Colombia. The Sisbén IV variable calculated by the DNP in the 2021 GEIH considers the algorithm, methodology, and variables used by the DNP to calculate the Sisbén IV, which takes both monetary poverty and

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[10] The ratio between net income and gross income is used in previous versions in order to calculate taxable income in the household survey (see Núñez et al., 2020).

[11] The information from the survey was used to model exemptions and deductions such as 25% exemptions on labor income, deductions for dependents, mortgage interest, and voluntary contributions to health and voluntary pension funds, and also takes into account the limits established by law in the general and pension schedules.

[12] The main results use the first scenario approach in order to establish comparability with previous versions. The second approach is used in order to model the details of the tax reform, insofar as the strength of the reform consists of modifying the limits on deductions and exemptions. Meanwhile, the third approach provides robustness to the modeling; its results are discussed in the annex section.

multidimensional poverty conditions of households, or, in other words, includes the presumptive income of the surveyed household and its poverty conditions into account.[13]

For the case of indirect taxes, calculations are made based on the population's consumption patterns in 2016-2017, which are captured by the ENPH and imputed to the 2021 GEIH. The value of VAT on consumption tax, gasoline tax, ACPM tax, and carbon tax was estimated as established by the law up to 2021. In the case of VAT, the direct effect was considered for those purchases in formal establishments (identifiable in the consumer survey), this effect is recognized as that paid by final consumers.

According to Bachas et al. (2020), the place of purchase (formal or informal) may affect the impact of indirect taxes such as VAT. In addition, producers that produce goods excluded from VAT as they do not charge sales tax on their goods, cannot deduct the tax from their purchased inputs. Consequently, the tax paid on their inputs fall on the final sales price, which is known as the cascade effect, since the tax is charged again through higher prices, creating an indirect effect that is levied on households' indirect payments because of taxing intermediate goods. Therefore, in the case of purchases in informal establishments[14] or in exempt goods, it is assumed that households pay an indirect effect, which is calculated considering the *Cost-Push* model.[15] Indirect effects are also calculated for gasoline and ACPM. No indirect effects are calculated for consumption, alcohol, and tobacco taxes.

Subsidies (home utilities, gasoline, and ACPM) are calculated based on the units consumed as identified in the ENPH and according to legal parameters. In the case of public subsidies (gas and electricity), both direct and indirect effects are calculated. It is assumed that the subsidy rates by socioeconomic stratum[16] as well as contributions for the upper strata are standard at the national level. For the tax on gasoline and ACPM, the annual average of the differential between the export parity prices and the producer price is assumed as the parameter for calculating the subsidy per gallon of gasoline or ACPM consumed.

Following Núñez et al. (2020), in-kind transfers in both education and health are calculated according to the cost per student or member of the health system reported by the national and local governments. In the case of allocations for education, the per capita value allocated by the national government for each student is taken from 2020 data due to information availability. This takes an adjustment value to include additional resources contributed by local governments

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[13] Sisbén IV establishes the following cut-offs: A1-A5: Extreme poverty. This group ranges from 0.2 extreme poverty lines to 1 extreme poverty line. B1-B7: Moderate poverty. From 1 poverty to 2.2 poverty lines. C1-C18: Vulnerable population. Ranges from 2.2 to 5 poverty lines. D1-D21: The non-poor population is considered to be the population whose income exceeds that of 5 times the extreme poverty line. Poverty lines in the GEIH are reported at the level of 25 geographic domains (23 major cities plus other urban areas and rural areas).

[14] Informal establishments are those that do not file sales tax returns, such as small retailers or street vendors. The condition of formality is attributed to large retail chains or supermarkets.

[15] The *Cost-Push* model is based on a price change model, which can be solved empirically under counterfactual scenarios to estimate the present value of subsidies received or taxes paid using the input-output matrix as an input (see Gillingham [2008] and Ahmad and Stern [1984] and [1991]). The main results of this model show a change in the final price separating the direct and indirect effect. The model and assumptions are implemented following Núñez et al.'s approach (2020).

[16] Dwellings are classified by socioeconomic stratum according to the physical and material conditions of the dwellings. This targeting instrument is used for the legal allocation of subsidies for residential public utilities. Their estimation depends on local governments and the DANE. Strata 1, 2, and 3 are recipients of subsidies while strata 5 and 6 contribute in the form of a cross-tax.

for the financing of primary, middle school, and secondary education into account. This per capita value is imputed to students by level of education in official schools, taking variability by urban or rural area into account. In higher education, we assume the per capita value of higher education expenditure following the data challenges reported in Núñez et al. (2020).

The cost of health insurance measured by the subsidized regime's Capitation Payment Unit (UPC), the value of which is assigned by the Ministry of Health according to age range, gender, and area of residence, was assigned. In addition, allocations are assigned to individuals in the contributory regime in accordance with Núñez et al. (2020) methodology. The above means that the allocation was made to people who declared that they were registered in the system.

Although the education and health allocations imputed to the survey have been reduced in previous studies in order not to overestimate their redistributive effect, this study follows recent best practices and does not make such adjustments. For purposes of comparison with the literature for Colombia, see Box 1.

4. Distributive impacts on inequality and poverty

The results of the impacts of fiscal interventions on inequality and poverty in Colombia for the year 2021 are presented below. First, comparisons are made with previous exercises in Colombia to show the scope of the present paper. Next, comparisons in inequality and poverty are established taking results from other countries using a similar methodology into account. The results are presented in terms of market income plus pensions in the scenario of pensions treated as deferred income and not as a transfer from the government. The methodological comparison with previous versions is described in detail in section 9.1.

> **Box 1. Comparison with the literature for Colombia**
>
> Relative to previous literature for Colombia, a redistributive improvement is observed with respect to the CEQ that used the 2010 National Quality of Life Survey (ECV, as per the acronym in Spanish) (see Lustig, Meléndez, and Rodríguez-Castelán, 2014). However, patterns in inequality reduction are similar between the previous CEQ (2016-2017 ENPH) and the current one (2021 GEIH), presenting slight differences in redistributive terms. For example, going from market income plus pensions to disposable income in the previous CEQ is responsible for a Gini reduction of 0.034 (compared to 0.36 in the current model), from disposable income to consumable income accounts additionally for just 0.003 (similar to 0.002 reduction in the current model) but from consumable income to final income captures additionally 0.61 Gini reduction points (compared to 0.87 in the current model).
>
> The differences may come from the change in survey, the GEIH being the official survey in Colombia to measure inequality annually, but also due to differences in the inclusion or exclusion of transfers, taxes, and subsidies between the CEQs explained in the previous section. In addition, there is a methodological difference in the calculation of final income. While the previous CEQ (see Núñez et al., 2020) re-scaled transfers in health and education, the current model, following the recommendations of the methodological

updates to the CEQ, does not contemplate re-scaling, resulting in a greater redistributive impact of public spending on health and education (as mentioned above, this impact does not consider differences in the quality of services received by the population). However, a comparison is presented when considering the rescaling factor with national accounts in the final income.

Figure 3. Gini coefficients
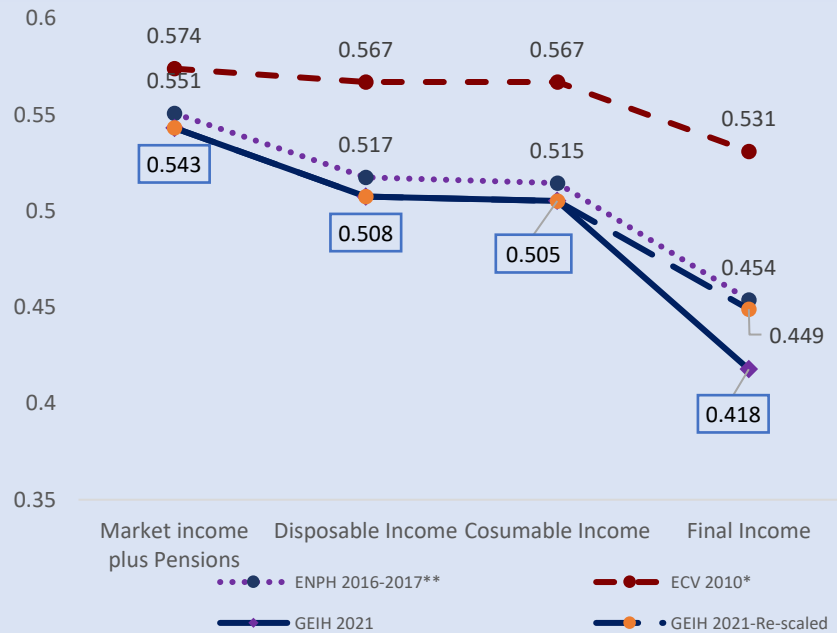
Source: Authors' estimates based on 2021 GEIH; Lustig, Meléndez, and Rodríguez-Castelán (2014)*; and Núñez et al. (2020)**. The values in the 2016-2017 ENPH case differ from those reported in Núñez et al. (2020), this paper reports pension income as deferred income as if it were pension income as transfers and vice versa. The present paper identifies this difference and corrects it. Market income corresponds to the scenario of market income plus pensions as deferred income.

4.1 The impact on inequality

The tax system in Colombia contributes to the reduction of inequality, albeit moderately. Figure 3 shows the results for both the current CEQ (2021 GEIH) and for the two previous CEQs considering pensions as deferred income. The Gini of market income plus pensions drops from 0.543 to 0.508 when including direct transfers and subtracting direct taxes, which represents a decrease of 0.036 in disposable income. Subtracting indirect taxes and adding subsidies, the impact on consumable income remains practically unchanged, accumulating a reduction of 0.002, reaching 0.505. However, in-kind transfers in education and health achieve an additional 0.087 effect in reducing inequality, reaching a Gini of 0.418 in final income.

20

The redistributive capacity of the Colombian tax system is low. Although there is a positive correlation between income level and redistributive capacity, when comparing with upper-middle income countries, where Colombia and most of the countries in the region are located, the Gini in consumable income in relation to market income[17] shows a moderate reduction. This is at the level of countries such as Peru or Mexico, but well below that of countries such as Brazil, Argentina, or Uruguay, which have the capacity to redistribute more.

Figure 4. Gini of consumable vs. market income
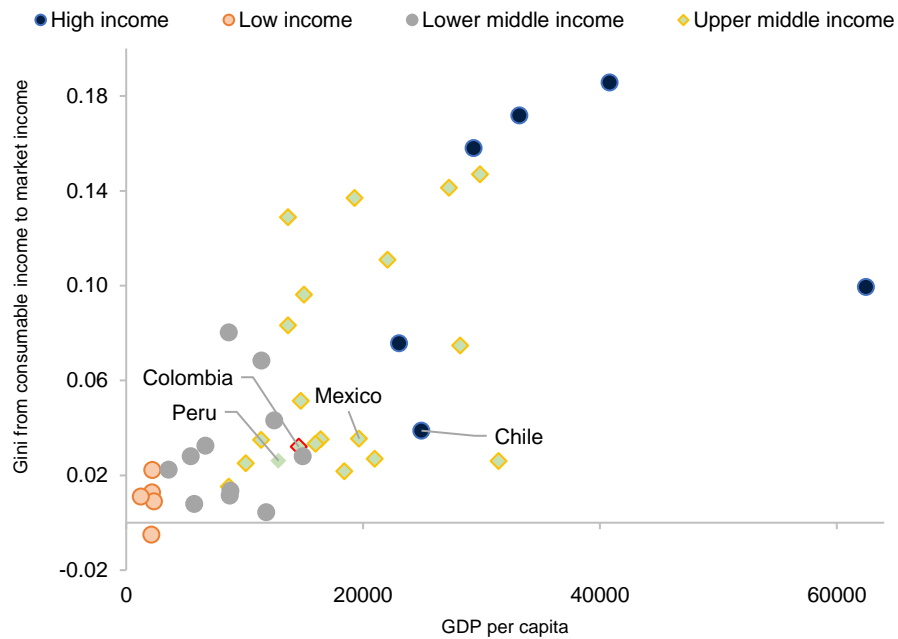
When considering the income inequality changes from market income to disposable income in comparison with other countries in the OECD, of which Colombia is a member, it is evident that the redistributive capacity of direct taxes and transfers in Colombia is well below that of the OECD countries. Out of 38 member countries, Colombia ranks second to last, only slightly above Mexico and below other countries in the region such as Chile and Costa Rica. In addition, Colombia ranks second in inequality after taxes and transfers, below South Africa. While Finland reduces the Gini coefficient by 0.25 points as a result of public transfer policies and direct taxes, the capacity of Colombia's fiscal system stands at 0.030 Gini points when considering pensions as direct transfers.

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[17] In this comparison, pensions are treated as a transfer.

Figure 5. Gini of disposable vs. market income

■ Gini antes de impuestos y transferencias monetarias   ● Gini después de impuestos y transferencias monetarias
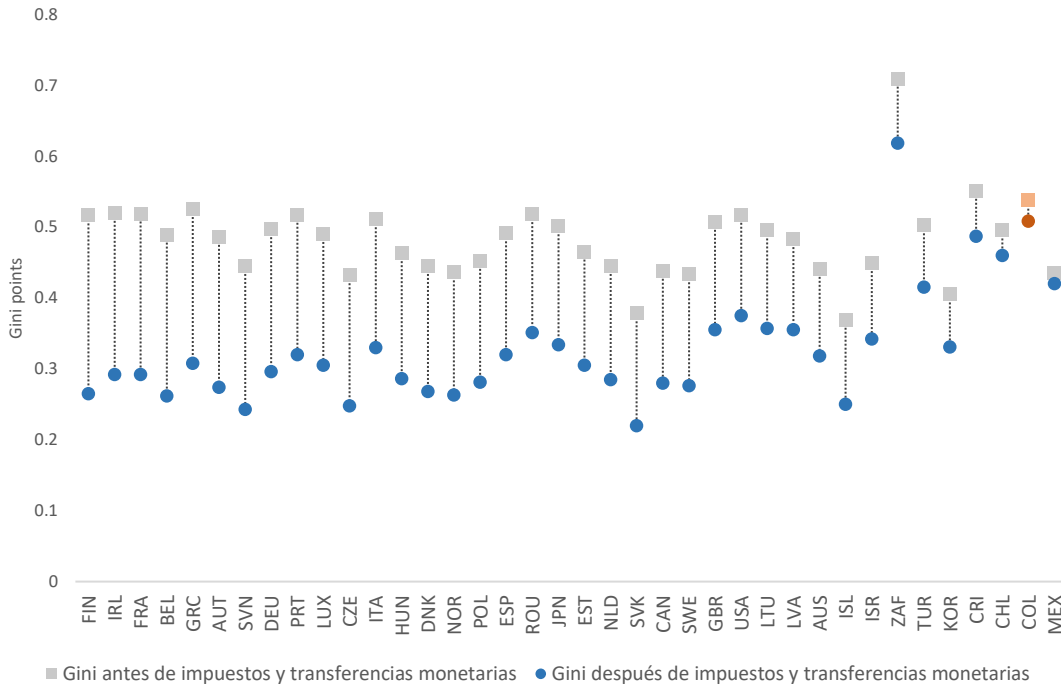
Source: Authors' estimates based on 2021 GEIH and OECD circa 2020. Pensions are considered direct transfers and are applied for Colombia in this graph for comparative purposes. In no case are subsidies or indirect taxes included.

4.2 The impact on poverty

The fiscal policies of taxes, direct transfers, and subsidies also contribute to the decrease in poverty. In particular, going from market income to consumable income implies a reduction in official poverty rates of 2 pp (percentage points) in total poverty and 4.2 pp in extreme poverty. Table 3 shows the evolution of poverty using by different income concepts. It is observed that when going from market income plus pensions to net market income, which means subtracting income tax and payroll taxes or social security contributions, poverty increases by 1.1 pp. However, it is substantially reduced by 4.1 pp when direct transfers are added, thus reaching disposable income with a total poverty level of 39.1 percent. Poverty increased again by 1 pp as a consequence of deducting indirect taxes (such as VAT, consumption tax, or taxes on gasoline and ACPM, among others) from household income and simultaneously including subsidies. In summary, monetary poverty, following the official DANE line and methodology in 2021, goes from 43.2 percent in market income to 40.1 percent in consumable income.

Table 3. Impacts on poverty including taxes, transfers, and subsidies

	Market income + pensions	Net market income	Disposable income	Consumable income
Panel A: Total poverty (official line)				
Incidence of poverty	42.1%	43.2%	39.1%	40.1%
Poverty gap	18.4%	18.8%	14.8%	15.5%
Severity of poverty	11.0%	11.2%	7.8%	8.3%
Panel B: Extreme poverty				
Incidence of poverty	16.1%	16.3%	11.2%	11.9%
Poverty gap	6.7%	6.8%	3.7%	4.2%
Severity of poverty	4.1%	4.2%	1.9%	2.2%

Source: Authors' estimates based on 2021 GEIH.

5. Progressivity, marginal contributions, and favorability for the poor

On whom does the burden of taxation fall or who is the recipient of transfers or subsidies? Figure 6 breaks down the contribution by decile of market income plus pensions (see panel A) of taxes, direct transfers (also known as social programs), indirect taxes, subsidies, and in-kind transfers as a proportion of the same market income plus pensions. In the lower deciles, in-kind educational transfers, social programs, and health transfers are the most significant benefit received. The concentration of these items in the upper part of the distribution, deciles eight (8) to ten (10), is low.

Social programs and indirect taxes have an important weight relative to market income plus pensions in the lower deciles. Direct taxes represent about 6.5 percent of market income plus pensions in the upper decile, while in the lower deciles it is about 1.3 percent. In the case of indirect or consumption taxes, these represent 24 percent as a proportion of market income plus pensions for the poorest ten (10) percent of the population, but only 3.7 percent for the richest ten (10) percent. The net cash position is negative from decile six (6) onwards, which means that taxes paid as a proportion of market income is higher than the monetary benefits from this population segment. In contrast, the total balance (net fiscal benefits including health and education) is negative only for the top decile.

While population groups such as indigenous, NARP (Black, Afro-Colombian, Raizal, and Palenquero communities), or rural inhabitants have positive net cash position. Social programs have a very important weight in their market income and taxes on consumption also come to represent a high proportion of their market income plus pensions. Other population groups such

as indigenous people are net recipients of benefits, with social programs and subsidies representing 32.2 percent and 7.7 percent of their market income plus pensions. When compared to people who do not identify with any ethnic group, these proportions are 13 percent and 4.7 percent, respectively. Regarding the differences between men and women, it is observed that, although direct taxes represent the same weight of market income plus pensions for both men and women, consumption taxes represent 7.1 percent of women's income compared to 6.8 percent for men. However, transfer programs reach 14.6 percent for women and 13.6 percent for men. As mentioned, the high impacts of health and education benefits are not adjusted for their quality. Learning results for Colombia, for example, are more unfavorable in areas with a high concentration of indigenous and Afro-Colombian populations.

Figure 6. Distributive impact of the tax system in 2021

Panel A: deciles of market income plus pensions
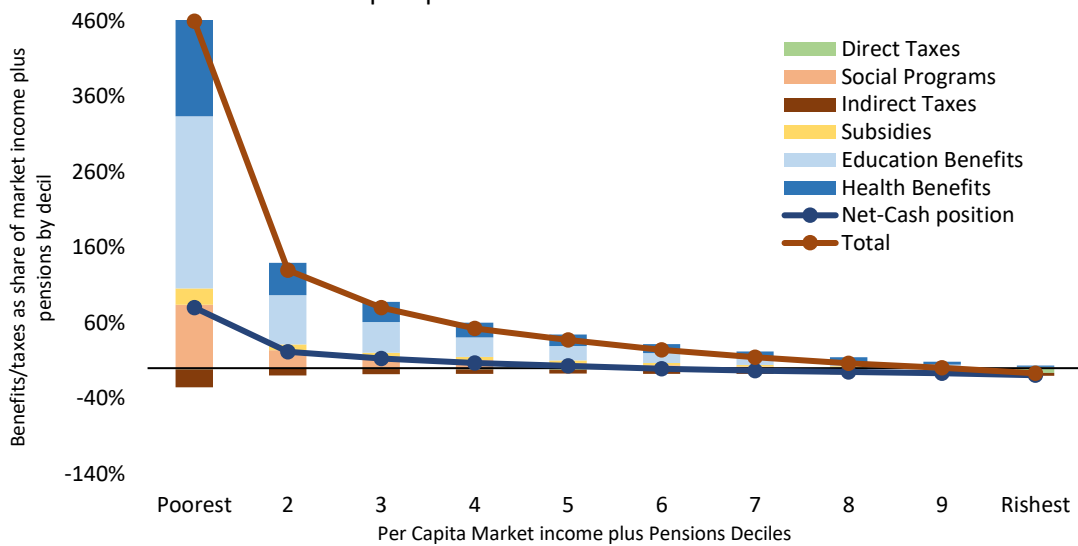
Panel B: population groups

Source: Authors' estimates based on 2021 GEIH.

Income tax essentially falls on the richest decile, while subsidies and transfers reach all income groups. A look at the absolute progressivity of the tax system, or composition by deciles of each tax intervention is presented in Figure 7. This does not include the 2022 tax reform, which refers to changes in the personal income tax, discussed below. The richest ten (10) percent of the population pays 98 percent of income tax, largely due to the high threshold at which they begin to contribute in Colombia with positive effective tax rates, coupled with high levels of informality. This same segment of the population contributes 36 percent of indirect taxes, followed by decile nine (9), whose share is equivalent to 14 percent. In turn, 67 percent of transfers are concentrated in the first four (4) deciles, of which 17 percent are equivalent to the first decile and 17 percent to the second decile of market income.

Subsidies and in-kind transfers in health are less concentrated, so they are almost equally distributed among the deciles. In the case of subsidies, the first three deciles participate with eight (8) percent each, while deciles eight (8) and nine (9) participate with 11 percent and the last decile with 15 percent. In-kind transfers in education are more concentrated in the lower deciles than are transfers in health. For example, in the first five (5) deciles, 68 percent of the benefits are concentrated in education, but in the last decile this proportion is equivalent to three (3) percent, while in the case of health it is equivalent to 54 percent and seven (7) percent, respectively.

