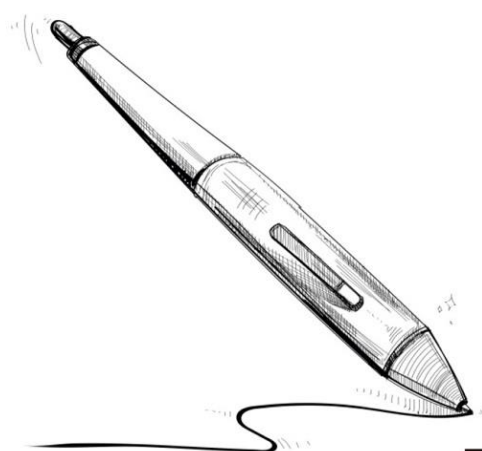# The effect of COVID-19 and emergency policies on Colombian households' income

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Non-Technical Summary

This paper studies the effects that the COVID-19 lockdown measures and the different emergency tax-benefit policies introduced by the authorities had on the household income distribution in Colombia. We measure the employment effects of the lockdown decree and use the tax-benefit microsimulation model for Colombia -COLMOD- to study the emergency policies for the first complete month of lockdown: April 2020. We found that 6.2 million of jobs are destroyed implying an average reduction of 16.5% of household income, with dramatic losses at the bottom of the distribution. The new policies introduced increased income by 0.8 billion pesos and offset the income loss of those in poverty but not of those slightly above the poverty line, this group could get on average only 84% of their previous income.

The effect of COVID-19 and emergency policies on Colombian households' income[1]

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January 2021

Abstract

This paper quantifies the effects that the COVID-19 lockdown measures had on the distribution of income across households in Colombia, highlighting the potential effect of the emergency policies introduced by the authorities. We simulate the occupational effects of the lockdown decree and use the tax-benefit microsimulation model for Colombia -COLMOD- to simulate the emergency policies for the first complete month of lockdown: April 2020. We found that the 6.2 million of jobs destroyed translate into an average reduction of 16.5% of household disposable income with important income losses at the bottom of the distribution. The new policies introduced increased disposable income by 0.8 billion pesos and offset the income loss of those in poverty. However, the recovering effect of the new policies for those out of poverty but vulnerable is more modest, this group could get on average only 84% of their previous income.

JEL: C81, D31, H55, I30, I38

Keywords: COVID-19, pandemic, poverty, income distribution, subsidies, microsimulation, Colombia

Introduction

The global pandemic caused by the COVID-19 has produced an economic crisis without precedent in recent history. The infection expansion and the latent vulnerability due to a globalized and interconnected world, have put on alert all nations and their healthcare systems and economies are in danger. Calculations on the global GDP contraction depend on changing assumptions, but the massive loss of jobs and the slowdown of the global economy are incontrovertible. World poverty will increase and national fiscal systems around the globe will face instability. The IMF (2020) estimates that global economic growth will fall to -3% in 2020 and the ECLAC (2020) projects a decrease in the economic activity of 5.3% in 2020 for the region, which will rise the number of poor people by 30 million. Simultaneously, the DANE (2020) announced that in April 2020 the national unemployment rate reached 19.8% and that around 5.3 million of jobs were lost in comparison with the same month in 2019.

Preliminary analyses indicate that Colombia and the world will require enormous quantities of resources to face the pandemic and the economic crisis. According to Elgin et al. (2020), on average, the world fiscal spending to face the COVID-19 is around 3.7% of the GDP, and there are countries in which this indicator reaches 20% such as Japan and Luxemburg. The average in Latin American is around 2.4%, Peru leading with 9% of the GDP. Whereas, Colombia has spent 2% (Elgin et al.,2020). Government debt and spending mainly via transfers to the most vulnerable household are the best tools to tackle the crisis, but at the same time impose challenges to fiscal schemes and social policy around the world.

The Colombian government decreed the state of Sanitary Emergency on March 17th and implemented a mandatory preventive lockdown on March 24th. The quarantine has been extended for months, but a gradual opening by economic sectors has taken place. With the aim of protecting the population and preventing the health care system to collapse, the government closed its borders and created temporary exemptions in the VAT payments for medical supplies needed to face COVID-19. Just essential economic sectors such as public services, healthcare, private security, sanitation, food and drink supply, and business able to work virtually, kept their activities. The imminent need of increasing the public spending forced the government to reassign national and local resources, as well as increasing public debt. Emergency private credits with public backing were made available to firms. The Central Bank increased liquidity and reduced the reference interest rate. The government disposed 1,48 billion of Colombian pesos to social programs and acquired a loan of US$250 million with the World Bank. Other measures included social security payments reductions and an increase in taxes for public workers with high salaries and pensioners with high allowances.

Regarding social policies, the national cash transfer programs: *Familias en Acción, Jóvenes en Acción* and *Colombia Mayor* were topped-up. Two new programs were implemented: *Ingreso Solidario* and the "VAT refund" for the poorest. The unemployment subsidy given by Family Compensation Funds was changed to a cash transfer available under less stringent conditions. Regional social programs were created: *Bogotá solidaria en casa, Medellín me cuida, Barranquilla es solidaria*, among others. Due to the lack of an information system allowing the government to identify each household, the government used the existing programs and the SISBEN welfare index as mechanisms of identification of potential beneficiaries. However,

the lack of access to finance for some population made difficult to reach all the potential beneficiaries of the new programs.

With this background, this article uses microsimulations to analyse the effect of COVID-19 and some of the emergency policies on the disposable income of Colombian households. By using COLMOD tax and benefit microsimulation model for Colombia we establish the effects that the lockdown and the public policies implemented had on poverty and inequality. We analyse two scenarios of job losses, a pessimistic and a moderate one. We pay special attention to differences between household disposable income with and without the new policies implemented. As a special exercise, instead of the multiple programs implemented we simulate a fix cash transfer to every worker who lost his job.

We find that a 6.2 million jobs loss implies that Colombian households have, on average, 83.4% of the income they had before the crisis. The most affected population is at the bottom of the income distribution. Poverty and inequality indicators suffer a considerable worsening. Government intervention moderately corrects the income losses for the poorest. Nevertheless, its effect is much modest for those households not poor, but vulnerable, which would recover between 4 and 7 percentual points (pp) of their disposable income lost.

This document has five sections, being this introduction the first. Section two briefly describes taxes and benefit microsimulation models and how these are being used to make distributive analysis of COVID-19 effects for Ireland, Italy, United Kingdom and Argentina. Section three presents the methodology and the social programs recently introduced in Colombia to be simulated. The results of the simulated scenarios are presented in section four. Finally, section five presents a few conclusions.

2. Microsimulations and COVID-19: Literature review

2.1 Tax-benefit microsimulation models

Tax and benefit microsimulation models combine representative data -typically based on a household survey- alongside the rules for benefits, social insurance contributions and taxes. With these two elements the model constructs each household's disposable income which results from deducting payments made and adding income receipts in the household relation with its government. This kind of models allow to analyse both, at the individual and macroeconomic level, how policy rules affect social welfare, especially they allow to computing poverty and inequality measures and fiscal financing and expenditures.

Tax-benefit microsimulation is an essential tool to reduce information asymmetries around welfare effects of policy proposals. The technique allows to take into account the heterogeneity of the population. It improves on aggregate analysis because, by focusing on the individual it allows researchers to understand the complexities of some policies, their details, and interactions.

2.2 Microsimulations on COVID-19 effects

Recent research for countries such as Ireland, England, Italy, and Argentina use microsimulation techniques to analyse the distributional effect of COVID-19 and the emergency policies enacted. For Ireland, Beirne et al. (2020) use EUROMOD to calculate the potential cost and the distributional effects of COVID-19.

They propose three scenarios with different levels of unemployment. Randomizing the job losses inside the affected economic sectors, they found that in the "medium" scenario with no public intervention, 618,000 new unemployed individuals would be eligible for an unemployment subsidy. Between 70% and 80% would correspond to job losses in the sectors with the highest risk, between 20% and 30% in medium risk sectors, and 5% or less in low-risk ones. 400,000 households would see a decrease of more than 20% of disposable income. Given Ireland´s automatic stabilizers the bottom of the distribution will recover a great deal of income lost, but major losses would take place for richer households. Furthermore, in the bottom quintiles there are fewer people working who are affected by the shock, and some of them are going to be better-off as a result of the new government transfers.

In the case of Italy, Figari and Fiorio (2020) analysed to what extent the welfare system provided compensation for those who lost their incomes due to the emergency lockdown measures imposed by the government. Using EUROMOD, they propose several counterfactual scenarios for the workers of the most affected sectors. Among the programs implemented they simulate a salary subsidy for one month, with an estimated cost of €5.1 billion and two cash transfers: The first one was aimed to independent workers with an income of less than €35,000 per year, the second to workers with no more than €40,000 of annual income. These two policies would cost around €4 billion. The worker's market income would suffer a loss of 30%, partially compensated by the government intervention for those at the bottom of the income distribution. Poverty would rise 15pp among those affected by the lockdown and 8pp for all the population. They find that the design of the lump sum given to the individuals did not differentiate the most vulnerable. They also find that the resilience of the households depends on the initial conditions and then of the tax and transfer scheme. The article's main point is that the automatic stabilizers of the Italian system of taxes and benefit were not able to operate completely, consequently new policies had to be applied.