**Figure 7. Absolute progressivity of tax interventions**
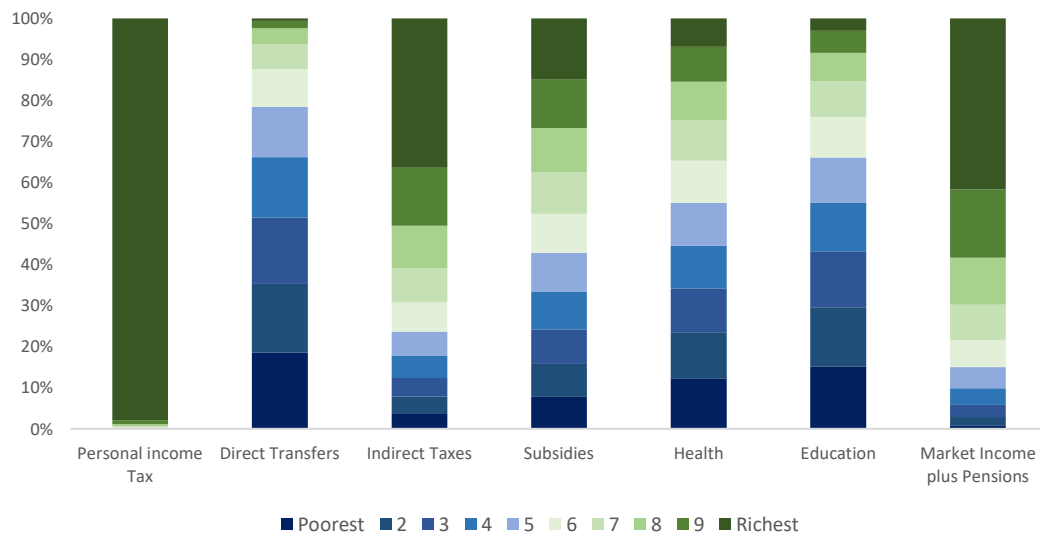
Source: Authors' estimates based on the 2021 GEIH.

However, it is important to analyze fiscal policies separately and determine their redistributive effect in order to determine the differential progressivity or regressivity of a given policy, distinguishing from the combination of a group of policies. For this purpose, two indicators are reported: the Kakwani index and the marginal contribution. The Kakwani index provides insight into the degree of progressivity of the tax intervention but does not provide information as to whether the policy makes the whole system equalizing. The latter is known as the marginal

contribution, which is calculated as the difference between the Gini of the reference income concept without the intervention and the Gini of the income concept with the intervention.

Figure 8 shows the results of both indexes for the set of policies. In general, it is observed that most are progressive, with direct transfers having the highest Kakwani index (0.903), followed by transfers in education (0.761), health (0.619), and subsidies (0.435). Personal Income Tax, although less progressive, is 0.426, while the total direct taxes 0.199. However, indirect taxes as a whole are clearly regressive (-0.125). In turn, direct transfers, and in-kind transfers (health and education) show the greatest equalizing effect by reducing inequality by 0.06 and 0.04, respectively. However, the other interventions do not have equalizing effects.

**Figure 8. Progressivity of fiscal interventions**
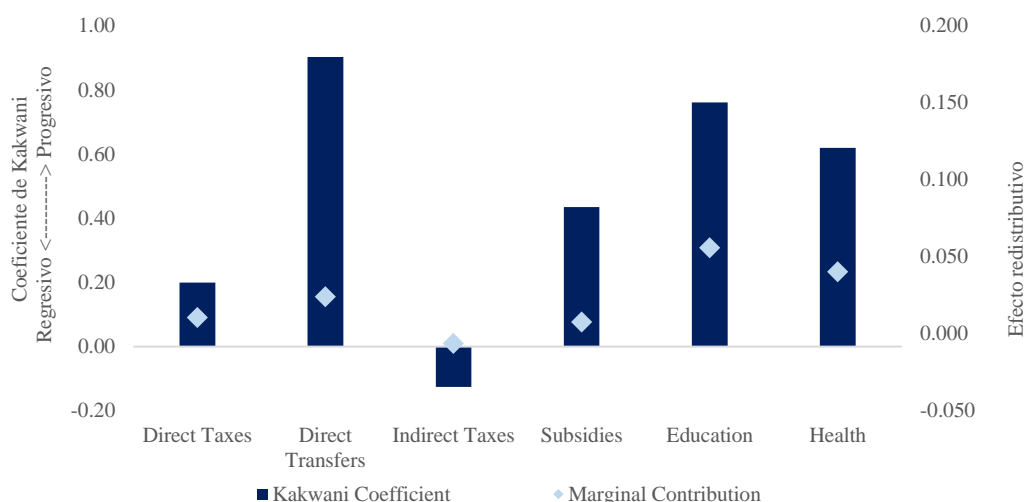
Source: Authors' estimates based on the 2021 GEIH.

Direct and indirect taxes

Indirect taxes are regressive. When analyzing each tax in particular and knowing the progressive and equalizing effect of the personal income tax, it is observed that, within indirect taxes, those that present a higher level of regressivity in relative terms are, in the following order: taxes on alcoholic beverages and cigarettes (-0.49 and -0.47, respectively), followed by taxes on hydrocarbons such as the tax on ordinary motor gasoline (GMC, as per the acronym in Spanish), and the carbon tax on gasoline (-0.18 and -0.22, respectively). With regards to VAT, the Kakwani coefficient is -0.084. In the case of indirect taxes, marginal contributions are unequal, but very low. Contributions to gas and electricity public utilities are progressive, given the contribution that falls on households in higher socioeconomic strata. However, the marginal effect on inequality reduction is negative.

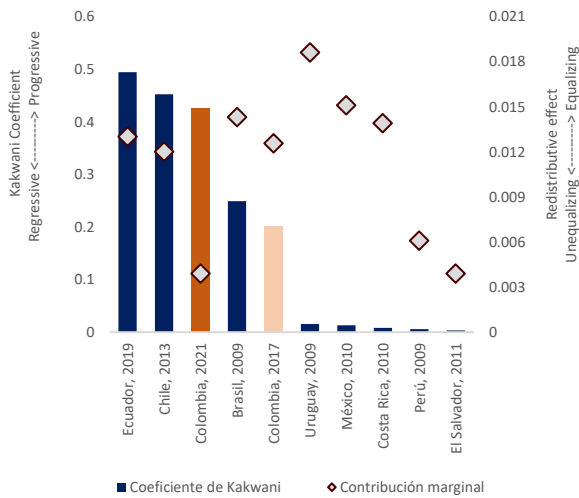## Figure 9. Progressivity of direct and indirect taxes
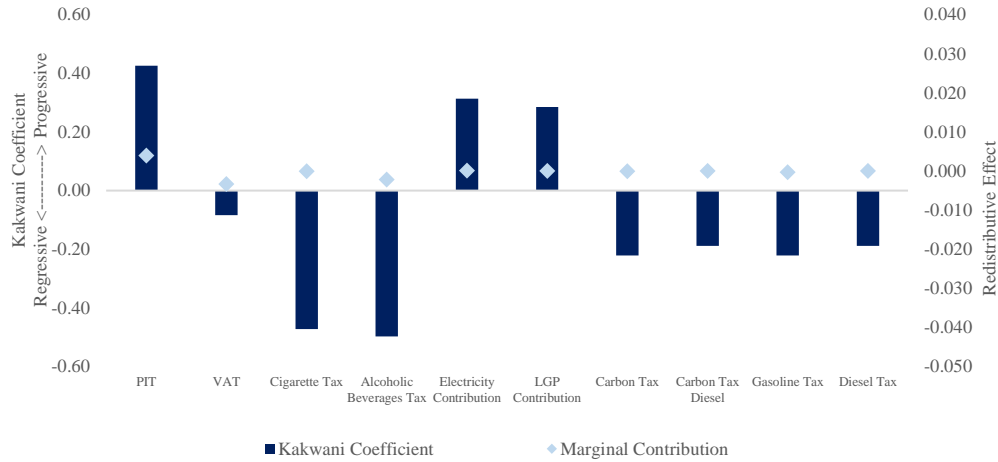
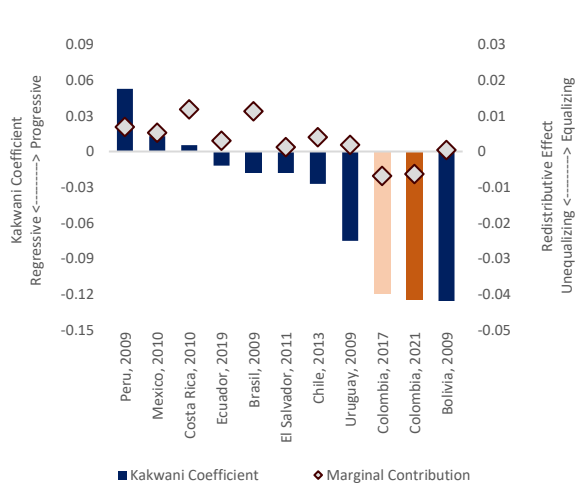

Source: Authors' estimates based on the 2021 GEIH.

Although direct taxes are progressive, they have a low redistributive impact. Compared to other countries, the current CEQ presents a high level of redistribution when considering only direct taxes, very close to Chile or Ecuador, which leads the list of available countries. In fact, the level of progressivity is above that estimated in the previous CEQ (0.22 more points in the Kakwani index). However, the marginal contribution is the lowest in the region. As for indirect taxes, Colombia's Kakwani index reduced its regressivity with respect to the previous CEQ (-0.125). This may be due both to changes in regulation and to the fact that each study uses a different household survey as the basis for the analysis.

Figure 10. Progressivity of direct and indirect taxes in Latin America

Panel A: direct taxes

Panel B: Indirect taxes

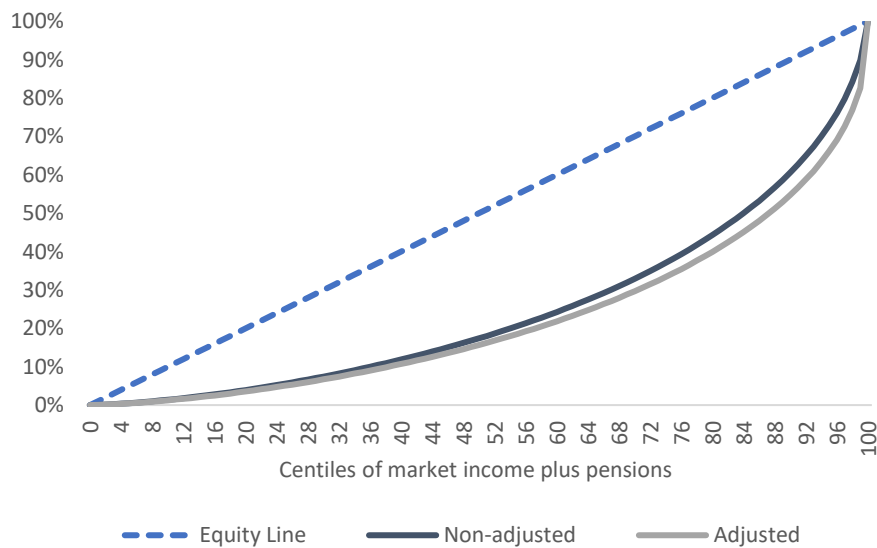*Source*: Authors' estimates using the 2021 GEIH and information from the CEQ Institute and the World Bank.

Direct taxes: Adjusting at the top of the income distribution (*top earners adjustment*)

In a context of high-income inequality and with the limitations of household surveys, it is important to adjust the distribution to capture what is happening at the top. While it is true that household surveys are preferable when analyzing poverty and inequality due to their richness in identifying the socioeconomic characteristics of the population, there are serious limitations when it comes to quantifying the magnitude of inequality, especially at the top of the distribution. This is because household surveys often underestimate the reporting of top incomes, due to the selected sampling, low response rate, or extreme value imputations (Lustig, 2019). On the other side, tax records only include a specific threshold, mainly top earner, and are not representative of the population.

Several methodologies have been developed to analyze the upper part of the distribution. In particular, the methodology implemented in this paper, seeks to complement household survey microdata with tax records combining replacing and reweighting approaches, selecting the merging point of both distributions in a non-arbitrarily (Blanchet et al., 2022; Alvaredo and Londoño, 2013; Diaz-Bazan, 2015). Considering the high and secular inequality in Colombia, the GEIH is complemented with DIAN micro data on income taxpayers' registers and follows the approach of Blanchet et al. (2022). The main purpose of that adjustment is to improve the fiscal microsimulation model's ability to identify inequality considering the missing rich. Methodological details can be found in the annexes, section 9.4. Figure 11 shows the Lorenz curves for disposable income with and without adjustment.

Figure 11. Lorenz curves with and without high-income adjustment

Source Authors' estimates based on GEIH and DIAN.

Not surprisingly, inequality increases when including the adjustment for the top of the distribution or, in other words, when accounting for top income. The Gini coefficient of market income plus pensions rises 0.05 points from 0.543 to 0.594. The Theil coefficient also shows a significant increase, rising 0.321. Consequently, inequality in gross market income, which is the product of including direct taxes, would go from a Gini of 0.533 to 0.578.
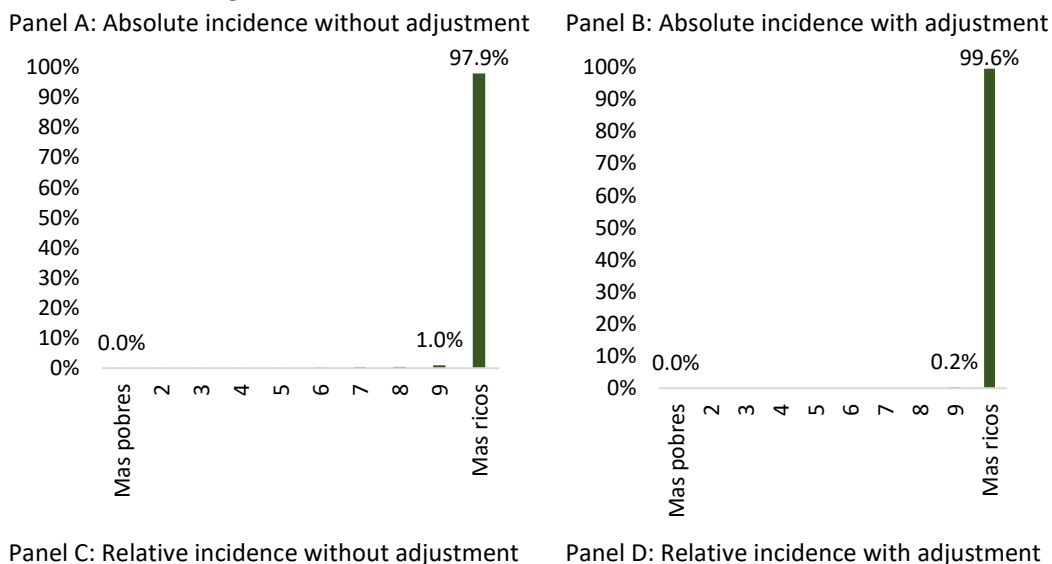
Table 4. Impacts on inequality with and without adjustment for top income

	No adjustment		With adjustment		Difference	Difference
	Gini	Theil	Gini	Theil	(Gini)	(Theil)
Market income plus pensions	0.543	0.579	0.594	0.900	0.051	0.321
Net market income	0.533	0.549	0.578	0.822	0.046	0.273
Disposable income	0.508	0.498	0.555	0.764	0.047	0.266

Source: Prepared by the authors based on the 2021 GEIH.

On the personal income tax absolute incidence side, that is, the proportion of the tax that is paid for each decile of gross market income, an even greater concentration is observed in the last decile as a product of adjusting for top income. This leads to the relative weight of the tax becoming more of the gross market income for this last income decile, from 1.06 percent without adjustment to 1.45 percent with adjustment. Consequently, the fiscal revenue estimated in the model also grows significantly to 11.6 trillion in annual collections. There is also a decrease in the progressivity of the income tax as measured by the Kakwani index, which goes from 0.420 to 0.395.

Figure 12. Absolute and relative income tax incidence

Panel A: Absolute incidence without adjustment Panel B: Absolute incidence with adjustment

Panel C: Relative incidence without adjustment Panel D: Relative incidence with adjustment

Source: Prepared by the authors based on the 2021 GEIH.

Direct transfers and subsidies

Direct transfers are highly progressive (Figure 13). An analysis by type of transfer confirms that progressivity is high in all programs. Thus, Más Familias en Acción and Ingreso Solidario are the transfer programs (conditional and unconditional, respectively) with the highest level of progressivity, 1.02 and 0.89, respectively. Both programs, with marginal contributions to the decrease in inequality close to 0.01. Other programs such as the VAT refund or compensation, followed by the School Meals Program, also present high levels of progressivity in spending with Kakwani indices above 0.89.

Figure 13. Progressivity of direct transfers

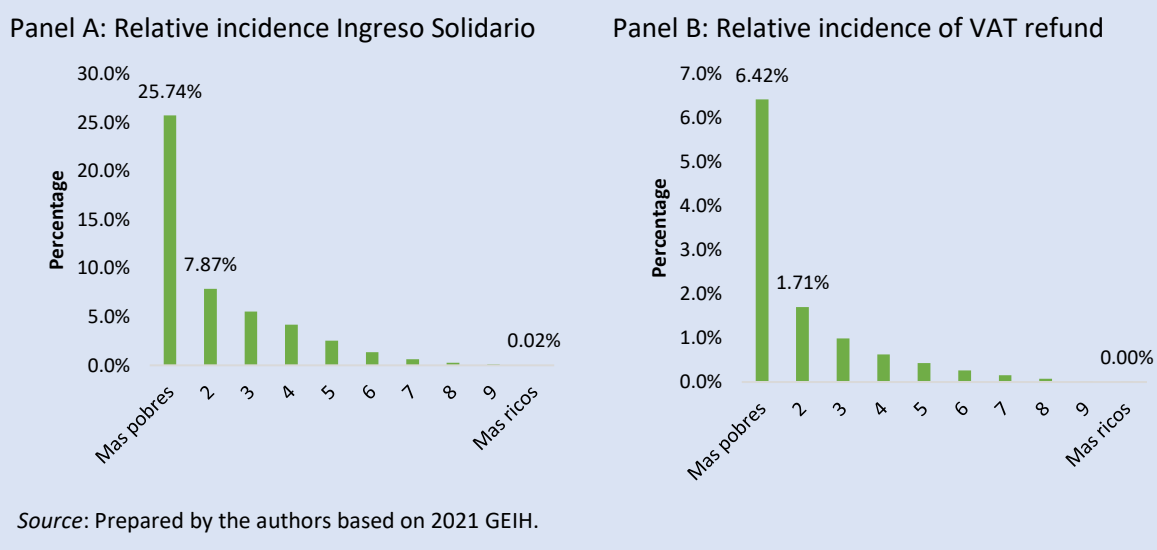*Source*: Prepared by the authors based on the 2021 GEIH.

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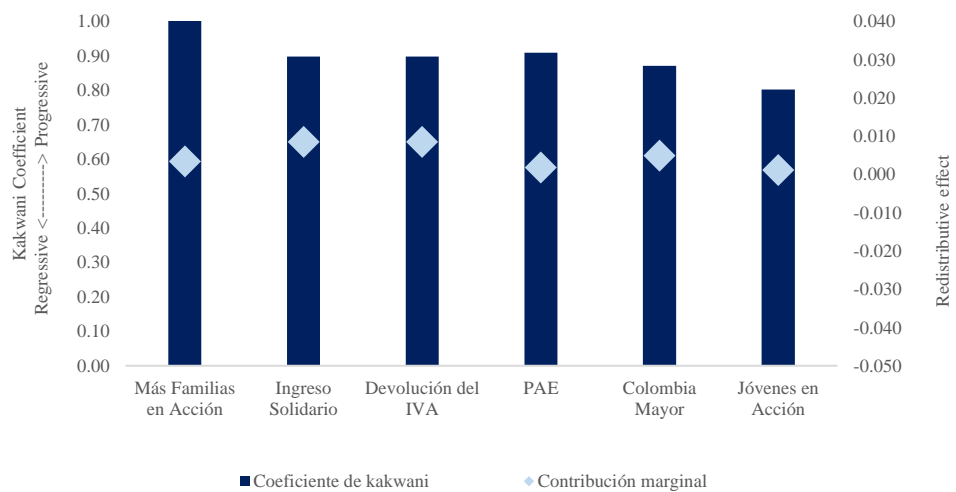
Box 2. Non-Conditional Extraordinary transfers. The case of VAT refunds and Ingreso Solidario

The Ingreso Solidario program emerged as an unconditional transfer to households living in poverty and extreme poverty during the COVID-19 health emergency and ended in December 2022. The beneficiaries of the program were essentially not recipients of other social assistance. The VAT refund program emerged as a support mechanism to alleviate the impact of paying VAT, a highly regressive indirect tax that represents 15.4% of the market income plus pensions of the poorest 10% of the country.

The results suggest that 67% of Ingreso Solidario transfers and VAT refunds are received by the first four (4) deciles of market income plus pensions, while 0.6% is received by the richest decile. However, in the case of the VAT refund, the poorest decile of the distribution receives 21.2% of the total program benefits, in contrast to 16.9% for the same income segment of the Ingreso Solidario program. The relative incidence, which indicates the weight of the program as a proportion of market income plus pensions for each decile, shows that the Ingreso Solidario program may represent close to a quarter of the income of the poorest decile, which explains to a large extent the prevalence of the program in reducing poverty. The VAT refund also has an important relative weight for the poorest households, although smaller (6.4%) given the program's size.
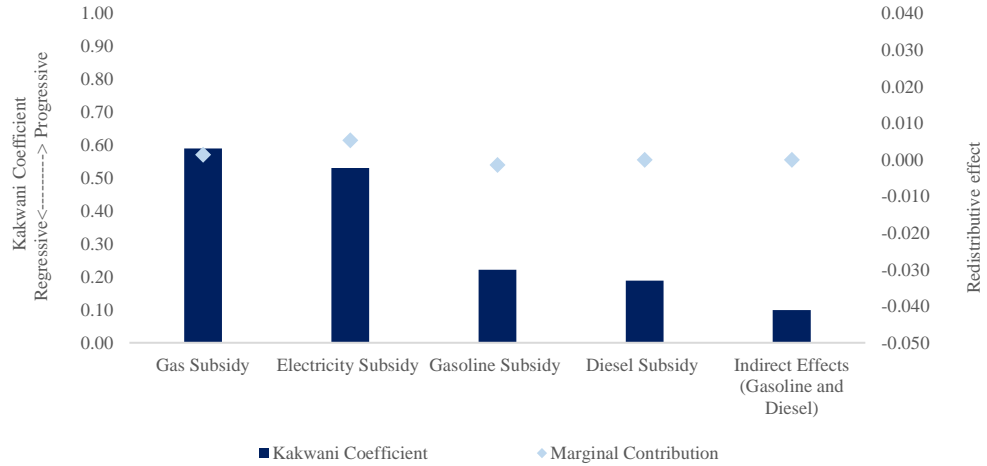
Figure 14. Progressivity of the social programs implemented during COVID-19

Panel A: Relative incidence Ingreso Solidario

Panel B: Relative incidence of VAT refund

Source: Prepared by the authors based on 2021 GEIH.