Transfer design plays a salient role in the discussions about public policy implementation. Torry (2020), using EUROMOD; analyses a possible income recovery in the UK through a universal transfer. Three types of transfers are evaluated: the first one would be an emergency one, with the aim of tackling the income decrease during the pandemic; the second one would play a role in the income recovery once the crisis has passed; and the third one, would be a universal basic income as a permanent policy. The article shows that the emergency basic income is not feasible administratively speaking. A recovery basic income of £197 per week, for working age adults could be funded with an increase of 5pp in every band of the income tax (from 20% to 25%, from 40% to 45% and from 50% to 55%). This policy would be temporary because it is not neutral. Once the COVID-19 crisis is overcome, the universal basic income as a permanent policy would be feasible if it becomes revenue neutral. As a main conclusion, a universal basic income would have relevant effects in poverty and income inequality reduction.

Finally, for Argentina, Bonavida and Gasparini (2020) analyse the implementation of remote work for some economic sectors in the context of COVID-19 lockdown. Using household surveys and establishing the main employment features, they found that just a quarter of working age population could do remote work. Informal and unskilled work, that requires low education achievement, is mostly incompatible with remote work. The authors also simulated the effects of the pandemic for this type of workers under the assumption of a total loss of income for two months. Poverty and income inequality are found to rise in Argentina

because the lockdown effects are more pervasive for low-income workers. Labour income remains almost unaltered above the sixth decile in the income distribution. This increases in poverty and inequality took place in spite of cash transfers implemented by the government such as the "Ingreso Familiar de Emergencia".

3. Methodology

The lockdown measures enacted on March 21st by the Colombian national government implied the closure of many economic sectors and the destruction of job and other income generating activities. Taking into account that the country does not have a benefit system with "automatic stabilizers" in response to systemic or idiosyncratic shocks, the Colombian government was compelled to create a series of emergency cash transfers, to increase the generosity of existing social assistance programs or to speed up the implementation of new transfers such as the so-called "VAT devolution to the poor"[5]. The government also reduced pension contributions for employees, employers, and self-employed with the purpose of decreasing labour costs and to increase disposable income for households. It also transformed an in-kind unemployment subsidy for employees to a cash transfer. Lastly, the government created a temporary tax on high pensions and high earnings for public workers. Some local governments with fiscal space introduced cash transfers for poor and vulnerable households in their cities.

The next section seeks to explain the methodology used to simulate the introduction of these policies. In the first one we introduce COLMOD the tax benefit model used for the proposed exercise. In the second, we present the assumptions and results of two job loss scenarios resulting from the lockdown. In the third section we present the details of the simulation and the programs introduced.

3.1 COLMOD: the tax-benefit microsimulation model for Colombia

COLMOD is a tax-benefit microsimulation model for Colombia based on EUROMOD and following its conventions[6]. The model is open access and is administered by the Faculty of Economics at Universidad Externado de Colombia. The version for this paper uses data from the main labour survey for the country (Gran Encuesta Integrada de Hogares, GEIH) for 2019, and also uses policy rules for 2020: benefits, social insurance contributions for employees, self-employed, and employers, and income tax. A previous version of the model using another household survey focused on living conditions (Encuesta Nacional de Calidad de Vida, ENCV) allows to simulate indirect taxes (VAT and consumption tax). In the version of the model using the GEIH data we are not able to simulate these taxes because of lack of data on expenditures.

The tax and benefit system that COLMOD simulates is presented in Table 1. In this table the inputs from the first two columns are taken from the GEIH data: household characteristics ($\mathbb{X}$) and market incomes ($\mathbb{Y}$). The model uses these two sources of information to recreate taxes ($\mathbb{T}$), social insurance contributions ($\mathbb{S}$) and benefits ($\mathbb{B}$). Some components of the tax-benefit system such as pensions cannot be simulated due to

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[5] A previous analysis of the potential effects of this policy using COLMOD can be found in Corredor and Rodriguez (2019)

[6] EUROMOD is the tax-benefit microsimulation model for the European Union. It is implemented in a homonymous software which allows to easily simulate the effect of tax and benefit changes on the income distribution and the fiscal balance. In top of the 28 European countries, six African countries and six Latin American countries (including Colombia) have models implemented in EUROMOD. This feature facilitates comparative studies between developed and developing countries in the search of better policies.

lack of data. However, their values are taken directly from the data. We refer the interested reader to previous exercises[7] and the documentation[8] for details of the scope of the simulations in COLMOD.

Table 1. Inputs and output for the tax-benefit system in Colombia[9]

Simulated outputs			Inputs			
			$\mathbb{Y}_i$	$\mathbb{X}_i$	$\mathbb{S}_i$	$\mathbb{B}_i$
	$\mathbb{T}_i$	Income tax	Market Income	Expenditures	Social Insurance Contributions	Pension Income
	$\mathbb{S}_i$	Employee or pensioner health insurance contributions	Labour Income	Employment type		Pension Income
		Pension contributions				
		Pension solidarity fund contributions				
		Employers' health contribution				
		Employers' pension contribution				
		Employers' severance contribution				
		Employers' risk insurance contribution				
		Employers' Family Compensation Fund contribution				
		Employers' SENA contribution				
		Employers' ICBF contribution				
	$\mathbb{B}_i$	Old age pension	Not simulated but taken from the survey			
		Survivors pension				
		Disability pension				
		Familias en Acción		Demographics		
		Colombia Mayor				Pension Income
		Jóvenes en Acción				
		Other transfers	Not simulated but taken from the survey			

Source: Authors' calculations

Among the policies that COLMOD simulate we find income tax, for which the taxable base is built by adding market income to pensions and subtracting deductions such as pension and health insurance contributions and exemptions such as mortgages or education payments[10]. Using information on earnings and whether the worker is contributing to social insurance or not (informality) we simulate social insurance contributions for workers and employers. Finally, we are able to simulate programs such as *Familias en Acción, Colombia Mayor* and *Jovenes en Acción*. However, transfers to households affected by natural disasters or the internal conflict are taken directly from the data given the lack of information on eligibility for them.

3.2 The COVID-19 effects on employment

The lockdown measures to control the COVID-19 pandemic in Colombia shut down the operation of many economic sectors putting jobs and earnings at risk for many workers. With the aim of measuring what type of workers were hit by the lockdown and to what extent, the microsimulation exercise considers the restrictions imposed by government and the specific workers' characteristics that make them more likely to keep their jobs even in the lockdown. According with the last two criteria, a pessimistic and a moderate scenario are created.

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[7] Bargain, et al. (2017), Arancibia, et al. (2019), Rodríguez y Jara (2019), Rodríguez (2019), Rodríguez, et al. (2019)
[8] These are available at: https://www.uexternado.edu.co/economia/colmod
[9] For a detailed description see Rodríguez (2019).
[10] These values are imputed as described in detail below.

The *pessimistic* scenario considered workplace and if the economic sector was affected by the confinement measures. Specifically, a classification of all sectors affected and not affected based on regulations in Decree 457/2020 is made. It is assumed that workers in affected sectors lose their jobs. Once the classification is made, those who perform activities among the non-affected sectors (e.g. retail sale of food and drinks) but work as street vendors lose their jobs as well, due to sanitarian restrictions that forbid their activities.

The *moderate* scenario keeps the same criteria as the pessimistic one, but other workers' characteristics were considered. In this case it is assumed that among the workers in affected sectors, public employees, professionals, administrative workers, and directors keep their jobs. For public workers, the government did not announced layoffs, thus, it is a reasonable assumption. The remaining type of workers could perform their work remotely. Additionally, it was assumed that workers in affected sectors with permanent contracts or a fixed contract by a 12-months term or more will keep their jobs, because for firms it is expensive to fire this kind of workers in the short run.

3.3   Microsimulation of the lockdown in Colombia

This paper studies the potential effect on employment and the distribution of incomes of the first complete month of lockdown in Colombia: April 2020. Its objective is to give an idea of how effective the new policies were in tackling the earnings loss (very short run). Our focus is not in making forecasts which require computable general equilibrium models that capture the supply and demand shock implied by the lockdown and their potential sectorial effects on employment and on the income distribution in the medium run.

As previously discussed, the main inputs for this exercise were the GEIH data and COLMOD.[11] For simplicity, we assume that all monetary variables in the GEIH for 2019 grew at the same rate that the minimum wage in 2020 (that is 6%). In that sense we are assuming that the best approximation to the income distribution of April 2020 is that of the entire 2019, however, we adjust the monetary values to give the different simulated scenarios in the exercise more realism, especially, considering that the new policies are in 2020 prices.

The original GEIH data underwent three imputation processes with further details in the appendix. The first one is the imputation of incomes, which follows the MESEP methodology: it identifies non-responses, false zeros (using discriminant analysis), and outliers (using quantile regressions). Those inconsistent incomes are imputed using the Hot-Deck algorithm. In this case, the imputation process is not done over the income components proposed by DANE and MESEP but for the income components defined for COLMOD. Considering that in COLMOD income variables are more disaggregated total imputed income in COLMOD is slightly higher than that in MESEP.

The second imputation is done to obtain some expenditures needed to simulate income tax liabilities: expenditures on dependent children, mortgage payments, and private health insurance. For them we follow the methodology proposed by Decoster et al. (2014). We use data from ENCV for 2014, we estimate a probability model to determine the likelihood of making the expenditure and an OLS regression to

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[11] It is important to highlight that at the time of writing these lines there is no information for the GEIH new Departments, so they are omitted. The GEIH without new departments is still representative of the entire Colombian population,

determine the amount spend conditional on making the expenditure. Both models use demographic and income variables common to both surveys: GEIH and ENCV. With the estimated coefficients we predict in GEIH the households making the expenditure and the amount spend. For the first part we sort households by the predicted probability of making the purchase and keep the observed proportions in ENCV, for the second we update the monetary values of the expenditure according to the observed CPI inflation. The effect of this imputation is minimal considering the reduced number of observations paying income tax in Colombia.

The third imputation process corresponds to the beneficiaries of *Familias en Acción* and *Jóvenes en Acción*. The aggregate number of beneficiaries in GEIH underestimate the figures reported by the national government and by other surveys such as ENCV. This discrepancy is of around 45.4% and 47.8% of beneficiary households missing in the GEIH for the two programs respectively. This could arise because problems in the set of questions and the target population in the non-labour income module of the GEIH. To overcome this difficulty and give the exercise a greater precision we proceed as follows: 1) we use a set of variables that determine eligibility for both programs and estimate a probability model in which the dependent variable takes the value of 1 if the household was observed as beneficiary of the program in the GEIH and zero otherwise. 2) We compute the predicted probability of being in the program 3) in case we observed the household as beneficiary of the program we set the prediction to one 4) in case the household is ineligible for the program we set the prediction to zero 5) for each program in each department (Colombian states) we rank households by the predicted probability and complete the observed shares within each department with those with the highest probability of receiving the benefit.

With the purpose of giving a better perspective of the pandemic effects we propose several alternative scenarios to the baseline which corresponds to April 2020 without lockdown or additional policies.

1. Lockdown with two scenarios of employment loss: pessimistic and moderate and **without** new policies.
2. Lockdown with two scenarios of employment loss: pessimistic and moderate and **with** new policies.
3. Lockdown under the two scenarios of employment loss, but with the introduction of a fixed hypothetical. benefit targeted to all workers affected by the lockdown. This transfer replaces all new policies introduced.

In all the scenarios the main income variable is disposable income (Equation 1). In simple words, this variable results from adding benefits and pension payments to market incomes and subtracting taxes and social insurance contributions paid by the household.

$$
\begin{aligned}
\text{DisposableIncome}_i & \\
& \equiv \text{MarketIncome}_i + \text{Pensions}_i \\
& + \text{Benefits}_i \\
& - \text{SocialInsuranceContributions}_i - \text{Direct Taxes}_i
\end{aligned}
\tag{1}
$$

Where i stands for each observation in the survey,[12] market income is composed of earnings, property rents and transfers from other households. Benefits include programs such as *Familias en Acción, Colombia Mayor, Jóvenes en Acción* and those introduced by the government to tackle the income loss of the

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[12]Pensioners and domestic services employees are excluded. This household definition corresponds to the spend unit used by DANE for monetary poverty measurement.

lockdown. Social Insurance Contributions include health insurance, pension, and pension solidarity fund contributions. Lastly, in direct taxes we find the income tax including the recently introduced income tax to high pensions and earnings for public workers. It is important to highlight that for this specific exercise we include the imputed value of housing for owners. Given that in practice this variable is not an income it is omitted in EUROMOD based models including COLMOD. However, we include it here for a better consistency with the official monetary poverty figures for Colombia which are based on the GEIH.

In most of the figures we make reference to income deciles, unless otherwise stated these deciles correspond to the household per capita disposable income before the COVID-19 and the new policies. This strategy is deliberate and is done to avoid the effect of the reordering of the distribution of incomes resulting from the extreme income changes of the pandemic. Moreover, each decile is accompanied by the average per capita income of the decile in millions of Colombian pesos displayed in squared brackets.

Our Approach to the welfare index for social programs SISBEN

Taking into account that most programs introduced to face COVID-19 use a welfare index: SISBEN version IV to determine eligibility, our exercise creates a welfare index based on the GEIH that works as a proxy for SISBEN. For this we follow the methodology of the CONPES 3877/2016 (DNP, 2016).[13] To classify each person in one of the three SISBEN categories: A (extremely poor), B (moderately poor) and C (vulnerable), we sort observations in GEIH by this SISBEN proxy and accumulate population until the totals for categories A,B, and C coincide with the external data provided by the government.

Simulated policies[14]

The government policies introduced to face the crises are presented in Table 2.

Table 2. Simulated Policies

Program or Bonus Name	Program Features	Program Simulation	Territorial scope
Familias en Acción Bonus	An additional amount of 145,000COP per household. Beneficiaries are those who are already enrolled in the program *Familias en Acción* and that are poor or extremely poor. 2,6 million of households is the government´s target.	**Eligibility:** cash transfer reception reported by the household in the GEIH. Imputed reception is included. **Amount:** 72,000COP per month to each household that already is receiving *Familias en Acción*.	National
Jóvenes en Acción Bonus	Two additional payments of 356.000COP per person. Young people who were enrolled in "Jovenes en Acción" before march the 16th 2020 are the beneficiaries. The target is to reach 275,000 people who their family does not participate in "*Familias en Acción*".	**Elegibility:** cash transfer reception reported by the household in the GEIH. Imputed reception is included. **Amount:** 60,000COP per month.	National

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[13] The process description is shown in the annex.
[14] A comparison between the aggregates of the new components of the system simulated and the external sources is presented in the annex.

Colombia Mayor Bonus	1'703,586 elderly receive a cash transfer of 160,000COP in April. 80,000COP is the ordinary payment and the other half corresponds to an extraordinary payment. The same happens with the payment in May. The estimation is that 1'600,000 people are beneficiaries.	**Elegibility:** cash transfer reception reported by the household in the GEIH. **Amount:** 80,000COP per month to each elderly.	National
VAT refund	VAT refund of 75,000COP each two months for vulnerable and poor households. Around 1 million people are going to be beneficiaries. Recipient of this refund are those who are the poorest among the beneficiaries of "*Familias en Acción*" and elderly who are part of the priority list of "Colombia Mayor", 700 thousand and 300 thousand households, respectively.	**Eligibility:** Recipient households of *Familias en Acción* (observed and imputed) or Recipients of Colombia Mayor (observed) who belongs to SISBEN-group A. **Amount:** 37,500COP per month.	National
Ingreso Solidario	Program created exclusively to support vulnerable and poor households during the pandemic. Beneficiaries are informal workers who are not enrolled in any national social program (*Familias en Acción*, Jóvenes en Acción, Colombia Mayor and VAT refund). 3 million people is the program's target.	**Eligibility:** Households considered vulnerable, poor or extreme poor, according to SISBEN IV[15] and that are not part of national social programs. Given that many of these households do not have bank accounts, for the simulation purposes, through randomizing, some households receive the transfer and others do not. Probability of having a bank account is obtained from the program payment reported by the government for April. This probability is compared to each observation with a random extraction from a uniformly distributed variable. **Amount**: 80,00COP per month.	National
Bogotá Solidaria en Casa	Program designed to help vulnerable and poor households from Bogotá D.C. The local government aim were 500 thousand households: 350 thousand poor households received less than 233,000COP and 150 thousand vulnerable households 160,000COP. Changeable bonuses were given too. 50,000COP in cards for purchases and a basket of basic goods equivalent to 90,000COP.	**Eligibility:** Bogotan households not enrolled in national social programs and defined as vulnerable, poor or extreme poor by SISBEN IV. A similar procedure to "Ingreso Solidario" is done. The probability of being selected is determined in a way that total amount of people eligible by category (vulnerable, por and extreme poor) coincides with the mayoralty reports. **Amount:** 116,000COP for poor and 80,000COP for vulnerable households. Monthly amount.	Local
Medellín Me Cuida	100,000COP cash transfer aimed to vulnerable households from Medellin and that have not received transfer from the national government. 1 million and 161 thousand families are the program aim.	**Eligibility:** Households in Medellin not enrolled in any national social program and defined as extreme poor, poor or vulnerable according to SISBEN IV. **Amount:** 100,000COP monthly per household.	Local
Barranquilla es Solidaria	Food aid for vulnerable households of Barranquilla by means of biweekly bonuses. 2.075 million COP were collected and there are bonuses of 40,000COP and 50,000COP.	**Eligibility:** Barranquilla's households not enrolled in any national social program and defined as extreme poor, poor or vulnerable according to SISBEN IV. **Amount:** 40,000COP monthly by home.	Local

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[15] SISBEN IV is the last update if SISBEN.