On the subsidy side, the results are somewhat more heterogeneous in terms of their progressivity, but relatively homogeneous in terms of marginal contribution. This means that the natural gas subsidy is the most progressive (0.59), followed by the electricity subsidy (0.53). Subsidies on gasoline (GMC) or ACPM show a low progressivity of 0.22 and 0.19, respectively. Fuel subsidies are not only received by households indirectly, since in the production process various products and services take fuels as an input, and by design, this fuel contains the subsidy. Consequently, the productive sector indirectly transfers the subsidy to households through the final price of

goods and services offered in the market. This indirect effect does not necessarily reach the poorest; its Kakwani index stands at 0.099. The marginal contributions are very low, which indicates very little contribution to reducing inequality with respect to disposable income as the reference income in this case.

Figure 15. Progressivity of subsidies

Overall, in Colombia the level of progressivity of direct transfers, also called social programs, is high, although it is below that of countries such as Peru, Ecuador, Uruguay, or Costa Rica (Figure 16). However, in terms of subsidies, the level of progressivity is much lower than that seen in countries such as Chile or Brazil. Furthermore, the results show that the progressivity of subsidies with respect to the previous CEQ is low, largely due to the inclusion of fuel subsidies, which show lower levels of progressivity.

Figure 16. Progressivity of direct transfers and subsidies in Latin America
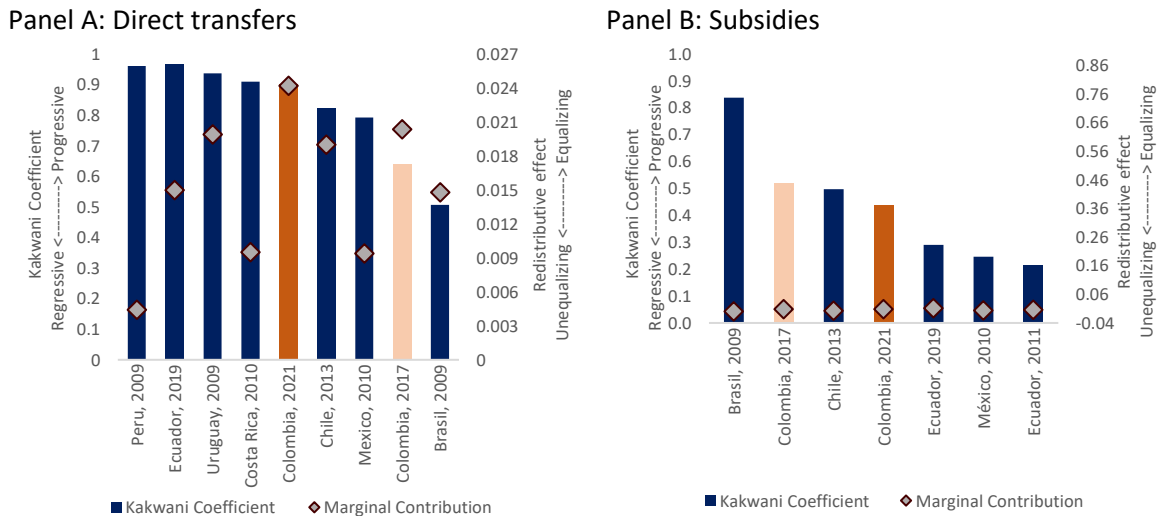
Panel A: Direct transfers   Panel B: Subsidies

Note: the results for all countries other than Colombia were obtained by applying the old CEQ methodology, which among other things did not include indirect effects of indirect taxes and accounted for in-kind income differently, while the results for Colombia and Ecuador were obtained by applying the new CEQ methodology.

Box 3. Gasoline subsidies, the Colombian case

In 2007, Law 1151 created the Fuel Price Stabilization Fund (Fondo de Estabilización de Precios a los Combustibles, FEPC) in order to avoid passing the frequent changes in international fuel prices, particularly those of gasoline and ACPM or diesel, through to final consumers. In other words, the fund smooths fuel prices by paying the fuel refiner the difference between the international price and the price paid by local consumers, a price set by the national government (MME, 2022). The initial capital with which the FEPC was created was around USD$277 million, which was emptied by the end of 2010, mainly because the government set domestic prices below the recovery of the international oil price between 2009 and 2010 (IMF, 2019). As a result, the fund's deficit reached 10.8 trillion COP in 2018 (MME, 2022), which is just over 1.1% of GDP. During most of the fund's existence, the international price has been above the reference price, to such an extent that the price of gasoline went from 4,865 pesos at the beginning of 2020 to 13,800 pesos in June 2022, putting significant pressure on the FEPC (see Figure 17).

The main results of the model show that in terms of absolute incidence, while 5.7% of the total gasoline subsidy reaches the poorest 10% of the population, 29.5% of the subsidy is received by the highest income decile. However, the relative incidence indicates the relative weight of this subsidy received by the household as a proportion of their per capita market income by income decile. It is observed that gasoline subsidies represent a higher proportion for lower income segments of the population, reaching 5.3% of market income for the first income decile.

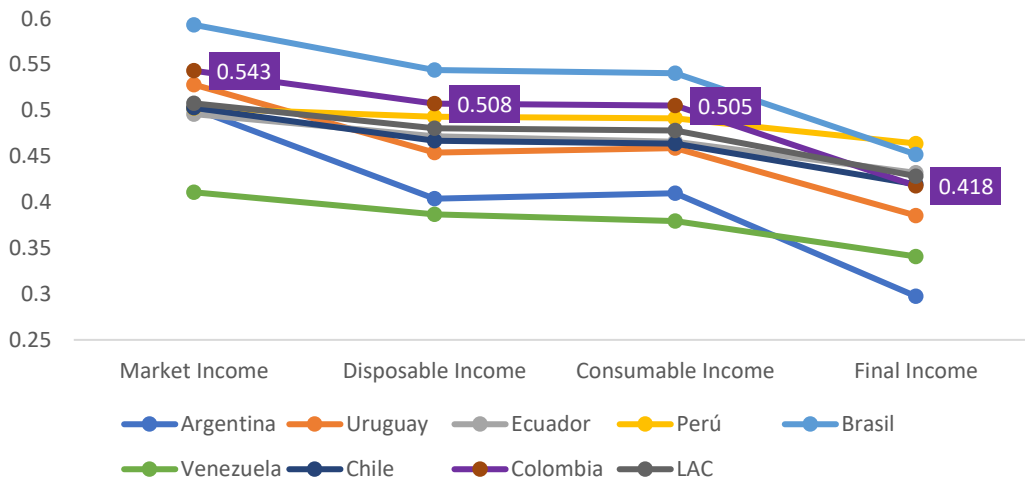**Figure 17. The case of gasoline and ACPM**

Panel A: PI evolution and international gasoline prices

Panel B: Absolute incidence-gasoline
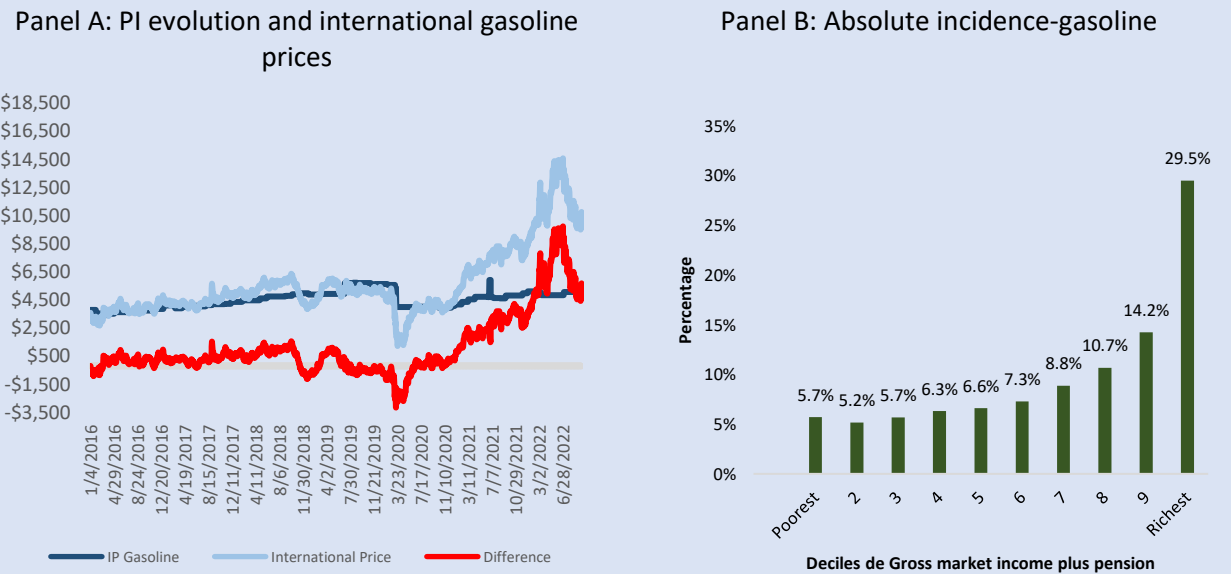
Source: Authors' estimates based on Ministry of Mines and Energy information.

Education and health

Progressivity in education and health is relatively high. In general, those who are recipients of in-kind transfers in education in public entities or in health are at the lower end of the distribution. Consequently, the Kakwani index for Colombia for in-kind transfers in education is 0.761, above the average for the countries analyzed, while for health it is 0.619. It is important to mention that the traditional method of allocating education and health benefits ignores the willingness of households to pay for these services, the return on investments in human capital, and inefficiencies in the use of public resources. That is, it does not take into account the quality of services received by beneficiaries, so education and health outcomes may be overestimated (Lustig, 2018).
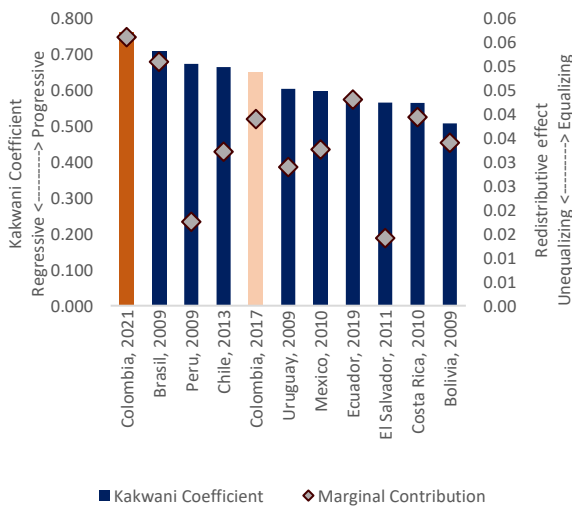
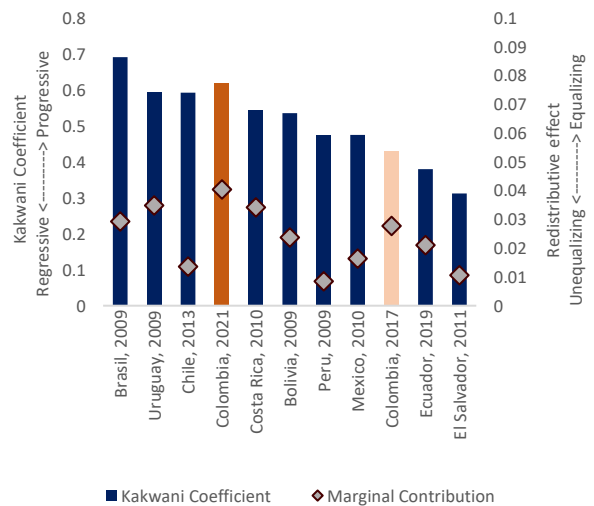**Figure 186. Progressivity of direct transfers and subsidies in Latin America**

Source: Núñez et al. (2020) and own calculations.

Figure 19. Progressivity of in-kind transfers in Latin America

Panel A: Education   Panel B: Health

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6. The 2022 tax reform: Exploring its potential impact

In November 2022, the Tax Reform for Equality, Social Justice, and Fiscal Adjustment Consolidation Act, which will take effect in fiscal year 2023, was introduced and approved by the congress. This tax reform included changes in income tax and complementary taxes for both individuals and companies, especially through the reduction of deductions and tax exemptions in the personal income tax, changes in rates for some sources of income and adjustments in the deductibility of royalties, as well as changes in discounts for investments made in technological development and innovation.

The reform also contemplated the creation of a permanent wealth tax. In addition, it included changes in the rates on the national carbon tax and the creation of the national tax on single-use plastic products used for packaging or wrapping goods. Finally, the approved law created health taxes, which impose tariffs on ultra-processed sugary beverages, as well as on ultra-processed industrially produced food goods with a high content of added sugars, sodium, or saturated fats.

In order to evaluate the redistributive impacts of the reform using the microsimulation tool described throughout this paper, the specific sections of the reform that can be captured by the household surveys used in the model are simulated, in particular the items of the reform corresponding to: (i) the reduction in the cap on personal income tax exemptions and deductions; (ii) the homogenization under the general schedule rate paid on dividend income; (iii) the introduction of the personal wealth tax with specific limits and rates; (iv) the changes in carbon tax rates; and (v) the short-term effects of the creation of health taxes. The main changes introduced and simulated in the model, as well as the results of the expected distributive impacts, are described below.

It is important to mention that tax exemptions and deductions are modeled in two ways: i) assuming the relationships between gross income and net income by schedules observed in the administrative data to arrive at the taxable income and ii) a combination of the above, but identifying specific deductions and exemptions that can be modeled in the household survey. The purpose of the latter is to make the model more flexible by including policy parameters that can be modified by tax reforms (see annex 9.1). Consequently, the results discussed below use the second modeling option as a baseline.

Direct taxes

One of the main changes of the reform focuses on redefining the limits for tax deductions and exemptions for the general schedule, which is made up of salaried income, professional gains, capital, and non-labor income. In general terms, Article 336 of the Tax Statute establishes that, to obtain the taxable income for the general schedule, deductions and exemptions may be subtracted from the net income of the general schedule, provided that these deductions do not exceed 40 percent of the same net income. Net income is defined as the difference between gross income and non-taxable income. In turn, deductions, and exemptions until before the reform could not exceed 5,040 UVT (tax value units, reference established by the DIAN) per year. With the tax reform, this limit was reduced to 1,340 annual UVT.

Within the deductions and tax exemptions for individuals, according to article 206 and clause 10 of the Tax Statute prior to the reform, 25 percent of the total value of labor payments could be deducted with an annual limit of 2880 UVT; the reform reduced this limit to 790 UVT per year. On the other hand, deductions for economic dependents are now limited to 72 UVT per year up to a maximum of four dependents, when before the reform the limit was 384 UVT per year. In addition, income from dividends will be taxed at the marginal rate of the general scheme, which is applied to the general schedule. In other words, dividends will not have a differential rate, but will be unified under the ranges described in Table 5.

Table 5. Table of application of Personal Income Tax (IRPN, as per the acronym in Spanish). General schedule, pensions, and dividends. Ranges in annual UVT

Bracket	From	To	Marginal rate	Tax
1	0	1,090	0%	0
2	1,090	1,700	19%	(Taxable income in UVT minus 1090 UVT) x 19%
3	1,700	4,100	28%	(Taxable income in UVT minus 1700 UVT) x 28% + 116 UVT
4	4,100	8,670	33%	(Taxable income in UVT minus 4100 UVT) x 33% + 788 UVT
5	8,670	18,970	35%	(Taxable income in UVT minus 8670 UVT) x 35% + 2296 UVT
6	18,970	31,000	37%	(Taxable income in UVT minus 18,970 UVT) x 37% + 5901 UVT
7	31,000	hereinafter	39%	(Taxable income in UVT minus 31,000 UVT) x 39% + 10,352 UVT

Source: Article 241 of the Tax Statute.

The tax reform law also introduced a permanent wealth tax on the owners of property whose value exceeds 72,000 UVT, excluding the first 12,000 UVT of the equity value of the house or apartment, where recreational properties or second homes are not covered by the exclusion. It is important to note that, although this tax previously existed on a temporary basis and for specific years, its rates and limits were different from those proposed by the reform.

Table 6. Wealth tax application table. Ranges in annual UVT

Brackets	Minimum	Maximum	Marginal rate	Tax
1				0
	0	72,000	0%	
2				(Taxable income in UVT minus 72,000 UVT) x 0.5% (Taxable income in UVT minus 72,000 UVT) x 0.5%.
	72,000	122,000	0.5%	
3				(Taxable income in UVT minus 122,000 UVT) x 1.0%+250 UVT
	122,000	239,000	1%	
4				(Taxable income in UVT minus 239,000 UVT) 1.5%+1420 UVT
	239,000	Hereinafter	1.5%	

Source: Conciliation Report on House of Representatives Bill 118 and Senate Bill 131.

Indirect taxes

The changes in indirect taxes and their redistributive impacts modeled in the fiscal microsimulation tool include two elements, namely the national carbon tax and taxes on sugar-sweetened beverages and ultra-processed foods. The national carbon tax is levied on the carbon content of fossil fuels derived from petroleum, fossil gas, and solids that are used for combustion for sale within the country. It was created by Law 1819 of 2016. At the time, the specific tariff was established considering the carbon dioxide (CO_2) emission factor for each fuel determined in unit of volume (kilogram of CO_2) per energy unit (Terajoulus), according to the volume or weight of the fuel, setting a tariff of 15,000 pesos per ton of CO_2. The tax reform modifies the rate to 20,500 pesos per ton of carbon equivalent and establishes that it will be adjusted annually to the variation of the CPI (consumer price index) of the previous year plus one point until it is equivalent to three UVT per ton of carbon equivalent. This rate for gasoline and ACPM (diesel) will be adjusted from 2024 onwards. The following are the equivalents to the rate per gallon for the fuels simulated in the tool: gasoline and Diesel or ACPM.

Table 7. Carbon tax rates as a fuel unit

	Law 1819 of 2016 (equivalent in 2021 given UVT growth)	Tax reform
Gasoline	135 (159)	169
Diesel or ACPM	152 (179)	191

Source: Conciliation Report on House Bill 118 and Senate Bill 131.

The introduction of a tax on sugar-sweetened beverages and ultra-processed foods is aligned with best practices and international evidence, with positive impacts on the containment of unhealthy consumption. The tax reform incorporates a gradual increase in the tax rate from 2023 to 2025. For ultra-processed foods, the tax rate will be ten (10) percent in 2023, 15 percent in 2024, and 20 percent starting in 2025. The tax rate on sugar-sweetened beverages may increase, given the sugar content in grams (g) per 100 milliliters (100 ml). Producers whose gross income from sugar-sweetened beverages and ultra-processed foods may exceed 10,000 UVT are excluded from this tax. It is important to note that only short-term impacts are evaluated, without considering

changes in consumers behavior, given the introduction of these health taxes. Results from countries that have implemented a similar tax suggest that, in the long run, the net revenue effect of an increase in taxes on sugar-sweetened beverages is progressive, given the gains in out-of-pocket medical expenses and productivity, where lower income deciles benefit more in relative terms than higher income deciles do (Fuchs et al., 2020).

Results

The results of the fiscal microsimulation show that the tax reform would have a slight positive overall redistributive effect and would essentially affect the highest deciles of the income distribution. By applying direct taxes, it is estimated that inequality as measured by the Gini index in disposable income may decrease slightly by 0.34 percent and when using the Theil index by 1.35 percent. The Kakwani progressivity index of the personal income tax may increase from 0.426 to 0.439, driven mainly by the reduction of exemptions and deductions. By adding indirect taxes, on the side of the Gini index in the consumable income, this may happen to decrease 0.31 percent, while the Theil would decrease by 1.29 percent. The microsimulation does not show changes in poverty since the tax reform does not affect the lowest deciles and does not contemplate additional allocations or modifications to social programs.

Redistributive impacts

In terms of collections, an increase of 34.3 percent in personal income tax and six (6) percent in carbon tax is expected. Personal income tax payments would rise from 1.1 percent of gross market income plus pensions for the richest ten (10) percent to 1.4 percent. As a result, the tax deductions, and exemptions that, excluding the changes introduced by the reform, have a weight of 30.3 percent for the top decile would be reduced by 2.4 percentage points to 27.9 percent of their gross market income (see
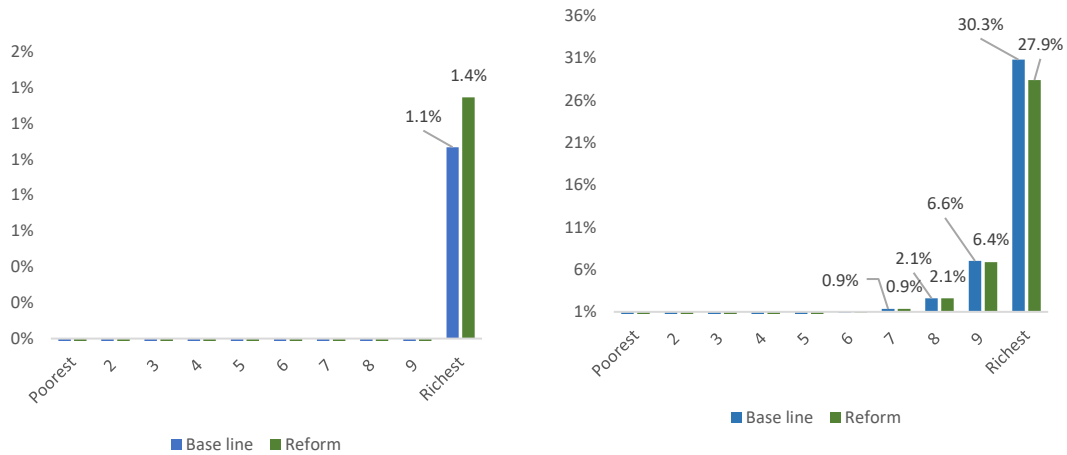
Figure **207**). Deductions and exemptions would fall by 11 percent, with the entire decrease attributed to the top income decile.

Figure 207. Relative incidence. Income tax vs. deductions and exemptions

Panel A: Personal income tax   Panel B: deductions and exemptions

Source: own calculations using 2021 GEIH information.