Cali Seguridad Alimentaria	With an initial budget of 60.000COP, the program aim is to guarantee food safety for most vulnerable households of Cali. 300.000 households which are not part of any national social program are the aim. A basket of basic goods equivalent to a maximum of 75.000COP is handed to those who have a 0-15 in the SISBEN score. Also, there are redeemable bonuses equivalent to 80.000COP.	**Eligibility:** Cali's households not enrolled in any national social program and defined as extreme poor, poor or vulnerable according to SISBEN IV. **Amount:** 80.000COP monthly per household.	Local
Pension contribution reduction	Employers from public and private sector and independent workers paid a smaller amount for mandatory pension payments in April and May. The normal pension rate was 16% and the temporary rate stablished for these two months was 3%. 75% of this 3% is paid by the employer and the other 25% is paid by the worker. Independent workers assumed the whole payment (3%).	**Eligibility:** Employers and independent workers who reported mandatory pension payments in the GEIH. For simplicity it is assumed that every employer accepts the aid. **Amount:** Pension mandatory payments rates, based on a Basic Income Contribution, were modified from 4% to 0,75% for employees, and from 16% to 3% for independent workers. Rates for employers changed from 12% to 2.25%.	National
Unemployment subsidy	The Colombian government extended benefits and coverage of the unemployment subsidy known as "mecanismo de protección al cesante". This subsidy, managed by Family Compensation Fund, gives a cash transfer equivalent to two SMMLV[16], distributed in a period of three months. Beneficiaries are those formal workers who made their payments to this private firms for 5 years. This benefit also takes into account health and pensions, keeping payments on a base of 1 SMMLV.	**Eligibility:** Workers contributing to pension (as an approximation of private social security) and simultaneously are simulated to lose the job they had for the last 12 months. **Amount:** 585.202COP monthly per eligible worker.	National

Besides programs and bonuses described in Table 2, an additional policy was simulated:

Tax on high salaries' government officials and high pensions

Policy features

Government officials or pensioners with monthly incomes higher than 10 million must pay a solidarity tax *Impuesto Solidario* according to the next table:

Table 3 Impuesto Solidario

Salary in COP		Gross rate
Greater or equal to:	**Not greater than:**	
10,000,000 COP	12,500,000 COP	15%
12,500,000 COP	15,000,000 COP	16%
15,000,000 COP	20,000,000 COP	17%
20,000,000 COP		20%

Source: Decree Nº558, April 15th, 2020. Ministry of Labour.

Policy simulation

Eligibility: Income information for government officials and pensioners is taken from GEIH.

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[16] Salario Mínimo Mensual Legal Vigente (Current Legal Monthly Minimum Wage)

Amount: In case income is located in any of these bands, the gross rate is applied to the bands amount after a discount of 1.8millon COP stablished by the Decree. (It is important to mention that the Decree does not mention a marginal rate)

4. Empirical Results

This section is composed of four parts. In the first one we present the effect of the lockdown measures on the employment levels under the two proposed scenarios. In the second part we focus on the simulated income changes and on some development indicators based on this variable. In the third we analyse the results from the tax-benefit system perspective. In the fourth and last section we analyse the effect of changing all the new policies with one fixed-amount transfer to each affected worker.

4.1 Labour market effects

Table 4 shows for every economic sector the number of workers affected by the lockdown and by the scenarios that were explained in the previous section. The pessimistic scenario shows a 9.6 million jobs losses, whereas a 6.4 million job losses is expected in the moderate scenario. Constructions, tourism, restaurants, and domestic cleaning services are the hardest-hit sectors in both scenarios.

Table 4. Workers affected by the lockdown, by sector and scenario (millions of workers and as percentage of each sector.

Economic Sector	Pessimistic scenario				Moderate scenario		
	Non-affected workers	Affected workers	Total		Non-affected workers	Affected workers	Total
Agriculture	3.6 (100%)	0.0 (0%)	3.6 (100%)		3.6 (100%)	0.0 (0%)	3.6 (100%)
Mining	0.0 (0%)	0.2 (100%)	0.2 (100%)		0.1 (59%)	0.1 (41%)	0.2 (100%)
Manufacturing	0.9 (34%)	1.7 (66%)	2.6 (100%)		1.7 (64%)	0.9 (36%)	2.6 (100%)
Water supply, electricity, gas	0.1 (100%)	0.0 (0%)	0.1 (100%)		0.1 (100%)	0.0 (0%)	0.1 (100%)
Construction	0.0 (0%)	1.5 (100%)	1.5 (100%)		0.6 (37%)	1.0 (63%)	1.5 (100%)
Wholesale and retail trade	2.7 (60%)	1.8 (40%)	4.5 (100%)		3.2 (71%)	1.3 (29%)	4.5 (100%)
Accommodation and food service activities	0.0 (0%)	1.6 (100%)	1.6 (100%)		0.4 (27%)	1.2 (73%)	1.6 (100%)
Transportation, storage, information, and communication	1.0 (59%)	0.7 (41%)	1.8 (100%)		1.1 (65%)	0.6 (35%)	1.8 (100%)
Financial and insurance activities	0.3 (100%)	0.0 (0%)	0.3 (100%)		0.3 (100%)	0.0 (0%)	0.3 (100%)
Real estate, professional and technical activities	1.3 (80%)	0.3 (21%)	1.7 (100%)		1.6 (96%)	0.1 (4%)	1.7 (100%)
Public administration	0.7 (100%)	0.0 (0%)	0.7 (100%)		0.7 (100%)	0.0 (0%)	0.7 (100%)
Education	0.9 (100%)	0.0 (0%)	0.9 (100%)		0.9 (100%)	0.0 (0%)	0.9 (100%)
Health services	1.0 (100%)	0.0 (0%)	1.0 (100%)		1.0 (100%)	0.0 (0%)	1.0 (100%)
Other services	0.2 (16%)	1.0 (84%)	1.2 (100%)		0.1 (45%)	0.7 (55%)	1.2 (100%)
Domestic cleaning services	0.0 (0%)	0.7 (100%)	0.7 (100%)		0.1 (14%)	0.6 (86%)	0.7 (100%)
Others	0.0 (100%)	0.0 (0%)	0.0 (100%)		0.0 (100%)	0.0 (0%)	0.0 (100%)
Total	12.7 (57%)	9.6 (43%)	22.3 (100%)		15.9 (71%)	6.4 (29%)	22.3 (100%)

Source: Authors' calculations based on GEIH 2019. The table includes domestic cleaners and pensioners.

Previous estimations about the effect of the lockdown on employment used the data from GEIH 2019 and considered similar criteria as the ones used in this simulation. The document from CEDE (2020a) considered the sectors allowed to operate, informality, and firms' size to determine which jobs were vulnerable. Besides the above criteria, Fernandez (2020) added characteristics such as type of contract and being able

to telework. This last characteristic was measured considering some occupational groups such as professionals, directors, and administrative workers. Jarramillo et al. (2020) considered the economic sector and workplace. Sánchez and Hernández (2020) take into account informality, workplace, and economic sector. Aggregate estimations about unemployment rate and the percentage of job losses were identified in the articles of Mejía (2020) and IDB (2020). However, estimations do not show at a disaggregated level which sectors or which workers' characteristics were at risk.

It should be noted that our simulations are not including potential job losses in sectors with permission to operate but with less revenues due to lower aggregate demand. Additionally, some firms are temporally suspending contracts, which means that employees keep their contracts, but they do not receive any income during this period. Another remark regarding the assumptions is that the simulation does not include the reopening of construction and industry sectors that started at the end of April (decree 593/2020).

Figure 1 shows the percentage of job losses by disposable income decile and scenario. The blue bars represent the share of affected workers in the pessimistic scenario and the red bars the share in the moderate scenario, which we consider more realistic.

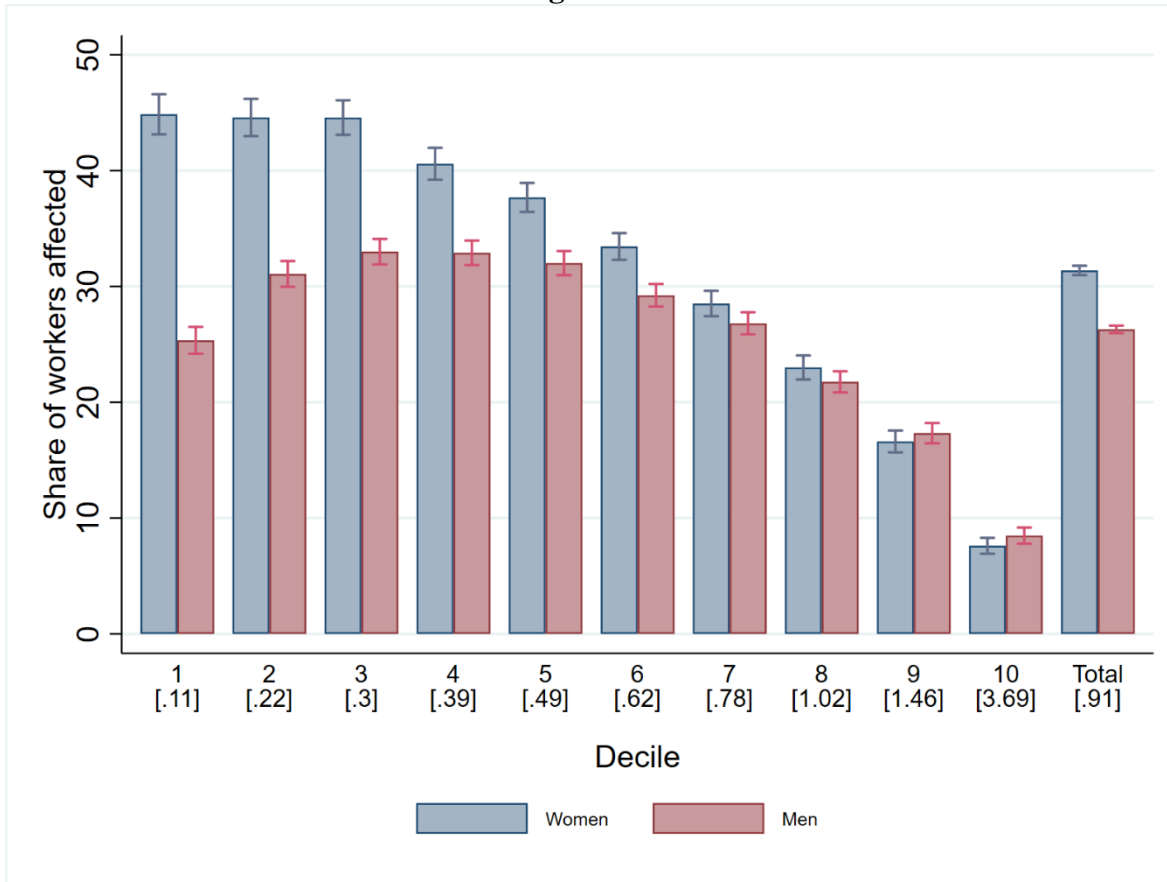**Figure 1. Share of affected workers by disposable income decile**
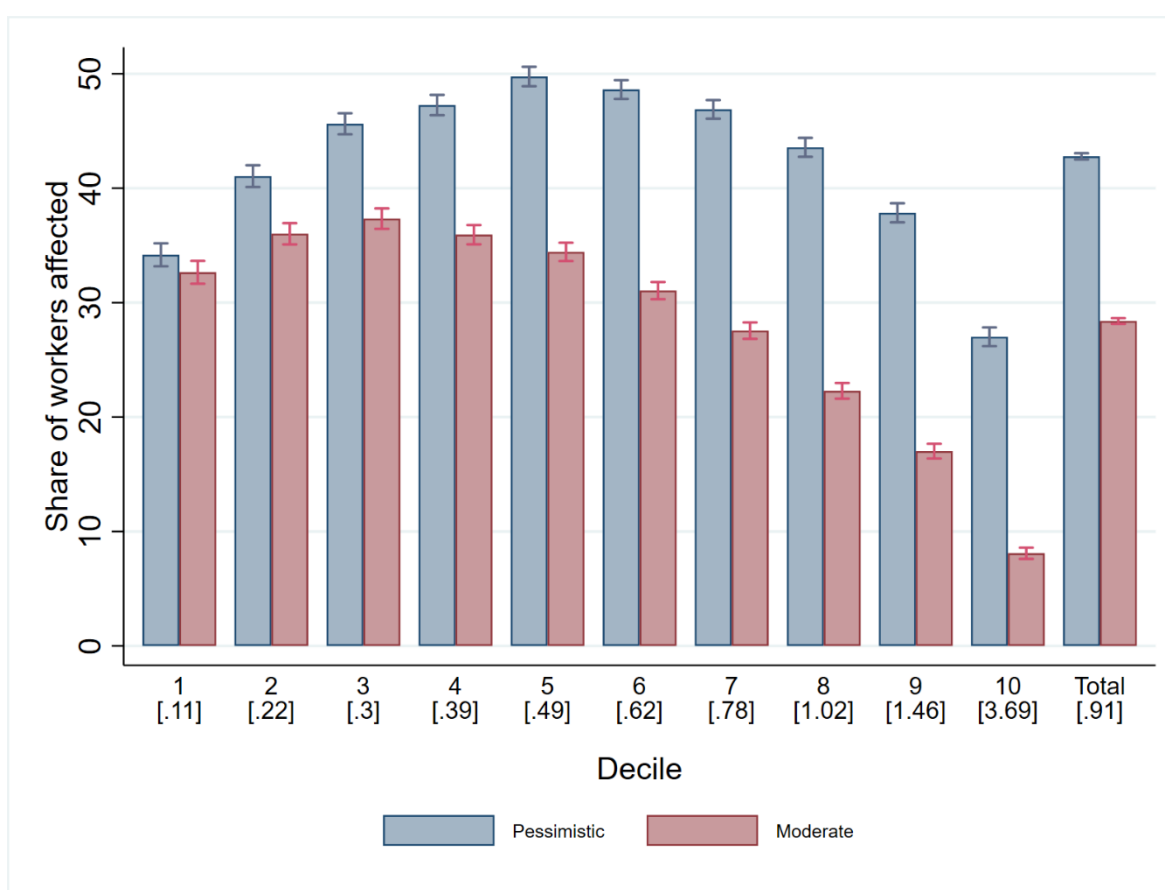
Source: Authors' calculations based on GEIH 2019 and COLMOD. Deciles of disposable income before COVID-19, household per capita income in squared brackets. 95% confidence interval.

In the pessimistic scenario, which assumes that workers in non-operating activities and street vendors lose their jobs, the share of affected jobs is 42.7% at the aggregate level. Deciles 5 to 7 (households with $500 thousands and $800 thousands income per person) have higher job losses, since around 46% lost their jobs. However, the moderate scenario, which considers contracts' term and type of occupation, registers a 28.4%

of job losses. However, this scenario affects mostly lower-income households: decile 2nd to 4th lost around 35% of their jobs, the first decile 32.6% and the last decile just 8.1%.

Figure 2. Share of affected workers in the moderate scenario by disposable income decile and gender

Source: Authors' calculations based on GEIH 2019 and COLMOD Deciles of disposable income before COVID-19, household per capita income in squared brackets. 95% confidence interval.

Gender inequalities at the labour market are exacerbated with lockdown's restrictions. Women have more precarious working conditions, and a higher proportion is employed at the hardest-hit sectors such as retail sale, tourism, restaurants, and domestic cleaning services. Those differences are more striking for women at the bottom of the income distribution, Figure 2 shows how 44.9% of women in the first decile lose their jobs, compared to 25.3% for men. As income is higher, differences between women and men diminish, but the percentage of job losses is higher for women. Deciles nine and ten show an opposite trend, a higher share of men lose their jobs. Nevertheless, the shares do not differ significantly between both genders. At the aggregate level, 31.4% women lose their jobs, and this share is 26.3% for men.

4.2 Changes in income and development indicators

Table 5 presents some poverty and inequality indicators for all the simulated scenarios. The income variable used is the household disposable income per-capita. For the poverty measurement we construct poverty and extreme poverty lines for April 2020 by adjusting the national lines for 2018 (the last year with available

information) with the CPI for low income households.[17] In the Table, column 2 represents the baseline, columns 3 and 4 represent the earnings loss without the new policies, columns 5 and 6 refer to the two employment loss scenarios but taking into account the new policies and lastly, columns 7 and 8 refer to the replacement of all new policies with a fixed amount transfer corresponding to $80,000 Colombian pesos to every person affected by the lockdown assuming the government has the information to reach each one of them. We can see that in any case the lockdown has an important negative effect on the selected poverty and inequality indicators.

Focusing on the moderate scenario, we found that the Gini coefficient would rise from 50.36 in the baseline scenario to 57.33. Government policies reduce this figure by less than 2pp. These results are observed because in the moderate scenario, higher deciles are not as affected as deciles 2nd to 4th.