With the regulatory change, income tax would continue to be concentrated almost entirely in the richest ten (10) percent of the population (see **Error! Reference source not found.**). In absolute terms, under the scheme in effect before the reform, 98 percent of this tax fell on the top decile. Regarding deductions and exemptions, it is expected that with the reform, the share of the last decile will increase from 99.7 percent, which means that tax exemptions will be less concentrated in this segment of the population. No changes in poverty are expected as a result of the tax reform itself. The Kakwani index for income tax would improve two (2) percent to 0.439, improving its progressivity, while the same index for deductions and exemptions would go from -0.382 to -0.377, slightly reducing regressivity levels. As for the wealth tax, which is entirely concentrated in the last decile, before the reform its progressivity in terms of the Kakwani index was 0.445 and would reach 0.455 with the reform.

Figure 8. Absolute incidence. Income tax vs. deductions and exemptions

Panel A: Personal income tax   Panel B: Deductions and exemptions
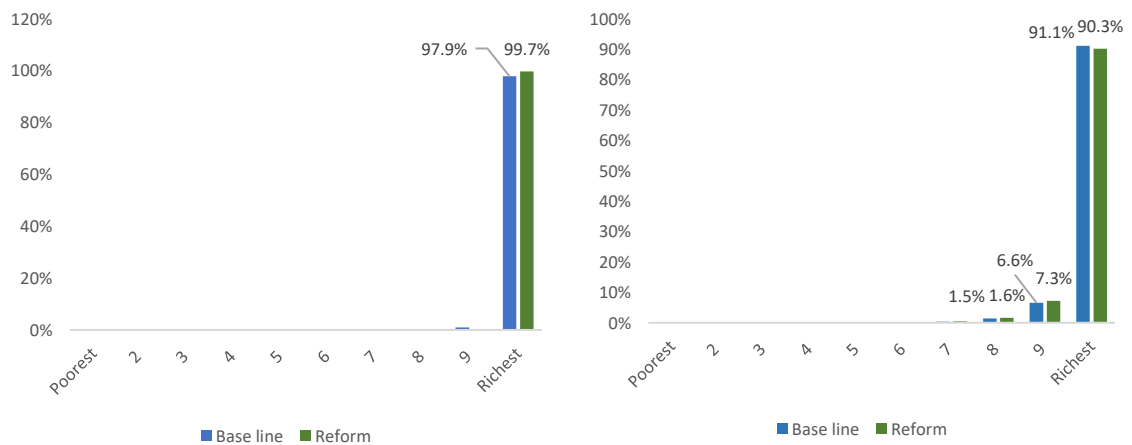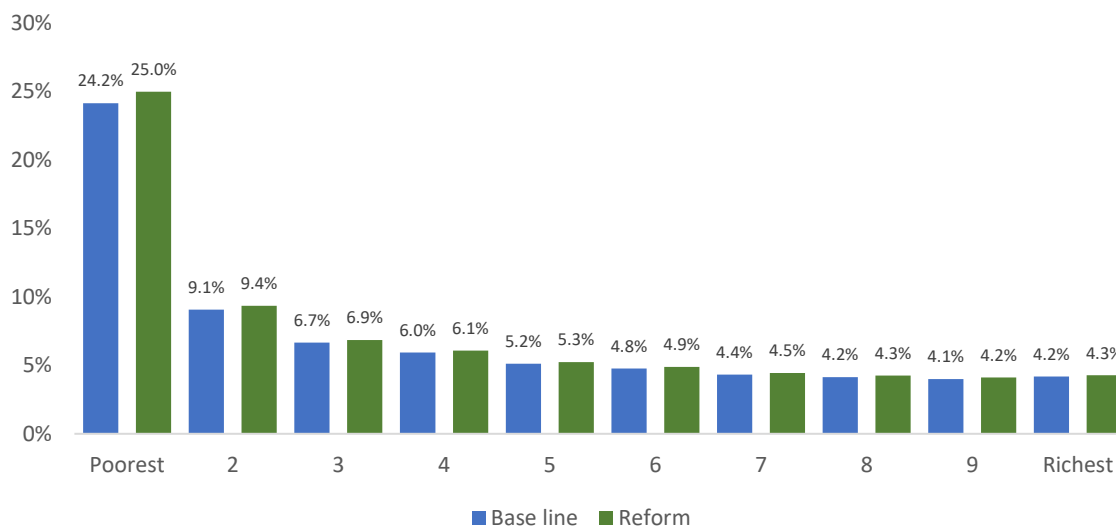

Source: own calculations using 2021 GEIH information.

As for the changes in indirect taxes, namely the introduction of health taxes and changes in the carbon tax rate, their redistributive effect is regressive without considering changes in consumption pattern behavior. Figure 22 shows that the weight of indirect taxes could increase from 24.2 percent before the reform to 25 percent with the reform for the lowest income decile (an additional 0.8 pp). The upper deciles are also expected to see an increase in this relative weight but to a lesser extent, by about 0.1 pp, which in the case of the last decile would represent only 4.3 percent of gross market income plus pensions.

No changes are expected in the progressivity of the carbon tax measured by the Kakwani index, which in the case of gasoline is -0.220, while that of ACPM is -0.188. On the side of the same index for health taxes, its regressivity reaches -0.125. It is important to highlight that one of the purposes of public policy in the case of the implementation of health taxes is to generate behavioral changes, in such a way that long-term benefits are observed for the most vulnerable population by reducing the intake of food products that do not have a high nutritional value. This microsimulation exercise does not take such behavioral changes into account, so this result should be analyzed with this consideration in mind.

Figure 22. Relative incidence of total indirect taxes

Source: own calculations using 2021 GEIH information.

7. Conclusion

Colombia had made important progress in poverty reduction but, even before the pandemic, the trend started to reverse. The pandemic hit the country very hard, and poverty has not yet returned to its pre-pandemic levels. Moreover, Colombia remains one of the most unequal countries in the region and in the world.

Having a distributive analysis of fiscal policy is an important tool for policy makers. Such analysis places an equity lens on tax system reform considerations, to be evaluated along with

considerations of tax and expenditure system efficiency as well as the impact on fiscal accounts. In a country like Colombia, with important equity challenges and with equity at the center of the public policy agenda, this analysis presents the most recent findings on the distributive impact of the tax system, introducing innovations that build on the existing literature. It also provides a more up-to-date picture that could be more easily adapted to changes in the socioeconomic context or changes in fiscal policy parameters.

Using 2021 data, the analysis shows that the fiscal system in Colombia has a positive distributional impact. Yet, the impact of taxes and transfers remains limited, particularly compared to other OECD countries. This limited impact mainly reflects three issues. First, a tax system that is progressive, but not progressive enough to compensate the regressivity of indirect taxation, particularly of the VAT. A low proportion of the population, and only those with very high levels of income, contribute through payments of personal income tax. Second, tax exemptions and deductions mostly benefit the upper part of the distribution, limiting the tax revenues collected to increase the impact on the poor and vulnerable. Third, cash transfer and subsidy programs have room for improvement in their targeting. Nevertheless, direct transfers are highly progressive with programs like *Más Familias en Acción* and *Ingreso Solidario* (an emergency program implemented to face the pandemic) with the highest level of progressivity.

One of the innovations of this paper is assessing the inclusion of top incomes, and the effect it has on inequality measures. The analysis shows that relying only on the traditional household surveys underestimates the level of inequality in Colombia, and that accounting for top incomes increases the share of the tax paid by the richest. The highest decile assumes almost the entirety of the personal income tax revenue. Moreover, by relying on the annual household income survey, this analysis can be updated with more frequency, allowing policy makers to have insights in line with the country context and with recent and upcoming policies.

Looking ahead, it is important to further evaluate the very large impact of in-kind health and education transfers. For instance, the methodology values in-kind benefits at the average cost of provision for the government, so it does not account for differences in the quality of services received by the beneficiaries. The literature is advancing on this front.

To conclude, this analysis can offer useful policy insights on recent policy changes, such as the 2022 tax law, but also upcoming reforms. For example, the results can inform the rethinking of the social protection system given the phasing out of *Ingreso Solidario* at the end of 2022, as well as potential reforms on fuel and utility subsidies.

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9. Annexes

9.1 Methodological comparison with the literature for Colombia

Lustig, Meléndez, Rodríguez-Castelán (2014) and Núñez et al. (2020) have developed previous exercises following the CEQ methodology for Colombia. The type of fiscal policies, as well as the economic and social context captured, differs from the present CEQ largely because of the inputs or information sources used. While the former considered the 2010 Quality of Life Survey, the latter used the 2016-2017 National Household Budget Survey (ENPH). For its part, the current CEQ uses the 2021 GEIH, which collects the socioeconomic, income, and labor market characteristics of households on a periodic (monthly) basis and is based on the most recent sampling frame following the 2018 National Population and Housing Census. In turn, consumption characteristics are imputed from the ENPH by connecting households, given a set of socioeconomic characteristics (see methodology). The main advantage of this approach is that it facilitates the CEQ updating process, better capturing the country's poverty and inequality situation.[18] The main differences between the current CEQ and previous works are described below.

Direct taxes and transfers

The version of Núñez et al. (2020) and the present version include social security contributions by calculating the legal rates according to the income of the individuals who report paying contributions, unlike the version by Lustig, Meléndez, and Rodríguez-Castelán (2014), which does not include them. Núñez et al. (2020) includes as direct taxes the personal income tax, property tax, and vehicle tax. This version of the CEQ focuses on modeling personal income tax.[19]

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[18] This paper bases the simulations on the 2021 GEIH. Additionally, the GEIH is the official survey with which DANE calculates monetary poverty and inequality, so the standard values in this CEQ use the official poverty lines. The cost of changing the year, as long as all the information is available, is very low.

[19] The version prior to this CEQ (Núñez et al., 2020) takes as given the values reported in the survey of property and valorization tax and vehicle tax expenditures, but models the personal income tax.

As for personal income tax, this new version updates the parameters and the form of calculating the tax according to the most recent version of the Tax Statute, which, unlike the previous CEQ (Núñez et al., 2020), unifies the sub-schedules of labor, capital, and unearned income into one general schedule. In addition, there are innovations in the calculation of tax deductions and exemptions by taking information by centile of gross income from DIAN form 210. As an additional exercise, deductions and exemptions were also broken down and modeled according to labor exemptions, deductions for economic dependents, mortgage interest, and voluntary contributions to health or savings accounts.

In terms of direct transfers, the current paper is limited to including the social programs identifiable in the GEIH such as Más Familias en Acción, Colombia Mayor, Jóvenes en Acción, and unemployment subsidy; the programs created as of 2020, Ingreso Solidario and VAT refund, and, due to its size, the School Meals Program, which is identified (not observed in the GEIH) and is imputed from the ENPH. Unlike the previous CEQ, it does not consider victimization, Familias en su Tierra, and early childhood transfers. In terms of methodology, a similar approach is used in both by including administrative records of the programs. The former CEQ simulated potential beneficiaries based on the survey and imputed per capita spending by administrative records program. The present CEQ combines the beneficiary reports in the survey and administrative values by simulating the remaining beneficiaries in the microdata based on the eligibility variables of each program. It then assigns per capita values for each program.

Indirect taxes and subsidies

In general, in indirect taxes the methodologies and sources of information are similar in both the previous CEQ (see Núñez et al., 2020) and the current one. However, this paper presents VAT exempt rates and products updated in accordance with the most recent version of the Tax Statute. The calculation of cigarette taxes is also refined by specifying the statutory rates according to the filter, the reference value, and the specific value. Similar innovations were made in the tax on alcoholic beverages by specifying the values by alcohol content, according to type of liquor. The previous CEQ did not include gasoline or diesel taxes and subsidies due to lack of information. The current CEQ includes the national tax on ordinary motor gasoline and diesel (ACPM), as well as the national carbon tax with inclusion of legal parameters in terms of pesos per gallon consumed. The estimate of gallons is identified in the ENPH considering the final month-to-month sales price between 2016-2017 and differentiating by major cities with representativeness in the consumption survey (ENPH). The indirect effects of the tax are also calculated.

On the natural gas and electricity utility subsidies side, the previous CEQ included rates differentiated by months and geographic domains. In contrast, the current CEQ assumes national rates by socioeconomic stratum to facilitate parameterization. Both direct and indirect effects are also included. Water, sewage, and sanitation subsidies are not included, since inconsistencies were found in the reports. Gasoline and ACPM subsidies are calculated considering the differential between the producer price and the export parity price (or international price) calculated by the Ministry of Mines and Energy with data aggregated to 2021.

Health and education

In terms of in-kind transfers, the methodology used in the previous CEQ is followed (see Núñez et al., 2020), which is plausible in the absence of institutional changes in the allocations to health and education benefits. The main difference is in the parameters that are updated to the most recent year possible. In this way, the values of the monthly Capitation Payment Unit (UPC) for 2021 and assigned to the subsidized regime (identifiable in the survey) were used for health spending, differentiating between rural and urban areas, and the indigenous population. The additional 68 percent of the UPC established for members of the contributory system is also considered.

In the case of education, the allocations by population served were consulted according to the distribution of the General Revenue-Sharing System (SGP) for 2020, taking into account the additional resources of the regional entities and differentiating between department/city, urban or rural area; and primary, middle, and high-school education. In higher education, the per capita value of public higher education spending is assumed. Finally, following Lustig's (2018) methodology, a reduction or adjustment used to be made to these allocations (in health and education) in order to avoid redistributive overestimates. However, recent methodological updates suggest not making the adjustment using national accounts, which is why Table A1 presents two scenarios: with adjustment for comparative purposes against previous methodologies and without adjustment. The latter serves as the basis for reporting results.

Imputation method

The GEIH does not inquire about household spending. One of the main challenges is to be able to include this information in the model to calculate indirect taxes and subsidies that depend on the level of spending. To this end, the ENPH is used and specific policies are imputed to the GEIH using a predictive model called Predictive Mean Matching (PMM), known as a hot-deck imputation method. Accordingly, the missing value in one survey (recipient, GEIH) is imputed using observed values from another survey (donor, ENPH) ensuring that the distribution of imputed values closely matches the distribution of observed values (White et al., 2014).

Three types of variables are defined: the dependent or target variable (y), independent variables from the donor survey (X_{obs}, the survey where y is observed) and the independent variables of the recipient survey (X_{mis}, the survey where y is not observed). The variables included in the imputation model are: age of head of household, household size, level of education of head of household, occupational status, work schedule, pension payment or pension contribution, gender, number of children studying by educational level, independent housing, overcrowding, homeownership, number of rooms, socioeconomic stratum, geographic area, flooring material, number of assets (washing machine, refrigerator, blender, stove, electric heater, color TV, LCD/LED TV, digital music/video players, laptop/desktop computer, vacuum cleaner, air conditioner, bicycle, motorcycle, private car).

In accordance with Van Buuren (2018), the PMM is calculated using the following steps:

1. Estimate consumption (y) as follows in the ENPH: $y = X_{obs}\beta + \varepsilon$
2. To obtain the estimated value $\hat{y} = X_{obs}\hat{\beta}$ in the ENPH
3. Take a $\dot{\beta}$ of the posterior distribution of $\hat{\beta}$ and calculate $\dot{y} = X_{mis}\dot{\beta}$ in the GEIH, which is obtained using bootstrapping.
4. For each individual in the recipient survey a set of d donors is calculated, which are chosen according to the minimum Euclidean distance between $\dot{y}$ and $\hat{y}$
5. Taking a random donor from the donor pool d
6. Impute the value y in the receiving survey by taking the donor chosen in step 5.

Using the aforementioned, a key is created between donor households in the ENPH whose consumption will be imputed to the GEIH, so that the following items are imputed to the receiving survey: consumption tax and VAT, monthly units (gallons) of gasoline and ACPM consumed, electricity (kilowatt hours), gas (cubic meters), consumption of alcoholic beverages (beer, wine, whiskey, rum, schnapps), cigarettes, and households that benefit from the School Meals Program, identifiable in the ENPH.

9.2 Direct taxes

The sources of information and data used, as well as the procedure for the analysis of direct taxes, are detailed below. Direct taxes include personal income tax, employee payroll taxes, and wealth tax.

A. Personal Income Tax

Annually, personal income tax is levied on income generated and on increases in assets for individuals. Although the most recent update to the Tax Statute was made through the Tax Reform Law 131 of 2022, the baseline of this paper is based on Law 2155 of 2021. The Colombian tax system classifies income into three main schedules namely, the general schedule, which is composed of labor income from salaries and self-employed, non-labor income, and capital; the pension schedule; and the dividends and profits schedule. An additional source of income to be reported on Form 210 is the Non-Occasional Income tax. Prior to Law 131 of 2022, each tax code had a specific rate, as well as a specific way of determining the net taxable income. However, the 2022 tax reform for equality and social justice, among other elements, unified the rates charged for dividend and share taxes along with the general tax rates.

The DIAN, the entity in charge of tax collection, defines the Tax Value Unit (UVT) as the reference value for determining taxable income, as well as the rates and limits of exemptions and deductions. The UVT is updated annually in Colombian pesos according to the previous' years inflation rate. In 2021, the UVT was 36,308 Colombian pesos. Only individuals whose gross assets exceed 4,500 annual UVT, or whose gross income, purchases with credit cards, total consumption or bank deposits or financial investments are greater than 1,400 UVT, are responsible for declaring this tax. To calculate the tax payable, the law stipulates that the gross taxable income must be reduced by non-income taxes, which in essence are not part of the taxable income, such as, for

example, social security contributions or payroll taxes. This subtraction is known as net income, from which tax exemptions and deductions established by law can be deducted, depending on the source of income.

i)   Rates

Rates are progressive and applicable to the adjusted income depending on the corresponding cédula. Taxpayers are grouped into three categories, according to source of income based on gross annual income: i) general category: with labor, non-labor, and capital income; ii) pension income category; and iii) dividends and shares category. The rates are established in the general schedule that comes from Tax Reform Law 2010 of 2019, and articles 335 and 336 of the Tax Statute (ET, as per the acronym in Spanish). The pension tax is established in article 337 of the ET and the dividends and shares tax is established in articles 342 and 343 of the ET. The Colombian schedular payment scheme distinguishes the general schedule from the pension schedule and from the dividends and shares schedule. The progressive rate for adjusted income from labor, capital, and unearned income (components of the general taxable income) and pensions is the same and is presented in Table A1. Separately (general pension), the ordinary net income is divided into UVT for the corresponding year and is placed in the range that corresponds to the marginal rates table. This has been in effect since 2019 and no changes to the law have been made since.

Table A1. Marginal rate for net income of general and pension income tax returns

Minimum (UVT)	Maximum (UVT)	Marginal rate	Tax
0	1,090	0	0
1,090	1,700	19%	(Taxable income in UVT minus 1090 UVT) x 19%
1,700	4,100	28%	(Taxable income in UVT minus 1700 UVT) x 28% + 116 UVT
4,100	8,670	33%	(Taxable income in UVT minus 4100 UVT) x 33% + 788 UVT
8,670	18,970	35%	(Taxable income in UVT minus 8,670 UVT) x 35% + 2,296 UVT
18,970	31,000	37%	(Taxable income in UVT minus 18,970 UVT) x 37% + 5,901 UVT
31,000	.	39%	(Taxable income in UVT minus 31,000 UVT) x 39% + 10,352 UVT

Source: Tax Statute, 2022.

The rate applicable to the dividends and shares tax depends on the income classification. The rates are classified in those revenues charged against profits generated before December 31, 2016, or after January 1, 2017. In the latter case, they are divided into two sub-schedules. In the former case, the marginal rate described in table A2 is applied. This means that the first 300 UVT are not taxed and the tax on the next 300 UVT is 10 percent. The net passive income from dividends received abroad and the equivalent portion of exempt income are added to the second

sub-schedule, thus arriving at the taxable income to which the 31 percent rate is applied. The marginal rate is applied to the remaining value.

Table A2. Marginal rate for the dividends and shares tax credit after 2017.

Minimum (UVT)	Maximum (UVT)	Marginal rate	Tax
0	300	0	0
300	0	10%	Dividends in UVT minus 300 UVT X 10%.

Source: Tax Statute, 2022.

In the meantime, the rate applicable to the profits generated before December 31, 2016, is presented in Table A3. The first 1,090 are exempt, while the remainder are taxed at the progressive marginal rate ranging from 19 percent to 33 percent. The rate for non-recurring income tax may be 10 percent or 20 percent of the taxable income.

Table A3. Marginal rate for dividends and shares prior to 2016.

Minimum (UVT)	Maximum (UVT)	Marginal rate	Tax
0	1,090	0	0
1,090	1,700	19%	(Taxable income in UVT minus 1090 UVT) x 19%
1,700	4,100	28%	(Taxable income in UVT minus 1700 UVT) x 28% + 116 UVT
4,100	8,670	33%	(Taxable income in UVT minus 4100 UVT) x 33% + 788 UVT

Source: Tax Statute, 2022.

ii)   Data

The main source of information is the 2021 Integrated Household Survey (GEIH) and the DIAN's administrative records. In particular, the information with the values of each item on form 210 for total income tax return and disaggregated by thousands of total gross incomes of the returns made in 2020, the most recent year. The tax system in Colombia, as explained above, contains a significant number of tax deductions and exemptions, not all of which can be modeled using the household survey. Consequently, administrative information is key to validate and model the tax system along the distribution according to the relevant source of income more accurately.

iii)   Methodology

In general, we followed the methodology developed by Núñez et al. (2020). The authors attempted to estimate the taxable income following the guidelines of the tax law. However, they found that such a procedure led to a considerable underestimation of deductions and exemptions and an overestimation of taxable income, largely because it is difficult to capture the totality of exemptions and deductions in the survey. However, in this paper, in addition to the update with 2020 data, some innovations are included such as: i) modeling part of the labor income exemptions to make the model more flexible with policy parameters useful to simulate policies

such as the 2022 tax reform (hereafter, the second scenario); and ii) taking administrative data that account for the behavior of deductions and exemptions along the distribution (not only at the median), with data disaggregated by income percentiles (hereafter, third scenario).

Two criteria are used to define the filers: the income criterion (1,400 UVT or more) and the gross assets criterion (4,500 UVT or more). However, since the survey does not inquire about people's wealth, we followed the methodology proposed by Núñez et al. (2020) taking survey information on homeownership and rental and interest income. The following is a description of the scenarios in which tax deductions and exemptions are modeled.

First scenario: base scenario

General schedule

For the calculation of gross income in the general schedule, the income by source reported in the survey is taken separately according to sub-schedules (labor, non-labor, and capital). The gross income of each sub-schedule is reduced by nontaxable income and the equivalent of exemptions and deductions to arrive at a total value of ordinary liquid income, which, when added together and applying the maximum limits of exemptions and deductions (5,040 UVT per year in 2021), yields the net taxable income. For the labor sub-schedule, the primary and secondary activity income was taken, including in-kind income from the household survey. This amount is reduced by nontaxable income receipts from social security contributions to the mandatory pension system and to the health care system. Following the DIAN definition of nonlabor income, the income of the unemployed and inactive are included as part of nonlabor income during the last 12 months of the year. Income from capital rentals or rental income, interest, and financial yields are taken as part of capital income. The survey reports monthly income, which is why it is annualized. There is no disaggregated income from royalties and exploitation of intellectual property.

As previously mentioned, deductions and exemptions were calculated using DIAN administrative data. The ratio between net taxable income and gross labor income is calculated. The net taxable income deducts non-income receipts (social security contributions), voluntary contributions to AFC, FVP and/or AVC together with other exempt income, as well as deductions for housing interests, economic dependents, and other chargeable deductions from the gross income of each source. This ratio is applied to the gross income estimated in the survey for each sub-schedule (labor, non-labor, and capital). While the average ratio of net taxable income to gross income is calculated in the main model (first scenario), we also analyze the proportions by brackets of thousands or 1,000-quintiles of total gross income (third scenario). However, we chose to take the first alternative as the base scenario. In the case of labor income, it is important to note that an average is estimated between the adjustment factors for labor and professional or self-

employed income. Table A4 shows the proportions used in the case of the general and pensions schedules.

Table A4. Components of form 210, total by sub-schedule

| Item	Total	% Gross Income
Panel A: Pensions		
Gross pension income	36,631,913	100.0%
Non-taxable income	3,092,483	8.4%
Net income	33,558,975	91.6%
Pension exempt income	32,220,830	88.0%
Net schedular pension income	1,493,289	4.1%
Panel B: Non-labor		
Gross nonlabor income	189,587,991	100.0%
Returns, rebates, and discounts	1,801,943	1.0%
Non-taxable income	3,748,351	2.0%
Costs and expenses incurred	149,555,685	78.9%
Net income	35,195,424	18.6%
Non-employment net passive income - CFC	8029	0.0%
Exempt income and deductions chargeable to unearned income	268,370	0.1%
Exempt income and deductions chargeable to unearned income - limited	521,315	0.3%
Ordinary net income for the year	34,681,555	18.3%
Net loss for the year	712,481	0.4%
Compensations	12,260	0.0%
Non-labor net schedular income	34,676,756	18.3%
Panel C: Capital		
Gross capital income	25,392,489	100%
Non-taxable income	1,861,334	7.3%
Costs and expenses incurred	7,226,461	28.5%
Net income	16,491,754	64.9%
Liquid passive income from capital - CFC	102,866	0.4%
Exempt income and deductions chargeable to capital income	222,726	0.9%
Exempt income and deductions chargeable to capital income - limited	670,981	2.6%
Ordinary net income for the year	16,511,643	55.3%
Schedular net income from capital	16,511,643	65.0%
Panel D: Labor		
Gross labor income	163,267,160	100%
Non-taxable income	11,985,740	7.3%
Net income	151,325,172	92.7%
Exempt labor income and chargeable deductions	45,179,582	27.7%
Exempt earned income and tax deductions - limited	55,005,113	33.7%
Schedular net labor income	96,324,269	59.0%

Pension and dividends and shares schedule

In accordance with the current Tax Statute, the pension and dividends and shares schedules are settled separately from the general tax schedule. For income from pensions or retirements due to old age, disability, or personnel substitution, the GEIH reports are taken as gross income from the annualized pensions schedule, assuming that the income is received during the 12 months of the year. Similarly, the proportions of the administrative records are used to maintain consistency with what is reported in the general schedule and not to overestimate the taxable income, as well as to preserve consistency with the methodology reported in Núñez et al. (2020).

However, the exempt income in the pension schedule can reach up to 12,000 UVT per year, which sets a very high threshold, to such an extent that, although the total non-income receipts are equivalent to 8.4 percent, the ordinary net income on which the taxable income is established is 4.1 percent of the gross pension income. Figure 93 shows the behavior of gross income, non-taxable income, and ordinary net income throughout the distribution, where the ratio of ordinary net income to gross income varies slightly. However, at the high end it can be as high as 11 percent. It is important to mention that in the case of pensions, the base model does not use proportions at the mean, but instead uses proportions across the distribution. This is done especially because it is people with high pension income who contribute, given the high threshold of deductions and exemptions.

Figure 93. Gross income, non-income receipts, and ordinary net income in the pension statement (amounts in millions of pesos)
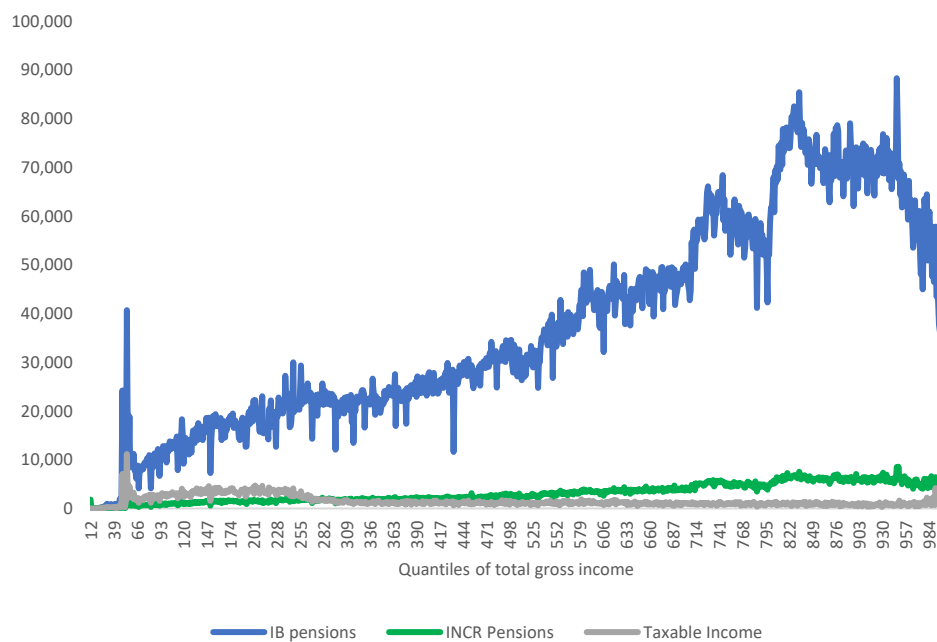
Source: Prepared by the authors based on information from the Sub-Directorate of Economic Studies - DIAN.

Regarding income from dividends and profits, the GEIH does not collect information exclusively about income from dividends and profits. Instead, it asks about i) income and dividend income as a whole and ii) occasional earning and sale of property and profits in another question. In order to distinguish the amounts corresponding to dividends and profits in these two questions, it is taken the share of gross income from dividends and profits reported on DIAN form 210 with respect to gross income from capital and income from occasional earning for the year 2020, after deducting the costs and expenses associated with capital and occasional earning. Table **A5**A5 shows the amounts reported by the DIAN, from which it is estimated that dividends account for 29.8 percent in the aggregate of capital, dividends, profits, and occasional earning after deducting their costs and expenses.

Similarly, the share of dividends in the component that adds occasional earnings and dividends amounts to 45.1 percent. These estimated factors are used to determine the proportion of dividends for the item reported in each question, such that, using a random distribution for the income reported in the GEIH, the proportion of individuals whose relative weight corresponds to that estimated in administrative data is assigned. Gross income from dividends includes income explicitly reported in the survey during the last 12 months of the year.

Table A5. Income from capital, dividends, and shares, and from non-recurring income

Item	Value in millions of pesos
Gross capital income	24,006,111
Costs and capital expenditures	8,082,821
Dividends and shares for 2016 and prior years	4,952,561
First sub-schedule for dividends and shares	1,782,121
Second sub-schedule for dividends and shares	45,161
Income from occasional earnings	34,813,030
Costs associated with occasional earning	26,574,415

Source: own preparation based on DIAN (2018).

The dividends and profits schedule contain three sub-schedules from which the taxable income is estimated, and rates are calculated separately. The first corresponds to those obtained in 2016 or earlier and is equivalent to 2.3 billion pesos, which when deducting non-income receipts results in an ordinary net income of 94 billion pesos, which is 1.8 percent of the total gross dividends and shares. The second and third, which apply to those obtained in 2017 or later years are equivalent to 54.9 percent and 1.4 percent of total dividends, respectively. Each proportion is applied to the gross income estimated in the survey, to obtain the income of each sub-schedule and its taxable income to which the pertinent rates are applied. For example, the taxable income of the dividends and profits tax schedule for 2016 and prior years corresponds to 1.8 percent of gross income, while 54.9 percent equals the first sub-schedule Meanwhile, the taxable income of the second sub-schedule equals 1.4 percent added to the proportion of net passive income from dividends (3.1 percent) minus exempt income (0.7 percent). This procedure is used for the other scenarios (in the case of dividends and shares).

Table A6. Dividend and shares items reported in 2021 (millions of pesos)

Item	Total	Share of total dividends
Dividends and shares 2016 and prior and others	2,329,505	43.7%
Non-income receipts	2,299,186	43.1%
Ordinary net income for the year 2016 and prior years	94,271	1.8%
First sub-schedule year 2017 and subsequent years	2,925,982	54.9%
Second sub-schedule year 2017 and subsequent years	72,989	1.4%
Net passive income dividends - CFC - and/or received from abroad	162,863	3.1%
Income exempted from box 72	39,726	0.7%

Source: Prepared by the authors based on DIAN information (2022).

Second scenario: alternative for modeling tax deductions and exemptions

The use of administrative records to determine taxable income has advantages, as previously explained. These include avoiding overestimation of taxable income, adding variability across the distribution and not just at the mean, distinguishing what happens at the high end of the distribution from what happens at the low end, as detailed in the third scenario below, as well as for consistency with previous versions of the CEQ for Colombia. However, when modeling potential tax reforms, such as the changes introduced by the tax reform through Law 2277 of 2022, it is essential to have more policy options to establish tax microsimulations on specific parameters, such as, for example, the cap on tax exemptions and deductions.

To this end, and to simulate the changes introduced by the tax reform, deductions and exemptions are modeled under certain assumptions for the labor and pension sub-schedules, differentially in the baseline. The main objective is to leave both percentages and annual limits as policy parameters. The rest of the schedules and sub-schedules maintain the same modeling explained in the previous section. The threshold value that applies to the general schedule is also modeled by limiting the total taxable income in accordance with the legally established parameter. In the pension schedule it is assumed that the only exemption is up to 12,000 UVT, as indicated by the law.

In the case of the labor sub-schedule, deductions for economic dependents are included at a cap of 10 percent of gross income (limited annually to 384 at baseline). For this purpose, households with children under 18 years of age and adults over 65 years of age who are not employed are identified, so that the number of dependents per household to be considered in the modeling is calculated. The legal parameters are followed considering the annual limits in UVT.

Table A7 Deductions and exemptions in effect as of 2021

Exemption/deduction	Maximum percentage	Annual limit prior to reform
Voluntary health contributions AFC, FVP, and/or AVC	30%	3800
Exemption from total labor payments	25%	2880

Deduction for economic dependents	10%	384
Deduction for mortgage interest	N/A	1200
Limits on special deductions	40%	5040
Annual exempt income in UVT	N/A	12,000

Source: own preparation.

Taking advantage of the fact that the survey inquiries about the value of amortization monthly payment and taking the benchmark mortgage interest rates for 2021 as a reference, housing interests are identified according to each household's report as to whether the home is owned and its payment status. The survey asks about amortization monthly payment, so the monthly housing interest rate is assumed to be 1.02 percent effective monthly. Next, the amount estimated above is annualized to make allocations to each individual taxpayer with positive gross earned income whose household reports paying for the home in which he or she lives. The rate is assumed to have an annual limit of 1,200 UVT.

In addition, the 25 percent discount on labor income is included, assuming that salaried employees deduct this amount in its entirety. As for deductions for savings in voluntary pension funds or construction promotion accounts, the GEIH makes it possible to identify individuals who make voluntary contributions to pension funds. It is assumed that they also make contributions to AFC accounts up to the legal limit, which is 30 percent of gross income and up to 3,800 UVT per year. Other sources of income (non-labor, capital, and dividends) are modeled according to the baseline scenario. However, following the provisions of the tax statute, the components of the net income of the general schedule are added and the general limit of deductions and exemptions of 5,040 UVT is applied to these, prior to the tax reform approved in 2022.

Third scenario: taxable income by income brackets or mil-quantiles

The purpose of this third scenario is to discount the value corresponding to the total deductions and exemptions observed in the administrative data throughout the distribution. When calculating the proportions by brackets, the aim is to identify variations in the entire distribution and not only at the median, particularly because not all taxpayers have the ability to deduct the same amount from their gross income.

Figure 104 shows the gross income by sub-schedule by quantiles of total gross income, the relevant part of non-income receipts and ordinary net income, which is obtained by subtracting non-income receipts from gross income, as well as all the deductions and exemptions applicable. Of the total gross labor income (163 billion pesos), 7.3 percent corresponds to non-income receipts, but ordinary net income is equivalent to 59 percent, higher figures than in the case of professional fees, with 4.6 percent and 48 percent, respectively. On the capital sub-schedule side of things, these proportions are 7.3 percent and 65 percent, while in unearned income they are 2 percent and 18 percent, respectively. However, the variability by gross income quantile is considerable, adding richness to the model. For example, in the case of the labor sub-schedule, it is observed that the ordinary net income grows, although not proportionally with labor income,

which indicates that in the upper part of the distribution, tax deductions and exemptions create a space that reduces the taxable income. This phenomenon is more important in the case of professional fee income. The proportions calculated using the total value of the distribution are shown in Figure 2 and are used in the main baseline model.

Figure 104 Gross income, non-income receipts, and net income in the general schedule (figures in millions of pesos)

Panel A: Work Sub-schedule
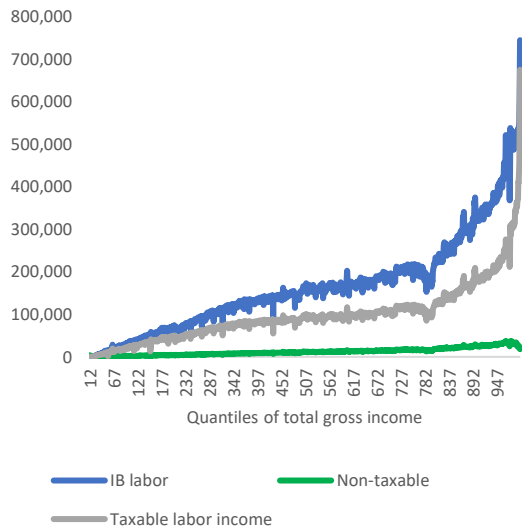
Panel B: Professional fee sub-schedule
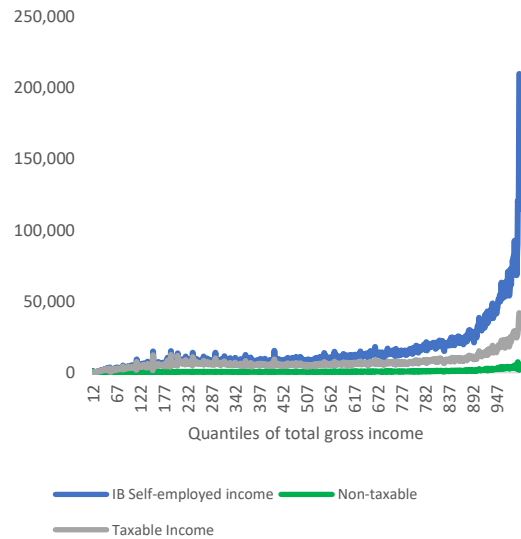
Panel C: Capital subordinated debt
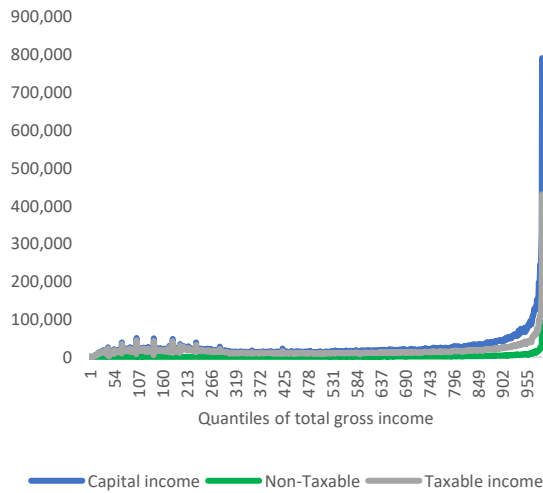
Panel D: Unearned income subcategory
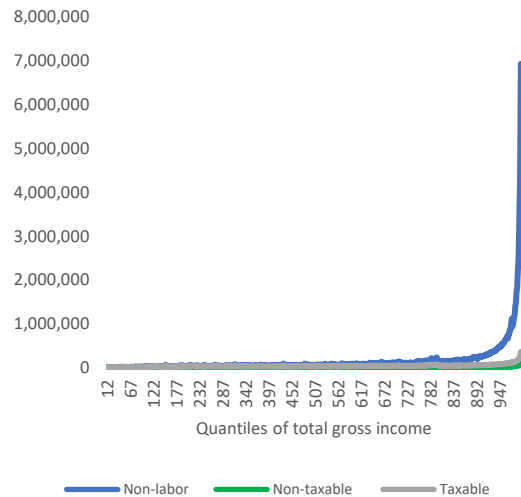
Source: Prepared by the authors based on information from the Sub-Directorate of Economic Studies - DIAN.

Thus, the gross income of each subcategory or source of income within the general schedule is adjusted in accordance with the rates reported in **Figure 10**5, so that a series by income brackets is constructed. The income bracket is defined according to the minimum and maximum value of each quantile in order to assign the equivalent ratio in the household survey. In general terms, professional fees, capital income, and unearned income experience a decreasing relationship across the distribution, implying that higher income segments will have higher deductions and exemptions and, therefore, a lower taxable income relative to their gross income. For example, while ordinary net income equals approximately 80 percent of professional fee income in the first 100 quantiles, in the last 100 quantiles it averages only 30 percent. However, income from salaried work behaves differently. First, it is more stable along the distribution, between 70 percent and 50 percent, and grows considerably again at the top of the distribution.

Figure 25. Ratio of net ordinary income vs. gross income. General schedule
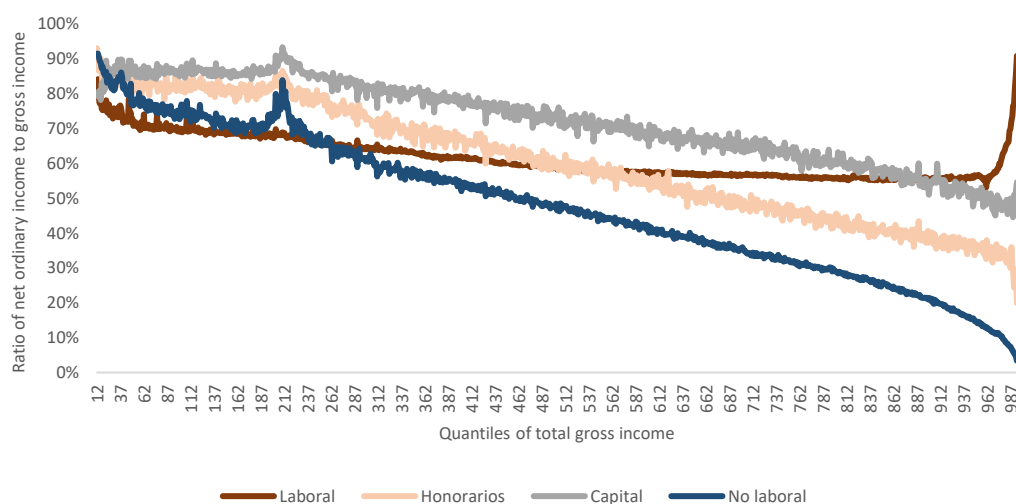
Source: Prepared by the authors based on information from the Sub-Directorate of Economic Studies - DIAN.

In terms of the results, the collection reaches only 75.6 percent of that reported by the model in the base scenario. This is related to the fact that the upper part of the distribution tends to accumulate a higher proportion of deductions and exemptions in relation to its gross income, which translates into lower tax collection. Income tax progressivity does not change significantly and remains at levels of 0.427 in the Kakwani index. As a result, the Gini in net market income reaches 0.534, slightly higher than that of the baseline scenario (0.533). The concentration curves show that the tax begins to accumulate increasingly in the higher income segments relative to the baseline scenario.

Figure 26. Concentration curves by scenario

Panel A: Base scenario
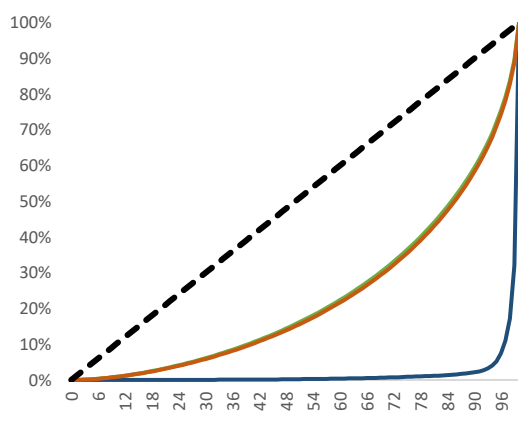
Panel B: Third scenario (mil-quantile adjustment)
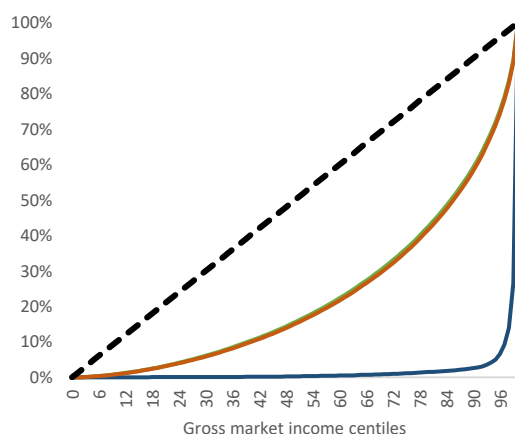
Source: own preparation.

A comparison between the three scenarios suggests that while the average taxable income in the first scenario is 37.3 UVT, in the second scenario it is 35.3 UVT, and in the third scenario it is 38.3 UVT. As for the differences in the collection of the general schedule, the first scenario is equivalent to 97 percent of the second scenario and the third scenario is equivalent to 72 percent of the second scenario.