Table 5. Poverty and inequality in the simulated scenarios

Indicator	Baseline	Lockdown without new policies		Lockdown with new policies		Lockdown with hypothetical policies	
		Pessimistic	Moderate	Pessimistic	Moderate	Pessimistic	Moderate
Inequality							
Gini	50.36	60.35	57.33	58.34	55.53	58.05	55.91
Atkinson 0.5	20.97	28.37	25.86	27.21	24.89	27.89	25.97
Atkinson 1	36.41	49.04	45.42	47.15	43.95	47.63	45.30
Atkinson 2	65.4	90.46	88.46	78.66	72.69	74.59	74.43
p90/p10	9.74	29.23	21.64	21.50	17.38	17.69	17.02
p90/p50	3.17	4.19	3.8	4.0	3.65	4.02	3.71
p50/p10	3.08	6.98	5.70	5.37	4.76	4.39	4.59
Poverty							
FGT0	26.57	47.74	38.87	45.06	36.14	45.75	37.51
FGT1	9.97	26.59	20.28	23.52	17.74	22.97	17.95
FGT2	5.33	19.07	14.12	15.97	11.71	14.73	11.34
Extreme poverty							
FGT0	6.84	25.27	18.42	21.99	15.74	21.64	16.19
FGT1	2.43	14.17	10.16	11.05	7.85	9.31	7.07
FGT2	1.31	10.53	7.59	7.58	5.42	5.36	4.17

Source: Authors' calculations based on GEIH 2019 and COLMOD. The income variable used is the household per capita disposable income.

The Atkinson index main feature is the explicit weighting of the individual's position in the income distribution by means of the inequality aversion parameter. The coefficient value goes from 0 (maximum equality) to 100 (maximum inequality). If the weighting for the bottom part of the distribution is low (Atkinson 0.5), inequality in the base scenario (20.97) increases by 5pp. Government intervention reduces this figure by 1pp. Assuming the coefficient is more sensitive to differences at the bottom of the distribution (Atkinson 2), initial inequality is already high in the base scenario (65.4) and increases around 23pp with the lockdown and in the absence of policies. Government programs reduce this Atkinson index significantly, by 16pp. This result is explained because a higher weighting to the lower part of the distribution means that transfers aimed to the most vulnerable have a greater impact on the index.

Regarding to the ratios p90/p10, p90/p50 and p50/p10, in the baseline scenario, the 90th income percentile is almost 10 times higher than the 10th. Due to the lockdown, the income for the first group would be 21 times the second one. The government intervention would imply a modest reduction, the 90th income percentile would be 17 times greater than the 10th percentile. These results arise because initial inequality in

Colombia is already high and the employment loss caused by the economic crisis affected mostly workers at the bottom of the income distribution. Other ratios are not as dramatically affected as this one.

In terms of monetary poverty, the poverty incidence or headcount ratio (FGT0), which measures the percentage of the population with a household per capita income below the abovementioned poverty line, would rise by 12pp approximately in comparison to the baseline scenario. Government transfers would reduce this number by 3pp. The poverty gap (FGT1), that measures how much a person needs to leave poverty, would increase by 10pp compared to the baseline, and government intervention would reduce this figure by less than 3pp. The severity of poverty (FGT2), which measures how intense is the poverty gap giving a higher weight to the poorest, would rise 9pp with the lockdown and to 7pp after public transfers. Regarding extreme poverty, in comparison to the base scenario, FGT0 increases by 12pp, FGT1 by 8pp and FGT2 by 7pp. Government social programs reduce these figures by 3pp, 2pp and 2pp, respectively. Results presented in Table 5 indicate government intervention does not offset completely the negative effects that the quarantine has on poverty and inequality.

For the remainder of the section our analysis focuses on the moderate employment loss with and without the new policies. Figure 3 presents the mean net replacement rate for each pre-COVID-19 disposable income decile. This indicator is defined as:

$$NRR_i = \frac{Y_i^{After}}{Y_i^{Before}} \tag{2}$$

Where i is each household, Y_i^{Before} and Y_i^{After} stand for the disposable income before and after COVID-19, respectively.

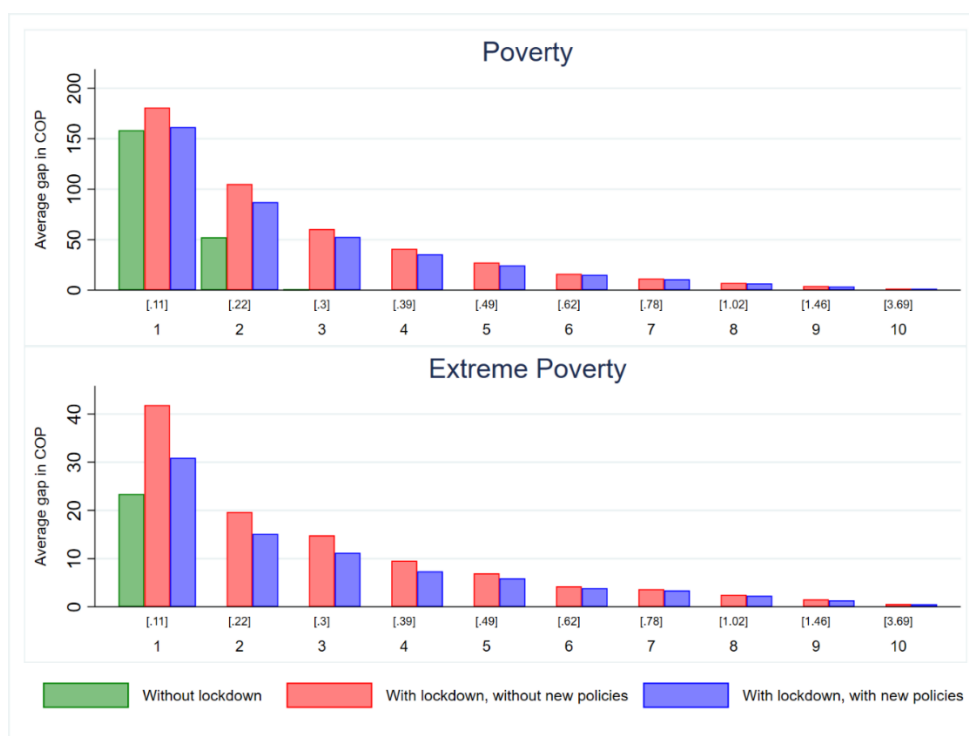**Figure 3. Net replacement rate by baseline disposable income decile**
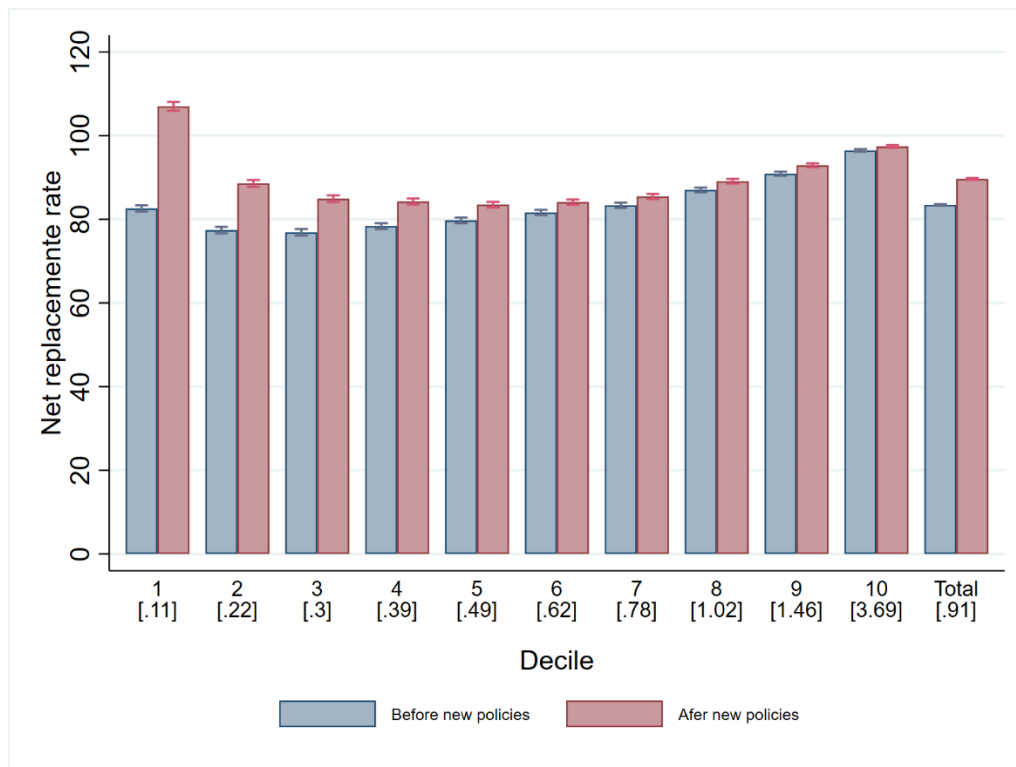
Source: Authors' calculations based on GEIH 2019 and COLMOD Deciles of disposable income before COVID-19, household per capita income in squared brackets. 95% confidence interval for the NRR.

Considering that the NRR indicator is sensible to low initial disposable incomes we drop the highest 1% of the NRR in the first decile for the scenario that includes the policies.