Table A8. Comparison between scenarios. General taxable income in UVT

	Scenario 1: baseline	
	Median	Total
Taxable income (UVT)	37.3	1,790,673,339
Tax	45,8	98,083,477
	Scenario 2	
	Median	Total
Taxable income (UVT)	35.34	1,749,063,526
Tax	47.34	101,412,687
	Scenario 3	

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	Median	Total
Taxable income (UVT)	38.31	1,895,780,086
Tax	34.03	72,888,602

Source: own preparation.

iv)   Comparison with macroeconomic data

The comparison between the administrative records and the baseline modeling that calculates the taxable income with the average ratios of the total line items reported on Form 210 from 2020 is presented. Table A9 shows that gross labor income represents more than half of total income in the household survey (58 percent), followed by gross pension income (15.2 percent), and unearned income (14.9 percent). Meanwhile, in the administrative records, gross unearned income accounts for 40 percent, followed by labor income, at 37.6 percent. Thus, the highest ratio among gross income is observed in pensions (59.2 percent), followed by labor income (46.7 percent), and capital income (41.3 percent). Unearned income is only 11.2 percent.

Table A9. Macrovalidation of gross income

	Administrative record		Household survey		Survey/administrative ratio
	Total	%	Total	%	
Gross labor income	177,943,659	37.6%	83,141,493	58.1%	46.7%
Gross capital income	25,392,489	5.4%	10,494,402	7.3%	41.3%
Gross nonlabor income	189,587,991	40.1%	21,270,002	14.9%	11.2%
Gross pension income	36,631,913	7.7%	21,685,557	15.2%	59.2%
Gross income dividends and profits	5,328,476	1.1%	827,241	0.6%	15.5%
Occasional Income	38,409,645	8.1%	5,584,961	3.9%	14.5%
Total gross revenues	473,294,173	100%	143,003,656	100.0%	30.2%

Source: Prepared by the authors based on GEIH and DIAN information.

A comparison between the model's aggregate estimated in relation to those observed by the DIAN, as a result of imposing the respective tax deductions and exemptions on the gross income of each source of income, as well as the tax rates to which they give rise, suggests that the total macro validation reaches 31.2 percent. Of these, the taxes received for income under the general and pension tax schedule stand out (31.3 percent), followed by taxes on non-recurring income (28 percent).

Table A80. Macrovalidation of taxes by schedule

	Administrative record		Household survey		Survey/administrative ratio
	Total	%	Total	%	
General and pension	11,377,205	94.2%	3,561,215	47.2%	31.3%
Dividends and shares for the year 2016	4,934	0.0%	-	0.0%	0.0%

Dividends and shares for the year 2017 and subsequent years, 1st sub-schedule	260,925	2.2%	17,952	0.2%	6.9%
Dividends and shares for the year 2017 and subsequent years, 2nd sub-schedule and others	76,138	0.6%	2913	0.0%	3.8%
Occasional income tax	680,148	5.6%	190,616	2.5%	28.0%
Donations and discounts	316,299	2.6%	-	0.0%	
Total collections	12,083,051	100.0%	3,772,695	50.0%	31.2%

Source: Prepared by the authors based on GEIH and DIAN information.

B. Payroll taxes

Correspond to mandatory non-wage payments made by the employer and the employee to contribute to social security. These payments are paid on salaries by employers and employees, and are regulated for health, pension, and labor risks. Both the parameters and the estimation methodology follow Núñez et al. (2020). The following is a brief description of the parameters used and the procedure.

There are two health affiliation regimes, a contributory one, in which affiliates (formal employees and pensioners) contribute according to their income to finance their health coverage and that of their beneficiaries. Members contribute 12.5 percent of income on a monthly basis; in the case of salaried employees, 8.5 percent is paid by the employer and 4 percent by the employee. Since members of the contributory system contribute according to their payment capacity, there is a solidarity scheme within the system whereby those with higher income levels finance or subsidize those with lower incomes. The subsidized regime, on the other hand, is fully financed with public resources, and poor and vulnerable people are affiliated to it, so no contributions are estimated. The value of the contributions made by employees was calculated using the primary income activity.

The General Pension System (SGP, as per the acronym in Spanish) has two schemes: the defined-benefit Average Premium System (RPM, as per the acronym in Spanish), and the private- and defined-contribution Individual Savings with Solidarity System (RAIS, as per the acronym in Spanish). All formal employees are obliged to join and contribute to the SGP, either to the RAIS or to the RPM, based on their salary. The fee is equivalent to 16 percent of the salary received, where 12 percent is paid by the employer and 4 percent by the employee; the self-employed and freelance individuals pay 16 percent. The workers' contribution is equivalent to 4 percent of their primary income activity if they report paying a portion of the contribution or 16 percent if they report paying the entire contribution. For individuals who report that they pay the full contribution or that it is deducted from their pension, the full rate of 12.5 percent applies.

Finally, the model takes into account the general system of professional risks, which fulfills the objective of insuring both employers and independent employees against risks arising from labor activity. The rate depends on the activity and the level of risk associated with it. The minimum

rate, equivalent to 0.522 percent, is assumed because there is no better information available to use the other rates. Payments are made entirely by the employer if the employee is a salaried employee (worker, domestic employee, day laborer) who has reported that he/she is affiliated to the system. For those who report that they are affiliated to ARL and pay their contribution, the value equivalent to 0.522 percent of their primary income activity is taken.

C.   Wealth tax

The wealth tax is estimated following Núñez et al. (2020), using the same parameters as those used in the 2021 GEIH. Legal tax deductions are applied to the estimated assets. In particular, in the baseline the modeling is based on Article 292-2 of the Tax Statute through Law 1943 of 2018, which established the temporary wealth tax. This tax is based on individuals' gross assets, liquid inheritance, and foreign companies or entities owned between 2019 and 2021, after deducting current debts. The first 13,500 UVT are included as exempt assets for 2021. The rate of wealth tax on the baseline is 1 percent for each year of the total taxable income established.

Figure 27. Lorenz curves with and without adjustment for top incomes

Panel A: no adjustment

Panel B: with adjustment
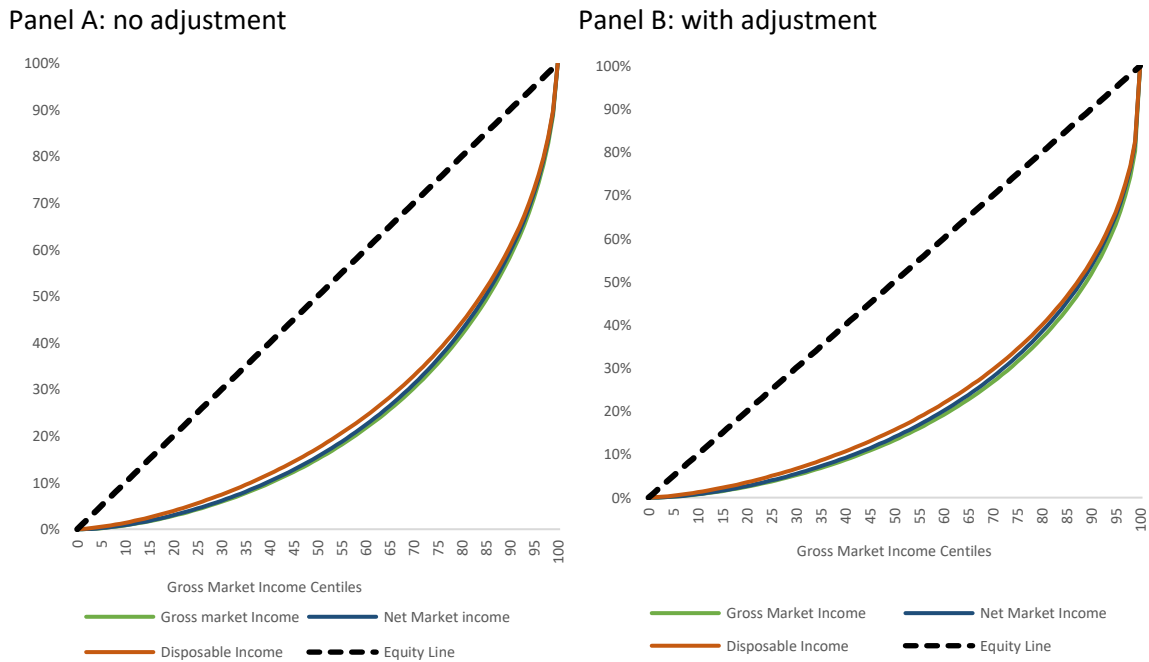
Source: Prepared by the authors based on GEIH and DIAN information.

9.3 Modeling of the top of the income distribution

Household surveys are the main source of analysis on poverty and inequality due to their richness in their analysis of population groups and their socioeconomic characteristics. However, these have limitations when it comes to quantifying the magnitude of inequality. In particular, they tend

to underestimate the reports of those with the highest levels of income and wealth. This is particularly due to sampling methods, low response rate, or imputations of extreme values that are usually done for household surveys in order to minimize bias. In the same direction, tax records or administrative data only include a specific threshold and are not representative of the population. Consequently, in order to analyze the upper part of the distribution more precisely, several exercises have been carried out and aimed at complementing micro data from household surveys with administrative data such as personal income tax records (Blanchet et al., 2022; Alvaredo and Londoño, 2013).

Alvaredo and Londoño (2013) applied Alvaredo's (2011) methodology for Colombia and found that, once adjusted for the high part of the distribution, the Gini coefficient in the 2010 GEIH went from 0.554 to 0.587. However, Diaz-Bazán (2015) applies a methodology that seeks to find a cut-off point between administrative data and household surveys by innovating in the choice of the threshold of intersection between both sources of information, and finds that, when adjusted, the Gini coefficient for 2010 is 0.598. For their part, Núñez et al. (2017) use another Pareto adjustment methodology of the Gini in 2015 and find that it would go from 0.501 without adjustment to 0.639 with adjustment.

Considering that there are several methods that allow combining the best of two worlds, it is to use household surveys with administrative data by complementing both sources of information, we follow the methodology designed by Blanchet et al. (2022), who endogenously determine a crossover point between both sources of information by modifying the weights on the entire distribution and replacing new observations on the originally used survey. While there are two distribution functions where at the high end the distribution of fiscal data exceeds that of the household survey and the opposite happens at the low tail, the relationship between both distributions just at the crossover point will lead to the parameter known as the pivot, which serves as an adjustment factor to pre-weight the final distribution (Blanchet et al., 2022).

In formal terms, to define the meeting point between household survey income series and administrative data from direct tax records, Blanchet et al. (2022) find that it is necessary to define two probability functions: the relative probability of response ($\theta(y)$) and the cumulative relative probability of response ($\emptyset(y)$).

$$\theta(y) = \frac{f_x(y)}{f_y(y)} \qquad\qquad \emptyset(y) = \frac{F_x(y)}{F(y)}$$

Here $f_x(y)$ equals the relative probability of income in the household survey for each point of its distribution and $f_x(y)$ equals the relative probability in the tax records. Meanwhile, $F_x(y)$ and $F_y(y)$ are the cumulative relative probability along the income distribution of each information source, respectively. The authors find that the optimal cutoff point occurs when $\theta(y) = \emptyset(y)$.

One of the main advantages of this method is that it preserves the multivariate capacity in the survey distribution and provides a framework of representativeness that allows us to explore the

socioeconomic dimensions of inequality. In turn, it establishes the crossover point between the two data sets that minimizes the selection bias at the crossover point by creating an algorithm for its calculation.

Choosing the cut-off point, which is the value where the administrative data intersects with the survey, has challenges. In particular, inconsistent results may be obtained if administrative data is used from where it is available, because it is not always well defined. Therefore, it is best to use tax data from when it is needed. Consequently, the authors seek to preserve the continuity of the density of the tax data function approximately, after re-weighting to establish the final distribution (Blanchet et al., 2022).

For this exercise, the household survey microdata refers to the 2021 GEIH. On the tax records data side, there is information used by Diaz-Bazán (2015) for 2010 for taxpayers who are not required to keep accounting records (small taxpayers) and those who are required to do so (large taxpayers). The data for small taxpayers comes from the 210 tax return form and is composed of a panel of balanced microdata and tabulations performed by the DIAN. In the case of large taxpayers, who at the time filed their taxes using form 110, the data set consists only of a panel of balanced microdata. This data provides annual information on labor income, capital gains, other income, deductions, exemptions, and taxes paid.

In order to apply the methodology and adjust for the high side of the distribution, the following step-by-step procedure is followed:

1.   First, the tax records are cleaned. This includes calculating the relationship between each of the sources and the average gross income. The sources include labor payments, professional fees, financial returns, capital income, and other income. Adjusted for inflation between 2010 and 2021. From this database, percentiles are created, which, in addition to being disaggregated into centiles, also expand the upper part of the distribution up to the 99.9998 percentile.

2.   The above information and the population size for the adult population from the household survey is processed in the World Inequality Database website interface. This allows interpolating the complete income distribution based on simple tabular data files, resulting in the application of the generalized Pareto interpolation method. Generalized Pareto interpolation is a method for reconstructing complete distributions based on tabulations that only contain information about some thresholds.

3.   The household survey is refined with income variables and socioeconomic characteristics such as age, gender, household identifier, working age population over 20 years old, and population expansion factors. With this database, we ran the routine designed by Blanchet et al. (2022) to improve the representativeness of survey data at the top of the income distribution using tax data. These re-weights the observations and creates new ones to obtain a new survey sample that is consistent with the information in the tax data. It replicates the statistical

properties of the survey in terms of covariates, household structure, and income distribution behavior. The command treats the data in memory as survey data to be corrected and corrects it using an external file containing the tabulated tax data. The methodology combines a calibration procedure that simulatively corrects for survey representativeness along the different dimensions with a substitution/imputation procedure that increases the number of observations in the upper part to obtain better estimates of upper tail inequality.

4.   Finally, we adjust for expansion factors and repeated observations, as well as making an adjustment for income based on household survey data. It is important to mention that the income adjustment is only made for disposable income.

9.4 Indirect taxes

This module includes the value added tax (VAT) and the national consumption tax, as well as specific taxes including the tax on alcoholic beverages, the tobacco tax, the national carbon tax, and the national gasoline and ACPM taxes. The calculation of these taxes is made based on the consumption patterns of the population in 2017 with information taken from the National Household Budget Survey (ENPH), given that it is the most recent consumption survey to date. Subsequently, the estimated tax amounts per household are imputed in the 2021 GEIH following the imputation methodology previously described.

Value added tax (VAT)

The tax modeling criteria are established according to the parameters of the law consulted in the Tax Statute as of 2022. The modeling base comes from Núñez et al. (2020), who use the 2017 ENPH expenditure module and the 2010 input-output matrix in base 2005. In particular, mapping is carried out in accordance with the product consumed and reported by households in order to update and assign the VAT rate taking into account changes due to tax reforms, particularly those in Law 2010 of 2019.

The main challenge in calculating the change in wellbeing due to the tax is that it is not feasible to determine the value of counterfactual consumption without the tax for the same household. In order to obtain an approximation of how household spending changes without the tax, we follow the methodology proposed in Lustig et al. (2018). The method assumes an inelastic demand for all goods in the survey, which means that the change in prices produced by the tax does not affect the quantity of goods consumed. If the observed expenditure on a certain good is E_t and the tax in the survey year (when the individual reported his expenditure) is τ^{ref}, then the counterfactual expenditure can be obtained as follows:

$$E_t = P_t Q_t$$
$$E_{t-1} = P_{t-1} Q_{t-1}$$

It is assumed that $Q_t = Q_{t-1}$ and it is known that the price is equal to a price without counterfactual tax multiplied by the increase generated by the tax $P_t = P_{t-1}(1 + \tau^{ref})$. When replacing you get:

$$E_{t-1} = \frac{P_t Q_t}{(1 + \tau^{ref})}$$
$$E_{t-1} = \frac{E_t}{(1 + \tau^{ref})}$$

Where the counterfactual pre-tax expense is estimated E_{t-1} using the observed expense E_t and the reference tax τ^{ref}. Once the counterfactual expenditure is estimated E_{t-1} and with the assumption of inelastic demand, it is possible to estimate the effect of alternative rates τ^{simu}

$$PV = E_{t-1}(1 + \tau^{simu}) - E_{t-1}$$
$$= \frac{P_t Q_t \tau^{simu}}{(1 + \tau^{ref})}$$

Where PV is the Paasche variation, a measure of the change in purchasing power due to the tax. Since each individual's quantity remains fixed, note that PV cannot be considered a measure of change in wellbeing. This only measures the loss in purchasing power in the face of a tax-induced change in prices. The loss in income derived from the increase in prices measured by PV is deducted from disposable income to obtain the consumable income.

The indirect effects of the tax derive from their respective exemptions. While producers of excluded goods do not charge tax on their sales and cannot deduct the tax from their input purchases, exempt goods and services are charged at VAT rates of 0 percent. This causes the tax paid to be charged to the final sales price, which is known as the cascade effect because after charging the tax to the final price, the tax is paid again through higher prices. Thus, the measurement of indirect effects consists of determining the increases in the prices of final goods assumed by consumers in the survey as a result of VAT exemptions. The steps followed are described in Núñez et al. (2020). First, the input-output matrix is prepared. Household spending is then mapped to the sectors of the matrix. Then, the sectors that maintain fixed prices are defined, in order to solve the Cost-Push model. The result is the percentage increase in the price of each sector resulting from the VAT exemptions. Finally, the increase obtained in each sector is applied to household spending on the respective goods. The indirect effect is assigned to goods excluded or purchased informally by the household. Details, including the modeling of informality, can be found in Núñez et al. (2020).

National consumption tax: Rates and specific products

In general, telephone, data, internet, and mobile internet services will be taxed at a rate of 4 percent on the total amount of the service. In addition, the following are taxed at the rate of 8 percent: the service of dispensing food and beverages prepared in restaurants, cafeterias, self-service stores, ice cream parlors, greengrocers, pastry shops, and bakeries for onsite

consumption, to be taken by the buyer or delivered to buyers' homes, food services under contract, and the service of dispensing food and alcoholic beverages for consumption in bars, taverns, and discotheques.

National carbon, gasoline, and ACPM tax

Law 1819 of 2016 established the national carbon tax considering the carbon dioxide (CO_2) emission actor, which falls on each fossil fuel according to the carbon incidence. For calculation of the tax, the law established the content in unit volume (kilogram of CO_2) per energy unit (Terajouls) according to the volume or weight of the fuel at COP15,000 per ton of CO_2, COP95 per gallon of gasoline, COP135 per gallon of ACPM for 2016, values subject to adjustments in accordance with price evolution in the economy. The same law also established the national tax on gasoline and ACPM, the collection of which is administered by the DIAN. The policy parameter is given in pesos per gallon.

The main challenge consists of estimating the number of gallons consumed by households because this value is not surveyed in the ENPH. For this purpose, the price structure of gasoline and ACPM from July 2016 to June 2017, the period in which the survey data was collected, is available. Considering the regional variability of gasoline prices, we have access to the structure for 21 main cities (Cúcuta, Pasto, Riohacha, Medellín, Bogotá, Barranquilla, Bucaramanga, Cali, Cartagena, Neiva, Pereira, Popayán, Santa Marta, Tunja, Valledupar, Manizales, Armenia, Ibagué, Sincelejo, and Montería), which are representative in the ENPH. Table illustrates the price structure in January 2017 for two cities, Barranquilla, and Bogotá.

Table A11. Gasoline price structure (January 2017)

City	Barranquilla	Bogotá
Percentage of mix by city	6%	6%
Income to the producer	4337.13	4337.13
Domestic tax	460.60	460.60
VAT	732.73	732.73
Carbon tax	126.90	126.90
Metering rate	7.45	7.45
Multi-purpose pipeline transportation rate	108.02	360.44
Alcohol transport rate	88.80	33.66
Continuity plan margin	71.51	71.51
Maximum selling price wholesale distributor	5933.13	6130.41
Wholesale distributor margin	358.63	358.63
VAT wholesale distributor margin	68.14	68.14
Surcharge	860.85	860.85
Maximum selling price supply plant	7220.75	7418.03
Retail distributor margin	706.37	706.37
Evaporation loss	28.88	29.67

Transportation from supply plant to service station	57.17	57.17
Maximum sales price per gallon, including surcharge	8013.17	8211.24

Source: Ministry of Mines and Energy.

The sales price per gallon is imputed to the survey on a month-by-month and city-by-city basis. For the rest of the zones, the national price is imputed. However, one difficulty lies in the fact that for 2016 there was no national carbon tax or gasoline tax, so it could not be imputed to 2016. Assumes similar behavior in 2016 to its equivalent in 2017, guaranteeing variability by geographic area and the difference between border zones. Then, the amount spent on gasoline and, separately, ACPM for each household is divided by the sales price for the respective month and the respective geographic area. As a result, on average, households consumed 5 gallons of gasoline per month while 0.1 gallons of ACPM were consumed in the same period of time. Once the gallons of gasoline and ACPM are calculated in the ENPH, the value of taxes is estimated using the policy parameters, which by law establish a fixed charge per gallon. Table A12 shows the charges at 2021 prices. Finally, the method of imputation between surveys is followed, from the ENPH (donor) to the GEIH (recipient).

Table A12. National gasoline and ACPM tax rates. Price per gallon 2021

National tax on gasoline and ACPM	
Regular gasoline	586.25
ACPM Gasoline	561.12
National carbon tax	
Regular gasoline	159.00
ACPM Gasoline	179.00

Source: Ministry of Mines and Energy.

9.5 Transfers

The procedure for estimating the cost per beneficiary of the programs and transfers considered in the impact analysis is described below. In general, information is available from administrative records that report both the number of beneficiaries and the cost of the program, in order to calculate the per capita value of the transfer, so as to allocate them to the people identified as beneficiaries of the program. Additionally, the calculation of the targeting instrument for social programs (Sisbén IV) made by the DNP based on 2021 GEIH information was used. This targeting instrument uses the methodology established for the calculation of Sisbén IV, which includes a set of socioeconomic and household income characteristics.

A. Pensions

In 2020, the central national government budgeted COP40.3 billion for the payment of pensions, which covers the Average Premium Regime (RPM, as per the acronym in Spanish), the special

regimes (Military Forces, Teachers, and National Police). Given that only part of the government transfers constitute the value of the subsidy, because retirees made contributions to accumulate savings for their old age, the corresponding percentage of the subsidy was applied to the income reported in the survey following the calculations of Núñez (2009) and, as done in Núñez et al. (2020), with parameters established by gender, age, the amount of pension, and the time at which they obtained the pension.

Table A13. Percentages of the pension that correspond to government transfers

Panel A: Pensioners before Law 100: men over 81 years of age and women over 75 years of age					Panel B: Pensioners under the transition regime: men under 81 years of age and women under 75 years of age			
Minimum wage range		Percentage			Minimum wage range		Percentage	
Min.	Max.	Men	Women		Min.	Max.	Men	Women
	1	82.5	85.4			1	74.4	79.3
1	2	48.5	51.4					
2	3	50.5	54.4		1	2	61.1	65.9
3	4	53.5	57.4		2	3	64.1	68.9
4	5	56.5	60.4		3	4	67.1	71.9
5	6	59.5	63.4					
6	8	62.5	69.4		4	5	70.1	74.9
8	9	68.5	72.4		5	6	73.1	77.9
9		71.5	75.4		6		75.1	79.9

Source: Núñez (2009), taken from Núñez et al. (2020).

In the GEIH, 2,057,303 people report being pensioned, for a total value of COP48.7 trillion and a total subsidy o COP33.4 trillion. Colombia, according to administrative data, about 2.4 million people receive pensions, which are distributed as follows:

- RPM (75%): this proportion is received through the public pay-as-you-go system or Average Premium Regime (RPM), where the vast majority (1.4 million) obtain their pension from Colpensiones and the remaining 389,000, who obtained their pension before Law 100 of 1993, receive their pension from the RPM with a defined benefit. The latter includes entities

such as Caja Agraria, Cajanal, Invías, Fondo de Ferrocarriles Nacionales, Banco de la República, and Telecom, among others.

- Special or excepted regimes (16%): about 393,000 members are pensioned with Ecopetrol, Teachers, Armed Forces, or National Police.

- Individual Savings System (RAIS) (9%): 210,311 people receive their pensions from the private or defined contribution system managed by private pension funds (AFP, as per the acronym in Spanish).

The number of affiliates with the GEIH is equivalent to 86 percent of those recorded in the administrative data. There is a limitation in the household surveys, since it is not possible to identify the regime from which the resources to finance the pension allowances for those surveyed come from. For this reason, and given the low proportion of people who are in RAIS, in CEQ-2017 it was decided to perform the calculations assuming that all people belong to the RPM. However, ENPH finds that the total value of pensions equals 98 percent of the total government budget figure for pensions, which means that this value may have been overestimated. In the GEIH, the total value of the pension is 16 percent above the value found in the national accounts. However, this value also includes people who receive pensions from the AFPs.

Table 9. Pensioners, value of subsidy, and total pension value CEQ 2017 vs. 2021

	Pensioners	Calculated value of pension subsidy	Total pension value	Central national government (millions)
ENPH				33,358
2017	1,803,623	21,580,558,506,288	31,725,733,256,952	
2021 GEIH	2,232,815	33,489,734,453,084	48,695,228,658,657	40,316

Source: ENPH, GEIH.

B. Colombia Mayor Program

In 2021, the Colombia Mayor program benefitted 1,776,137 senior citizens with bimonthly payments totaling nearly COP2.5 trillion. The GEIH reports 1.59 million beneficiaries, which is equivalent to 89 percent of the number of beneficiaries in administrative records. However, the value reported in the survey is above that reported in the administrative data, largely because there are outliers in the records.[20] Consequently, the average per capita value from the administrative record is imputed.

Unlike the results obtained in the CEQ with data from the 2017 ENPH, the imputation is done with the national per capita average and not for the municipalities identified in the survey, as is the case in that of Núñez et al. (2020), since the amounts have since been unified and the vast majority

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[20] For example, the minimum reported value is 10,900 COP, while the maximum is 19.4 million COP, which alters the median to 1.1 million COP.

of municipalities receive the monthly amount of COP80,000. Additionally, although the ENPH reached 86 percent of the total number of beneficiaries, the program's coverage has grown by almost 13 percent since then, growth that the GEIH does not cover. The total number of beneficiaries is modeled up to the number reported in the administrative data. Firstly, the beneficiaries who reported receiving the benefit in the survey are maintained. From a potential number of beneficiaries that meet the eligibility criteria of the program, such as differential age by sex, not receiving a pension and Sisbén IV level in the poverty and extreme poverty ranges, the benefit is assigned until the total number of beneficiaries in administrative records is reached.

Table A15. Colombia Mayor transfer program. Beneficiaries and value of the subsidy

	Beneficiaries	Reported in survey (COP)	Assigned in survey (COP)
Panel A: Household surveys (annual)			
ENPH 2017	1,294,041	62,537,325,426	960,712,882,139
2021 GEIH	1,776,044*	30,125,166,418,675	2,533,402,072,548
Panel B: Administrative records (annual)			
	Beneficiaries	Total subsidy amount	
2017	1,503,939	1,053,699,411,307	
2021	1,776,137	2,534,649,735,000	

Source: DPS, Pension Solidarity Fund, GEIH, ENPH. *Simulated values.

C. Jóvenes en Acción ("Youth in Action")

The amount of the conditional transfer to young people in the program depends on where they study (SENA or HEI), as well as their academic performance. The cost of Jóvenes en Acción for 2020 was COP586,742,148,000 and benefited more than 494,000 young people.

However, the GEIH underestimates the beneficiaries of the Jóvenes en Acción program (155,903), so potential young people who could receive the benefit were identified. They are between 16 and 28 years old, declare in the survey that they receive government aid, and are in poverty according to the Sisbén IV level. This adjustment leads to the identification of 337,000 additional young people, which represents 68 percent of the population actually recorded in the administrative data. Understanding this limitation, the average per capita value of the ordinary transfers was imputed, so that the household survey yields COP586 billion in ordinary transfers from the program. This, in contrast to the outliers reported in the survey, would have resulted in an overestimation of the total amount allocated.

Table A16. Jóvenes en Acción transfer program. Beneficiaries and subsidy amount

	Beneficiaries	Reported in survey (COP)	Assigned in survey (COP)
Panel A: Household surveys			

2017 ENPH	141,303	90,330,907,982	169,237,810,644
2021 GEIH	494,834 (155,903 unadjusted)	2619,621,039,228	586,374,246,415

Panel B: Administrative records		
	Beneficiaries	Total subsidy amount (COP)
2017	157,499	188,635,600,000
2021	494,981	586,742,148,000

Source: DPS, ENPH, GEIH.

In the ENPH, it was possible to identify 89 percent of the beneficiaries recorded in the administrative data, a fact that made it possible to get close to the same percentage the total amount of the program imputed in the survey for 2017. However, the number of beneficiaries has grown substantially since then; in 2020, it was 2.7 times more than in 2017.

D. Más Familias en Acción ("More Families in Action")

Más Familias en Acción offers a nutrition incentive for families with children up to six years of age and up to three monetary incentives for children studying at educational institutions. The transfer is conditional on the children's attendance to growth and development checkups and 80 percent of their classes. The amount of the transfer is determined according to the municipality to which the family belongs, and, in the case of the education component, of the academic grade. There are four groups,[21] because the survey is representative of 23 major cities and metropolitan areas. The first group includes Bogotá, and the second group includes the main cities, of which the GEIH is representative, except Riohacha and Quibdó. The third group includes rural areas, Riohacha, Quibdó, and the rest of the urban centers. The incentive amount, which comes from the updated 2020 program manual, was adopted to the GEIH survey following the 2017 CEQ model. Thus, the education incentive, which is paid for 10 months, was calculated as a monthly amount and the third and fourth categories of municipalities were unified, since it is not possible to differentiate the municipalities in the survey.

Table A17. Value of MFA cash transfers used for the allocation

Group	Health incentive	Education incentive (grades)				
		Zero	1-5	6-8	9-10	11
1	74,750	-	-	31,150	37,425	56,025
2	74,750	24,925	12,500	31,150	37,425	56,025
3	87,175	24,925	18,750	37,425	43,600	62,275

Source: DPS, Más Familias en Acción Program, 2020.

The allocation is made per household. This means that cases in which a household reports several subsidies received by Más Familias en Acción are removed. The transfer was assigned to a

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[21] The first is made up of Bogotá; the second of Armenia, Barranquilla, Bucaramanga, Cali, Cartagena, Cúcuta, Florencia, Ibagué, Manizales, Medellín, Montería, Neiva, Pasto, Pereira, Popayán, San Andrés, Santa Marta, Sincelejo, Tunja, Valledupar, and Villavicencio; the third, by municipalities with MPI poverty incidence below 70%; and the fourth, by municipalities with MPI poverty incidence above 70%, including the departmental townships.

maximum of three children per household, and were organized from highest to lowest in cases where the household had more than three children. In addition, it was found that only 352,000 households reported being beneficiaries of the program, so we proceeded to calculate a variable that identifies the potential beneficiaries of the program. This included households that met the conditions of the program (children under six (6) years old and students between six (6) and 18 years old) that in the survey also reported having received a government subsidy and are in poverty levels according to Sisbén IV. Additionally, it is found that the survey overestimates the amount received by households, therefore, the amount assigned according to the incentive table described above is imputed.

As a final result, 1,387,444 MFA beneficiary households are found in the survey, which when applying the allocation on the simulated potential beneficiaries reaches 2,259,973 households with imputed regular transfers of COP1,397,302,552,720, which is similar to the amount reported in administrative data. In contrast, in the CEQ 2017 exercise, a very close ratio is found between the value assigned in the survey and that reported in administrative data (101 percent). This is 77.5 percent as far as program beneficiaries are concerned.

Table A18. Más Familias en Acción transfer program. Beneficiaries and subsidy amount

	Panel A: Household surveys		
	Beneficiaries	Reported in survey (COP)	Assigned in survey (COP)
2017 ENPH	2,147,121	2,140,400,740,276	1,936,000,000,000
2021 GEIH	2,259,973 (1,387,444)	15,501,770,772,640	1,397,302,552,720
	Panel B: Administrative records		
	Beneficiary households	Total subsidy amount (COP)	
2017	2,503,632	1,910,945,548,069	
2021	2,264,997	1,338,050,283,000	

Source: DPS, Más Familias en Acción Program, 2020.

E. VAT refund

As one of the measures to address the effects of the social emergency caused by COVID-19, the national government advanced the VAT refund scheme to lower-income families, who received resources to alleviate the impact of the tax on the consumption of products and services of the most vulnerable people.

By 2021, 2.8 million of the poorest households, recipients of the Familias en Acción and Colombia Mayor programs, were sectioned off. The prioritization criterion was Sisbén IV. Therefore, in the first place, there is a pseudo-Sisbén IV applied in the GEIH that replicates the GEIH poverty rates in order to select the first 2.8 million households with the lowest Sisbén, but which are also in the social programs of Familias en Acción and Colombia Mayor. Next, the per capita values per household from the DPS administrative data are imputed to the selected households. As a result,

2.77 million households are identified for an annual investment of $810,513,000, which coincides with the 97 percent reported in the administrative data.

F. Ingreso Solidario ("Solidarity Income")

The program emerged as the main source of unconditional transfers to households living in poverty, extreme poverty, and economic vulnerability in order to mitigate the economic impacts of the COVID-19 pandemic emergency on this population. Ingreso Solidario was assigned to households that were not beneficiaries of social programs such as Familias en Acción, Jóvenes en Acción, Adulto Mayor, or VAT Compensation.

The GEIH does not directly inquire about the beneficiaries of the Ingreso Solidario program. However, it asks about other programs received in which, in their response to an open-ended question, respondents can state which program. However, this variable significantly underestimates households participating in the program. Therefore, the first 3.4 million households that, according to the Sisbén IV level (calculated on the GEIH), met the criteria to belong to the program were selected. Next, the average monthly per capita program allocation was imputed from administrative records. As a result, almost all the participants (3,457,147) were identified for a total of COP4,050,389,000,000.

Table A19. VAT refund program and Ingreso Solidario. Beneficiaries and transfer amount

Panel A: Household survey		
	Beneficiaries	Reported in survey (COP)
VAT refund	2,760,435	810,513,000
Ingreso Solidario	3,457,147	4,050,389,000,000
Panel B: Administrative records		
	Beneficiaries	Total subsidy amount (COP)
VAT refund	2,881,893	846,162,656,000
Ingreso Solidario	3,458,982	4,052,177,232,000

Source: DPS, GEIH 2020.

G. School Meals Program (PAE, as per the acronym in Spanish)

The PAE is financed with resources from the Ministry of Education (MEN, as per the acronym in Spanish), a percentage of the General Revenue-Sharing System (SGP, as per the acronym in Spanish) that is allocated to school meals and with resources from the certified regional entities (ETC, as per the acronym in Spanish), which are responsible for providing the service. With the information on resources, students benefited and meals supplied by ETCs in 2017, the allocation in pesos per student is calculated for the representative departments of the GEIH, taking into account the budgetary growth of the program between 2017 and 2021 at the national level. Equivalent growth is assumed between ETCs and representative cities in GEIH.

However, the GEIH does not ask about the beneficiaries of this program, unlike the ENPH. Therefore, the probability of belonging to the program is estimated for all public-school students reported in GEIH. For this purpose, a linear probability model is estimated on the ENPH of receiving the School Meals Program.

Then, with a set of covariates in common with the GEIH such as age of the head of household, household size, schooling of the head of household, occupation status, working hours, pension payment or pension contribution, gender, number of student children by educational level, independent housing, overcrowding, own housing, number of rooms, socioeconomic status, geographic domain, flooring material, number of assets (washing machine, refrigerator, blender, stove, electric heater, color TV, LCD/LED TV, digital music/video players, laptop/desktop computer, vacuum cleaner, air conditioner, bicycle, motorcycle, private car), the fitted value of the model is estimated. The School Meals Program is assigned to the sample of households that have children in public schools.

As a result, the total value of the program reaches an allocation of COP2.3 trillion annually in the survey, which is 95 percent of what is reported in administrative records.

9.6 Subsidies

This section details the subsidies included in the model. In principle, this includes subsidies and contributions to household public utilities (gas and electricity) included in the fiscal year in question, details of which can be found in Núñez et al. (2020). Additionally, gasoline and ACPM subsidies are included.

A.   Subsidies for household public services

In general, it includes gas and electricity utilities. In the case of residential natural gas, all homes classified in strata 1 and 2 are entitled to a subsidy on the gas service provision tariff of up to 60 and 40 percent, respectively. Stratum 3 does not receive a subsidy nor contribute. The values of the unit cost per KwH in the case of electricity and M3 in gas from the SUI (Sole Information System) for the set of 32 geographic domains in the ENPH were used as a parameter to establish the subsidized value once the subsidized units had been calculated.

In the case of electricity, a differential factor is taken into account in the subsidy according to the location of the homes, that is, if they are located in municipalities 1000 meters above sea level or more, they receive the subsidy on the first 130 kWh, and those homes located in municipalities located at an altitude of less than 1000 meters above sea level, which receive the subsidy on the first 170 kWh. Dwellings are classified differentially according to the 23 cities and metropolitan areas. All households classified in strata 1, 2, and 3 are entitled to a subsidy on the electricity service provision tariff of up to 60, 40, and 15 percent, respectively, on subsistence consumption. Although these rates vary, we assume subsidy rates, which can be modified for simulation purposes, by stratum and also contribution rates for strata 5 and 6. If the consumption of the

dwelling exceeds the subsistence consumption, the additional units will be paid for at the full marginal rate, that is, at the average cost of supplying the service.

Unlike in Núñez et al. (2020), water, sewerage, and sanitation are not included: the criterion for grouping these three utilities together is not plausible, given that the services are not usually billed together in most cases. The ENPH reports the total invoiced value for each of these services, so the CEQ above takes the invoiced values per unit of consumption for each service, which comes from administrative sources, in order to aggregate the information at the end. Due to the lack of administrative information that would allow differentiation of these services, it was decided not to include them in this version.

The modeling involves imputing from the stratum, the main city, and the month, the information corresponding to unit consumption for households that do not have this information. With this, the service units consumed by the household and the subsidized service units are determined, as well as the monetary calculation of the subsidy. Finally, the monetary calculation of the contribution or the excess cost paid by the household is determined. Although this is done on the ENPH, the last step is to impute the subsidized amount, the value of the contributions, as well as the indirect effect per household following the imputation model between surveys to the GEIH. The calculation of the direct effects for each of the utilities is specified below.

Electricity

For municipalities at less than 1,000 meters above sea level, a distinction is made between households with consumption above the subsidizable minimum ($UC \geq M$) and below the subsidizable minimum ($UC < M$)), as follows:

$$UC = \frac{VF - VU * M * (1 - s) + VU * M}{VU}, si\ UC \geq M \quad (1)$$

and,

$$UC = \frac{VF}{VU * (1 - s)}, si\ UC < M \ (2)$$

Where UC equals the units consumed, VF equals the billing value, VU equals the unit value of the service, s equals the subsidy percentage. For municipalities at more than 1000 meters above sea level, M = 130, and for those at less than 1,000 meters above sea level, the units M = 173. Where VF is the invoiced value of electric energy, VU is the invoiced value per unit consumed, s is the subsidized percentage.

Once the units consumed have been calculated, the non-subsidized units are calculated for municipalities at less than 1,000 meters above sea level, as follows:

$$UNS = \ UC - 170\ , si\ \ UC > 173 \ (3)$$
$$UNS = 0\ , si\ \ UC \leq 173 \ (4)$$

Similarly, non-subsidized units are calculated for municipalities at more than 1,000 meters above sea level, as follows:

$$UNS = UC - 130, si \ UC > 130 \quad (5)$$
$$UNS = 0, si \ UC \leq 130 \quad (6)$$

Thus, the subsidized units and value are obtained as follows:

$$U_{subsidiadas} = UC - UNS \quad (7)$$
$$Valor_{subsidiado} = U_{subsidiadas} * VU * s, si \ estrato \ 1, 2 \ o \ 3 \quad (8)$$

The contribution charged to strata 4, 5, and 6:
$$Contribucion = \frac{c}{1+c} * VF, \quad si \ estrato \ 4, 5 \ o \ 6 \quad (9)$$

Natural gas

By design, the units consumed are calculated as follows:

$$UC = \frac{VF - VU * M * (1 - s) + VU * M}{VU}, si \ UC \geq M \quad (10)$$

Where M = 20 cubic meters consumed that belong to the minimum consumption above which the subsidy is paid. Where VF is the invoiced value of electric energy, VU is the invoiced value per unit consumed, s is the subsidized percentage.

Once the units consumed have been calculated, the non-subsidized units are calculated as follows:

$$UNS = UC - 20, si \ UC > 20 \quad (11)$$
$$UNS = 0, si \ UC \leq 20 \quad (12)$$

In order to calculate the subsidized units, following the structure of the electricity subsidies, but also the value of the subsidy following equations (7) and (8). The contributions follow equation (9). Now, the final variable that agglutinates contributions includes the value of the subsidy for strata 1 to 3, 0 for strata 4, and the value of the contribution for strata 5 and 6. However, in the calculation of the total effects, the values of the separate contributions and subsidies for each public service are added. Indirect effects are taken into account in the case of taxes on or contributions to industry.

B. Gasoline and ACPM Subsidies

In 2007, through Law 1151, the Fuel Price Stabilization Fund (Fondo de Estabilización de Precios a los Combustibles, FEPC, as per the acronym in Spanish) was created with the purpose of not passing on the frequent changes in international fuel prices, particularly those of gasoline and ACPM or diesel, to end consumers. In other words, the fund softens fuel prices by paying the refiner the difference between the international price and the price paid by local consumers, a

price set by the national government (MME, 2022). The adjustment mechanism consists of adding: i) the differential between the export parity price in the U.S. Gulf Coast and the income of the domestic producer, ii) the costs associated with the producer's import logistics such as international mobilization, freight, and tariffs, among others; and iii) special supply operations that guarantee the supply of fuels.

The initial capital with which the FEPC was created was around USD$277 million, which was exhausted by the end of 2010, mainly because the government set domestic prices below the recovery of the international oil price between 2009 and 2010 (IMF, 2019). As a result, the fund's deficit reached COP10.8 trillion in 2018 (MME, 2022), which is just over 1.1 percent of GDP.

Figure 28 shows the evolution of the producer's income, essentially set by the government through regulatory decrees, and the international price of gasoline and Diesel. During most of the fund's existence, the international price has been above the reference price, to such an extent that the price of gasoline went from COP 4,860 at the beginning of 2020 to COP 13,800 in June 2022, putting significant pressure on the FEPC.

Figure 28. Evolution of producer income (PI) and international gasoline and ACPM prices

Panel A: Gasoline

Panel A: ACPM or Diesel
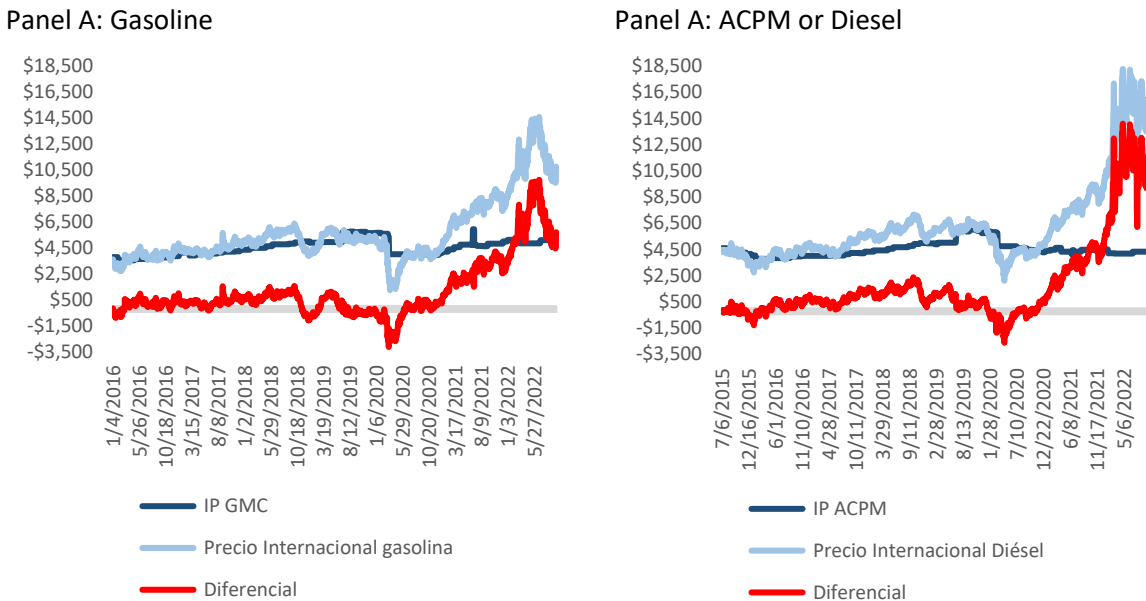
Source: own preparation based on Ministry of Mines and Energy information.