We observe that the NRR without the new policies varies from 76.8% for the third decile to 96.4% for the tenth decile. Introducing the new policies, the NRR improves for all deciles but especially for the first one that would reach on average a disposable income 7% higher than before the pandemic as a result of the targeting of the new transfers and the relatively lower employment loss. The second to fifth decile are the ones most affected by the pandemic and could see NRR between 84% and 88% after the new policies, that is the NRR for these deciles would increase between 6th and 11th pp from the scenario without new policies. Lastly, deciles 8th to 10th are the least affected by the pandemic and would see their disposable incomes increase less than 4pp with the new policies. A combination of lower market incomes, higher income tax and lower pension contributions imply that this group would receive around 90% of their pre COVID-19 disposable income. Summarizing, the new policies increase the disposable income of households along the entire income distribution but benefits much more those households on extreme and moderate poverty and to a lesser extent the vulnerable population.

In aggregate terms, without the introduction of the new policies, the disposable income loss reaches $4.1 billion of Colombian pesos per month or 16.5% of the baseline disposable income. With the introduction of the policies the loss is reduced to $3.3 billion of Colombian pesos or 10.4% of the baseline disposable income of all households.

Figure 4. Average poverty gap by income deciles (thousands of COP)

Source: Authors' calculations based on GEIH 2019 and COLMOD Deciles of disposable income before COVID-19, household per capita income in squared brackets.

Figure 4 presents poverty and extreme poverty gaps for the different scenarios analysed. For instance, in the baseline scenario (green coloured bar) the first decile needs, on average, 158,000COP in order to leave extreme poverty and the second decile only 50,000COP. When the lockdown is taken into account, the gap dramatically increases for the second decile, with a new gap of more than 105,000COP. Government

intervention offsets on average the income losses suffered by the first decile, but that is not the case for the second one, for which the poverty gap is 87,000COP after the new policies, that is an additional 35,000COP compared to the baseline scenario.

The first decile has an extreme poverty gap of 23,000COP in the baseline scenario, 40,000COP under the lockdown and 31,000COP after public transfers. For deciles 2 and 3, these figures are 20,000COP and 15,000COP with the quarantine and government intervention reduces these numbers to 15,000COP and 11,000COP, respectively. After the shock extreme poverty initially observed only for the first decile ends up affecting every single decile of the baseline disposable income distribution.

Precarious employment is a relevant factor that can define households' income security when a negative economic shock hits their livelihoods. Having a labour contract and being part of social security system allows households to cope the income shock during this period more easily. Therefore, prevalence of informality in the Colombian labour market implies that a high percentage of population has a high vulnerability level.

Table 6 Household simulated transitions between different income categories
Total and by formality status of the household
Total

	Extremely poor	Moderately poor	Vulnerable	Not Vulnerable	Total (mill.)
Extremely poor	76%	24%	0%	0%	0.8
Moderately poor	23%	65%	12%	0%	2.3
Vulnerable	12%	13%	73%	2%	4.9
Not Vulnerable	4%	2%	9%	85%	6.9
Total (mill.)	2.0	2.5	4.4	6.0	14.9

No formal workers in the household

	Extremely poor	Moderately poor	Vulnerable	Not Vulnerable	Total (mill.)
Extremely poor	77%	23%	0%	0%	0.8
Moderately poor	25%	65%	10%	0%	2.1
Vulnerable	18%	16%	65%	1%	3.1
Not Vulnerable	8%	5%	11%	76%	2.7
Total (mill.)	1.9	2.2	2.5	2.1	8.7

At least one formal worker in the household

|	Extremely poor	Moderately poor	Vulnerable	Not Vulnerable	Total (mill.)
Extremely poor	46%	48%	5%	1%	0.0
Moderately poor	7%	63%	30%	0%	0.2
Vulnerable	2%	7%	87%	4%	1.8
Not Vulnerable	0%	1%	7%	92%	4.2
Total (mill.)	0.1	0.3	1.9	3.9	6.2

Source: Authors' calculations based on GEIH 2019 and COLMOD. Informality is defined as non-contribution to pension.

Among households with no formal workers, 34% of those vulnerable turn into moderately or extremely poor, and 24% of non-vulnerable households lose this condition under the lockdown and government measures scenario. Whereas for households with at least one formal worker, 9% of those vulnerable worsened their conditions and 92% of non-vulnerable households keep their condition under the new scenario.

4.3 The role of the tax and transfer system

The share of the different components of the tax and transfer system in the disposable income of each household can be seen in Figure 5. The figure presents for each of the household income deciles (before the virus) three scenarios: the first corresponds to the share of each instrument before the pandemic (baseline scenario), the second corresponds to the share of each instrument with the lockdown, but without the introduction of new policies. The third corresponds to the share of each instrument including the new elements of the tax and transfers system. Note that in this case the share of each instrument is relative to the disposable income of each scenario.

Figure 5. Share of the components of the tax and transfer systems in the scenarios: baseline and of lockdown with and without policies.
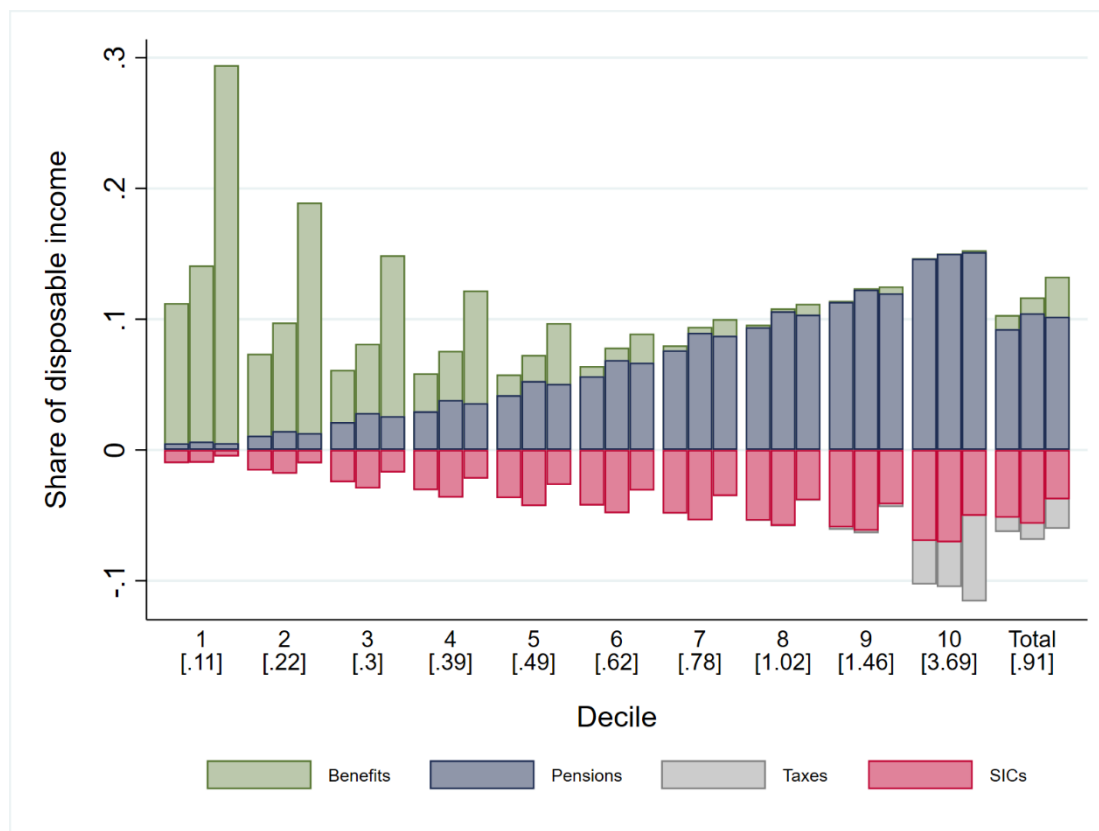
Source: Authors' calculations based on GEIH 2019 and COLMOD Deciles of disposable income before COVID-19, household per capita income in squared brackets.

In the baseline scenario we can observe that the cash transfers represented a little over 10% of the household disposable income in the first decile. The share of transfers decreases as it moves toward the top of the income distribution. Conversely, the share of pensions (which are not simulated but taken from the GEIH) is increasing in household income reaching 14.6% of the disposable income for 10% of households with higher incomes. The share of contribution to social security of employees and self-employed, as well as income tax are also increasing in the households' disposable income. Since the social security contribution rates do not depend on income (with the exception of payments to the *Fondo de Solidaridad Pensional*),

the result for the baseline scenario is due to the fact that formal jobs (that is, those that pay contributions) are more abundant in the upper deciles. Lastly, income tax only becomes important for households in the last decile of disposable income representing only 3.3 of the disposable income for this group in the baseline scenario.

The loss of jobs caused by the pandemic makes the share of cash transfers and pensions in disposable income to increase due to the fall in labour income. For the social security contributions, the effect is relatively lower given that the loss of jobs removes the contributions for a percentage of workers. Since the last decile of income was relatively unaffected, the share of the income tax only increased by 0.1 pp.