However, the deficit is financed with budgetary resources. This has led to the deficit being covered in different ways as established by laws 1450 of 2011, 1819 of 2016, or law 1955 of 2019 with the implementation of the 2018-2022 National Development Plan. In the first quarter of 2020, an extinction of the FEPC deficit was made with COP17 trillion for outstanding settlements between 2011 and 2019. As of March 2022, the FEPC accumulated outstanding balances of COP16.5 trillion. Thus, taking 2021 as a reference year, the base year of this fiscal simulation model, the FEPC

accumulated a deficit of COP7.7 trillion. Consequently, this deficit constitutes a subsidy on fuel consumption.

The methodology used to include gasoline and ACPM taxes in the model was detailed in the annex on indirect taxes. This serves as the basis for including subsidies, since the policy variable, as explained below, is in terms of pesos per subsidized gallon. Data external to household surveys are used for the purpose of detailing the inclusion in the CEQ of gasoline and ACPM taxes and modeling the effects on household poverty and inequality of gasoline and ACPM subsidies. The main source of information is the set of reports from the Ministry of Mines and Energy, with the reference price or producer's income and the international price of gasoline.

It is important to mention that there is an adjustment mechanism, called the smoothing formula, which depends on and is referenced to the U.S. Gulf market, for each daily observation of regular motor gasoline produced in Colombia. It will be calculated with reference to the index of UNL 87 USGC gasoline and USGC Naphtha, using the following formula:

$$PPEt = ((0.7 * UNL87t + 0.3 * Naftat) - FLt - CTt) * TRMt$$

Where UNL87t is the quotation of the UNL 87 (Ron 92) index in the U.S. Gulf Coast Waterborne from Platts, expressed in dollars per gallon (US$/Gal), on day t. Naftat refers to Platts U.S. Gulf Coast Naphtha index quotation, expressed in dollars per gallon (US$/Gal), on day t. CTt is the cost of pipeline or overland freight to transport a gallon of gasoline from the refinery to the local export port, according to regulated rates. FLt is the cost of maritime or inland freight and other costs incurred to transport a gallon of gasoline from the local export port on the Colombian coast to the U.S. Gulf Coast, expressed in dollars per gallon (US$/gallon), on day t. This value will be the result of applying the following formula:

$$FLt^{22} = [Wst / (f * 42)] * (STRt / 100)$$

However, there is a gap between the reference price defined by the Ministry of Mines and Energy and the result of the price smoothing system as a result of the formula, which is exacerbated at times when the international price increases, which is especially vehement in the case of ACPM (IMF, 2019). Consequently, and given that the gallons of gasoline and ACPM consumed by each household have been previously derived, the subsidy will be the difference between the export parity price and the producer price per gallon of fuel consumed by household h:

$$Subsidio = \sum_{h=1}^{N} g_h(IP - PPE)$$

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[22] Where Wst refers to the daily quotation of the reference freight rate for the Houston-Pozos Colorados route, published by the Worldwide Tanker Nominal Freight Scale "Worldscale", expressed in dollars per metric ton, on day t, f to the conversion factor from metric tons to barrels. For Colombian regular motor gasoline, this conversion factor is 8.535 at 60° and API. 42 to the barrel to gallon conversion factor. STRt is the daily quotation of the market correction factor, for clean tanker freight of 38,000 metric tons, for the CARIB/USG route, from Standard & Poors' Platts publication, expressed in Worldscale units (WS Assess), on day t.

It is important to mention that there are two important assumptions. The first consists of no change in consumption patterns, specifically in 2016-2017 and 2021. The second is that households receive a constant subsidized amount throughout 2021. The latter, given that the prices assumed as a policy parameter are calculated as an annual average, so that the differential, or subsidy, for regular motor gasoline amounts to COP2,591 per gallon. Meanwhile, in the case of ACPM, it is COP3,265 per gallon.

Indirect effects are also included in the model. Since the subsidy is not only received by households, but also by industry, it is feasible that, in the event of a decrease in the subsidy, part of this change will be reflected in an increase in general prices in the economy. This price transfer comes from the same interaction in the production chain, given the weight of fuels in the production of final consumer goods and services.

In order to determine this effect, the Cost-Push model is used to estimate the effect of changes in subsidy prices for each of the goods and services in the household survey. Details on the calculation of indirect effects can be found in Núñez et al. (2020). In general terms, the variation in the subsidy is calculated and applied to the expanded input-output matrix, so as to obtain the percentage change relevant to each sector of the economy. This relative weight by sector is mapped for each of the goods and services in the survey.

Finally, the value of the subsidy per household is imputed from the ENPH to the GEIH following the imputation methodology explained in the methodology section. As a result, the model manages to capture COP3.5 trillion in subsidies, while administrative data for 2021 point to COP11.4 trillion, which is equivalent to 30.5 percent.

Figure 119 shows the absolute and relative incidence of gasoline and ACPM subsidies. The absolute incidence indicates that while 5.7 percent of the total gasoline subsidy reaches the poorest 10 percent of the population, 29.5 percent of the subsidy is received by the highest income decile. This relationship is even more acute in the case of the ACPM subsidy, where the richest 10 percent receive 27.6 percent of the total subsidy captured by the model. However, the relative incidence indicates the relative weight of this subsidy received by the household as a proportion of its per capita market income, which clearly represents more for the lower income segments of the population, to the point that gasoline subsidies are equivalent to 5.3 percent of market income for the first income decile.

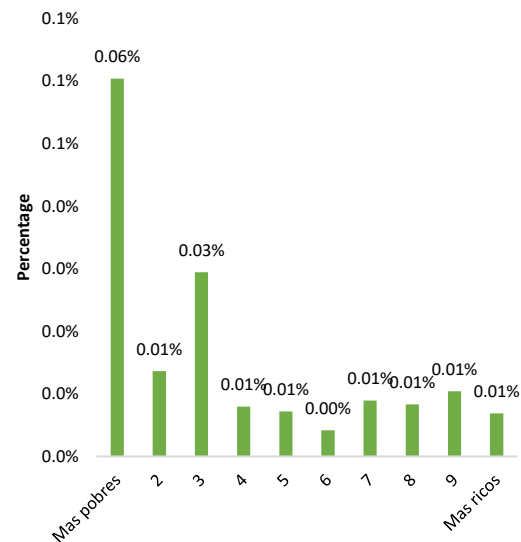**Figure 119. Relative and absolute incidence of fuel subsidies**

Panel A: Absolute incidence-gasoline   Panel B: Relative incidence-gasoline
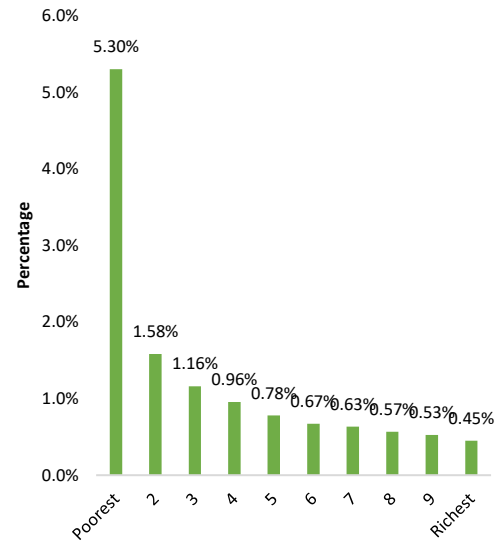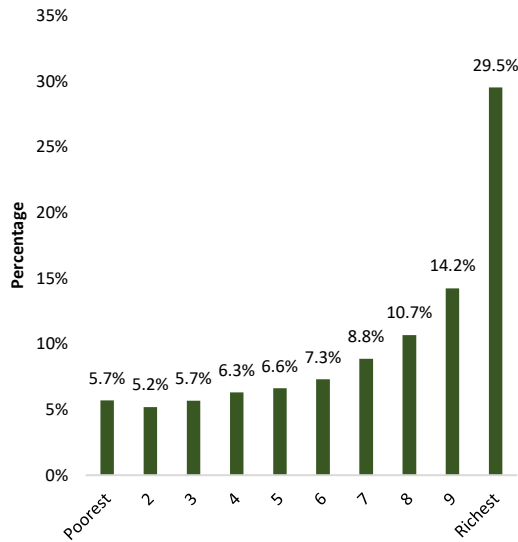
Panel C: Absolute incidence-ACPM   Panel A: Relative incidence-ACPM
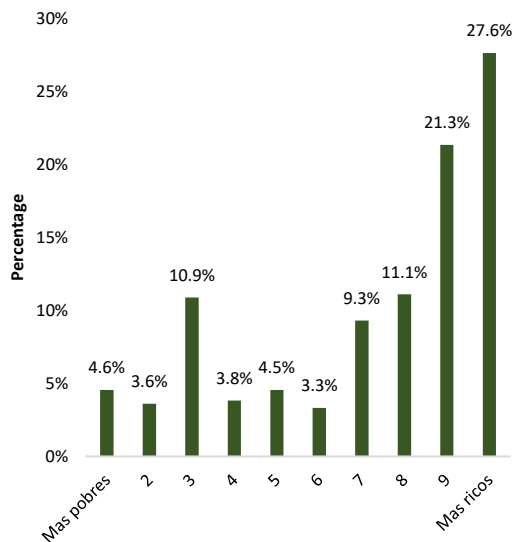
Source: own preparation.

9.7 In-kind transfers

9.7.1   Education

Public (or official) basic and secondary education is financed mainly from the General Revenue-Sharing System (SGP), which may be co-financed with resources from regional entities. Starting in 2021, COP26,836.784 billion were initially distributed from the SGP to certified regional entities (ETC), municipalities and Educational Establishments (EE) in the education sector, where COP19,592.072 billion correspond to the provision of education services. These resources are governed by the criteria of population served, and the population to be served in conditions of

efficiency and equity. Likewise, they must guarantee the costs of the teaching, management, and administrative personnel with their corresponding social benefits. Thus, an associated cost per student is assigned for each ETC and educational level, with differential costs between urban and rural areas.

The sources of information used come from: the initial distribution document of SGP-education resources in order to extract the allocation per student, ETC, educational level, and urban or rural area. The GEIH is used to identify students according to educational level (transition, primary, middle, and high school in official schools) and the information collected in the CEQ 2017 on the Sole Regional Form (FUT, as per the acronym in Spanish) containing the municipalities' expenditures on education.

In CEQ 2017, the distribution of resources executed in education was calculated between the SGP and other sources, within which the ETCs' own resources are included. This led to the calculation of a constant that is interpreted as the additional percentage to the SGP resources to finance education in each ETC. Assuming that there are no significant changes in this percentage between 2017 and 2021, this value is multiplied by the initial assigned value of the distribution document, updated to 2021. In addition to this assumption, it is also assumed that each additional resource to the SGP is distributed proportionally to each student. The Table A20 presents the value assigned in the 2017 CEQ and current CEQ for 10 selected ETCs (out of 95 in total).

Table A20. Distribution of resources executed in education between SGP and other sources (in pesos)

ETC	Preschool	Primary	Middle	High
2021 GEIH				
Armenia	3,646,254	2,917,004	3,281,628	3,463,940
Atlántico	3,229,170	2,583,335	2,906,251	3,067,711
Barranquilla	3,397,596	2,718,076	3,057,836	3,227,716
Bogotá	3,565,664	2,852,532	3,209,099	3,387,380
Bolívar	3,558,773	2,847,017	3,202,896	3,380,834
Boyacá	4,391,806	3,513,445	3,952,625	4,172,215
Bucaramanga	3,605,556	2,884,446	3,245,000	3,425,278
Caldas	3,844,180	3,075,343	3,459,762	3,651,970
Cali	3,390,199	2,712,159	3,051,179	3,220,689
Cartagena	3,124,259	2,499,407	2,811,832	2,968,045
2017 ENPH				
Armenia	2,715,303	2,172,243	2,443,773	2,579,538
Atlántico	3,007,079	2,405,663	2,706,370	2.856.725
Barranquilla	2,619,853	2,095,882	2,357,867	2,488,860
Bogotá	3,732,105	2,985,684	3,358,895	3,545,499
Bolívar	2,520,289	2,016,231	2,268,260	2,394,274
Boyacá	3,612,744	2,890,195	3,251,469	3,432,106
Bucaramanga	2,924,017	2,339,214	2,631,615	2,777,816
Caldas	2,991,230	2,392,984	2,692,107	2,841,668
Cali	2,685,168	2,148,135	2,416,652	2,550,910

| Cartagena | 2,578,751 | 2,063,001 | 2,320,876 | 2,449,814 |

The allocation of the final cost per student was made for each of the people who declared in the survey that they were studying in an official school, according to their educational level, membership in the corresponding ETC, and whether they live in urban or rural areas. The survey identifies 23 major cities and metropolitan areas. In the rest of the municipal seats, the allocation is made by department, as well as in rural areas.

The results are presented in Table 21. The GEIH captures 8.7 million students. Forty-one percent are concentrated in elementary school, followed by high school (41 percent), preschool (11 percent), and middle school (7 percent). The total annual allocated cost equals COP29.3 trillion, which is 93 percent of what was reported in administrative records (COP31.6 trillion).

Table A21. Results of the allocation

Educational level	GEIH Registration		Annual cost	
	Students	% of total	High	Total
Preschool	955,511	11%	3,723,311	3,557,665,590,549
Primary	3,625,169	41%	3,085,773	11,186,447,989,787
Middle	3,551,182	41%	3,440,486	12,217,789,889,112
High	637,388	7%	3,556,577	2,301,827,387,755
Total	**8,769,250**	**100%**		**29,263,730,857,202**

Higher education

In order to identify transfers in higher education, it is essential to know the level at which the student is enrolled (technical, technological, undergraduate, postgraduate). However, the survey does not identify this level of disaggregation. This is important, since the associated costs by level of education in higher education are high. Thus, it is assumed that the total higher education budget is allocated to those who declare in the survey that they are studying a higher education program in a public institution. Data are taken from transfers from the nation and enrolled for 2021.This value is imputed and also reduced following the above procedure.

Table A22. Higher education budget

Total transfers	Beneficiaries	Per capita value
6,873,255,637,875	**1,193,235**	5,760,186

9.7.2 Health

In Colombia there are two health systems: the mandatory contributory system, to which formal workers and pensioners contribute, and the subsidized system, which is financed through public spending. Following the methodology developed in the CEQ 2017, health transfers to affiliates of the subsidized regime are considered for affiliates who have access to the benefit plan (POS, as per the acronym in Spanish) and the portion corresponding to the contributory regime. The Ministry of Health ensures the financing of the system through the Capitation Payment Unit (UPC), which is an annual amount transferred to the health promoting entities (EPS) by each of their affiliates to cover the provision of the service. This works as a premium to cover the risk of disease occurrence and allows the EPS to have the resources to pay for the care provided to its members, as well as a margin for the administration of the service.

According to Resolution 2503 of December 28, 2020, by which the UPC was set for 2021, the average UPC was COP872,496, which is 30 percent more than in 2017. However, the value of the changing UPC is made by age group (main health risk) distinguishing between 15 and 44 years old, between men and women, as shown in Table A23. What is more, additional payments are recognized according to the location of the affiliates, as follows: 11.47 percent in dispersed municipalities, 15 percent for conurban municipalities and 3.81 percent for indigenous health promoting entities (EPSI, as per the acronym in Spanish).[23]

Table A23. Value of the UPC in pesos for members of the subsidized system

Age group	Subsidized UPC	Subsidized UPC (monthly)
Under one year of age	2,412,799	201,067
Between 1 and 4 years	713,613	59,468
Between 5 and 14 years old	285,044	23,754
Males between 15 and 18 years old	335,649	27,971
Women between 15 and 18 years old	556,740	46,395
Men between 19 and 44 years old	559,706	46,642
Women between 19 and 44 years old	885,931	73,828
Between 45 and 49 years old	905,302	75,442
Between 50 and 54 years old	1,131,890	94,324
Between 55 and 59 years old	1,373,133	114,428
Between 60 and 64 years old	1,698,314	141,526
Between 65 and 69 years old	2,104,898	175,408
Between 70 and 74 years old	2,567,232	213,936
75 years or more	3,191,155	265,930

Source: Resolution 2503 of 2020.

Since indigenous EPS receive a higher value of UPC and in the household survey we do not know the name of the EPS, the cities with representativeness in the GEIH and where indigenous EPS

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[23] San Andrés also has a differential UPC, however, given that the GEIH does not have representation for this municipality, it is not counted (unlike what happens in the ENPH).

have affiliates to the subsidized regime (Popayán, Valledupar, Riohacha, Santa Marta, Pasto, Ibagué, Cali) were taken, consistent with what was done in the CEQ 2017.

The **Table** presents a comparison between the administrative records in 2021 and 2017, as well as the ratio of indigenous people affiliated to the subsidized regime in the household surveys for the selected cities. In the case of Popayán it is found that there could be a considerable underestimation of the indigenous population affiliated to the subsidized regime, while there is an overestimation in Cali. Thus, in these cities, the people who are recognized as indigenous in the survey were identified, so that this population was assigned the value of the indigenous UPC table. An important assumption is that the entire indigenous population of the subsidized regime belongs to an indigenous EPS, which is not necessarily the case.

Table A24. Affiliates of the subsidized regime in indigenous EPS and affiliates in household surveys of those who recognize themselves as indigenous.

DOMAIN	(i) Administrative record				(ii) Survey			
	Affiliates	Indigenous EPS members	Affiliates (%) in indigenous EPS	Affiliates (%) in indigenous EPS 2017	Affiliates	Indigenous affiliates	Percentage indigenous GEIH	Percentage indigenous-ENPH
Popayan	148,543	7653	5.15	4.43	122,120	1852	1.52	5.41
Valledupar	312,708	38,590	12.34	12.24	242,035	6781	2.80	1.58
Riohacha	194,185	62,707	32.29	30.83	153,209	27,247	17.78	17.37
Santa Marta	298,643	7112	2.38	2.09	261,861	776	0.30	0.69
Pasto	231,420	9364	4.05	2.86	196,299	9089	4.63	2.55
Ibagué	199,877	11,420	5.71	6.05	209,287	377	0.18	1.63
Cali	753,825	2236	0.30	0.27	797,850	22,351	2.80	2.27

Source: Ministry of Health and Social Protection (n. d.), 2021 GEIH and 2017 ENPH.

Also identified are the urban municipalities defined in Resolution 2503 of 2020, which are also representative in the GEIH. Table 27 compares the municipalities or geographic domains captured in both the ENPH and the GEIH. In addition, the imputation for other urban centers and rural areas is done at the level of dispersed municipalities, which have other UPC rates. In sum, people who reported in the survey that they were affiliated to the subsidized regime were assigned the UPC of their geographic domain and age group, according to whether they belonged to a conurbation or dispersed area, as shown in Table 27. The average value of the UPC is imputed or the rest of the urban areas or other capitals.

As a result, 24,511,064 people report in the GEIH that they are affiliated to the subsidized regime, which is 2 percent higher than the administrative records (23,968,577). The total UPC cost reported in the survey for the subsidized regime was COP23.7 trillion, which represents 91.4 percent of the cost reported in administrative data (COP25.9 trillion). It is worth noting that in the 2017 CEQ the percentage between household survey and administrative data was 95.5 percent.

Table A25. Municipalities in dispersed or urban areas ENPH vs. GEIH

ENPH		GEIH	
Dispersed	Urban	Dispersed	Urban
Inírida	Armenia	Rural areas	Cartagena
Leticia	Barrancabermeja	Quibdó	Manizales
Mitú	Bucaramanga		Popayan
Mocoa	Buenaventura		Valledupar
Puerto Carreño	Cartagena		Monteria
Quindío	Cúcuta		Neiva
San José del Guaviare	Ibagué		Riohacha
	Manizales		Santa Marta
	Monteria		Villavicencio
	Neiva		Pasto
	Pasto		Cúcuta
	Pereira		Armenia
	Popayan		Pereira
	Riohacha		Bucaramanga
	Santa Marta		Sincelejo
	Sincelejo		Ibagué
	Soledad		Cali
	Valledupar		Medellín
	Villavicencio		Bogotá

Source: GEIH and ENPH.

The UPC of the contributory system was also taken into account as an in-kind health benefit, since part of the contributory health system is paid for with public resources that come from company taxes. In addition, the contributions made by employees and pensioners to the contributory system are tied to their payment capacity. This means that those who contribute to the common pool and have high contribution incomes may be helping to finance taxpayers with lower payment

capacity. For example, high-income taxpayers with a small family may be financing a lower-income taxpayer with a much larger family. Ultimately, these are cross-subsidies. Following the 2017 CEQ, contributions to this health care system are modeled as a direct tax.

The average UPC of the contributory regime in 2020 was COP892,591.2, the structure by age and gender differentiated can be found in Table . The ministry also recognizes additional values for conurban municipalities and dispersed areas (10 percent and 9.86 percent, respectively), so these differentiated values are assigned to each beneficiary, according to their municipality of residence, gender, and age, when they state in the household survey that they are affiliated to the contributory regime.

Table A26. Value of UPC in pesos for members of the contributory system

Age group	Subsidized UPC	Subsidized UPC (monthly)
Under one year of age	2,786,342	232,195
Between 1 and 4 years	894,700	74,558
Between 5 and 14 years old	312,534	26,045
Males between 15 and 18 years old	297,889	24,824
Women between 15 and 18 years old	470,728	39,227
Men between 19 and 44 years old	530,060	44,172
Women between 19 and 44 years old	983,419	81,952
Between 45 and 49 years old	972,716	81,060
Between 50 and 54 years old	1,240,657	103,388
Between 55 and 59 years old	1,516,579	126,382
Between 60 and 64 years old	1,951,819	162,652
Between 65 and 69 years old	2,427,897	202,325
Between 70 and 74 years old	2,913,458	242,788
75 years or older	3,661,138	305,095

Source: Resolution 2503 of 2020.

The GEIH considerably underestimates the number of members of the contributory system (19,582,132), which contrasts with the number reported in administrative data for 2021 of 24,623,736. Likewise, COP13.7 trillion was allocated to the contributory regime, which is equivalent to 74.8 percent of the total UPC cost of the contributory regime analyzed.

The health benefits of the contributory regime are adjusted, since not all those in the contributory regime turn out to be net contributors. The 2017 CEQ found that, according to the Ministry of Health's sustainability model, the total cost of the contributory regime in 2017 was COP23.594 billion, of which COP7.887 billion came from the income tax. For this reason, the value of the

estimated UPC is adjusted by multiplying by the additive inverse of 33.42 percent, which corresponds to the percentage financed with public resources. This is done for those who actually contribute, excluding workers who earn less than the equivalent of ten (10) minimum wages and who in the survey declare that they make partial payments (the other part is paid by the employer) or whose employers pay the full amount.