The introduction of policies has two effects: the disposable income from most of the population increases which mechanically reduces the share of the tax and transfer instruments. At the same time the relative importance of each instrument is altered. In this scenario we can observe that the introduction to the " VAT refund", *Ingreso Solidario* and the other local programs drastically increase the share of the transfers in the household disposable income for the first five deciles, reaching a value of 28.5% for the first decile and 4.5 % for the fifth decile. The reduction in the payment of the social security contributions represents between 1 and 2 percent in savings for households from the third decile to the tenth. Finally, the taxes for high pensions allowances and public workers with high salaries increase the share of the income tax up to 6.5 for the tenth decile.

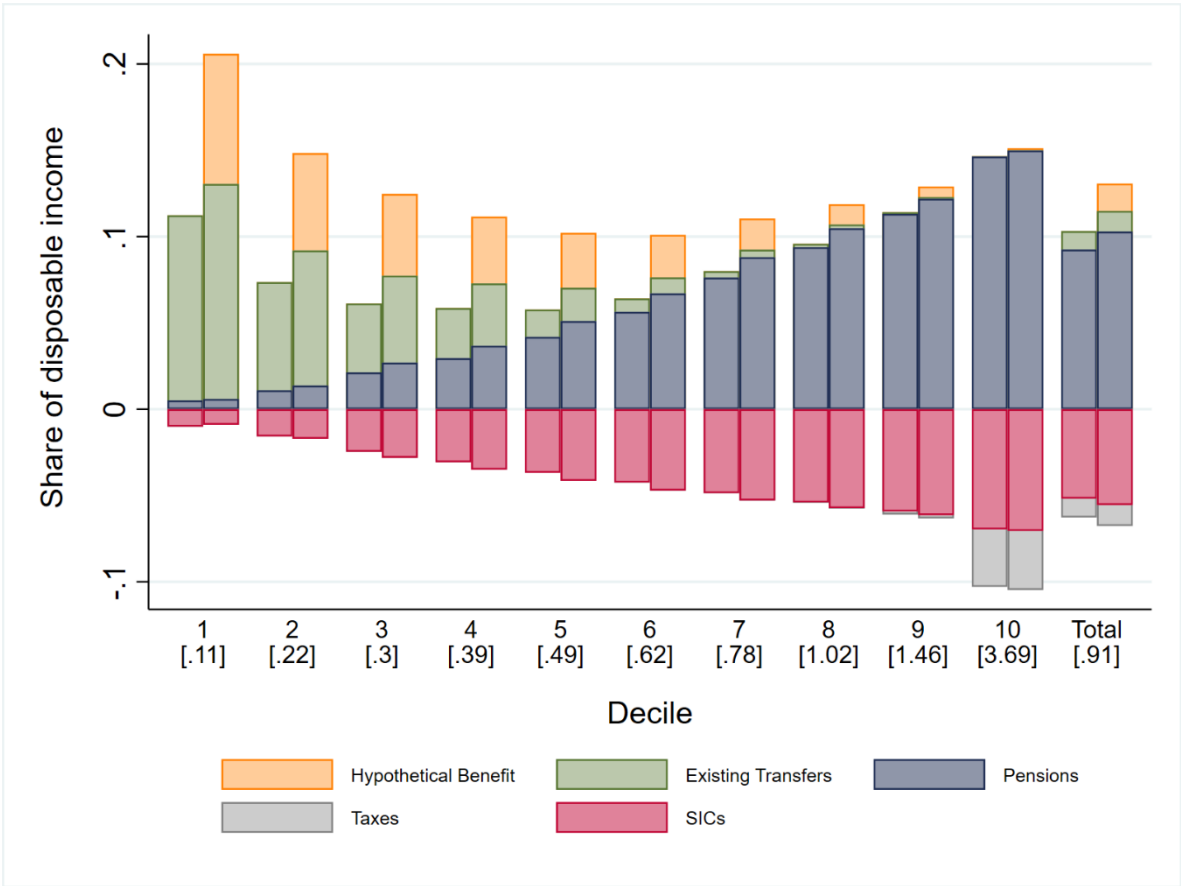**Figure 6. Share of the new component of the tax and transfer system in the new disposable income**
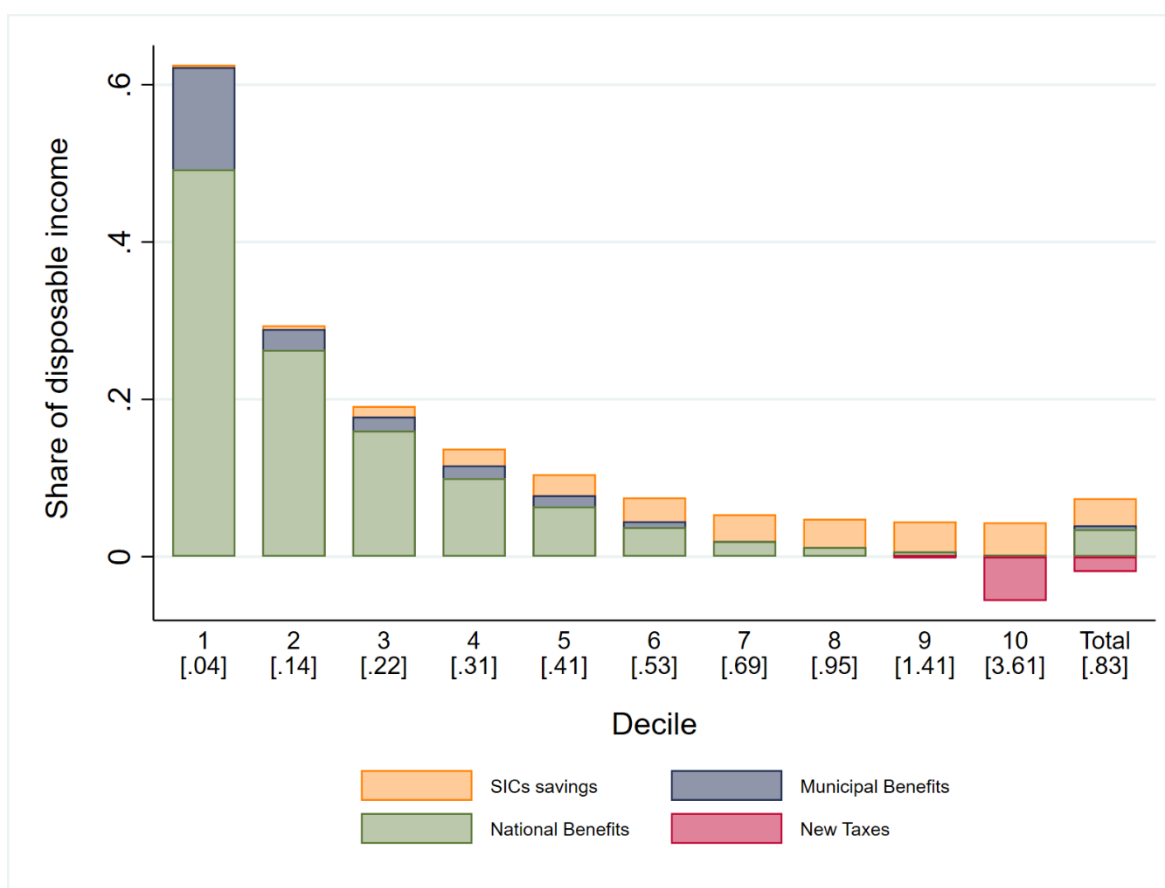
Source: Authors' calculations based on GEIH 2019 and COLMOD Deciles of disposable income **after** COVID-19 and **including** new policies, household per capita income in squared brackets.

Figure 6 shows an analysis of the new components of the tax and transfer system, in this case allowing reordering of the households in deciles of disposable income after lockdown and new policies. We can observe that the new average per capita income of all the deciles will be lower. Especially, the first and second decile reduce their average income per capita from 110,000COP to 40,000COP and from 220,000COP to 140,000COP, respectively. The new most important component is the set of new transfers. They represent 3.4% of the disposable income of all the households, but 50.1% of the income of the households now in extreme poverty in the first decile. National transfers are followed in order of importance by: savings from the reduction in social security contribution rates, the new income tax and the transfer program from local governments; they represent 4%, 1.9% and 0.4% of the disposable income respectively.

4.4 Hypothetical scenario: only one cash transfer

The hypothetical scenario supposes that the government can identify each worker that lost his job irrespective of his income level or condition of formality and make him a transfer of 80,000COP. The idea is to capture the effects that having a precise information system about the employment loss (as it is currently the case in developed countries) has over the distribution. Unlike unemployment insurance whose amount is proportional to the previous labour income and which seeks that the loss of income is not transferred 1 to 1 in a fall in consumption, here we consider a fixed transfer for the same amount of the program *Ingreso Solidario* established by the government. For this reason, the transfer seeks to avoid households that lost their income to fall in extreme poverty, however it does not avoid disposable income to vary significantly.

Figure 7. Share of the new components of the tax and transfer system in the new disposable income

Source: Authors' calculations based on GEIH 2019 and COLMOD. Deciles of disposable income before COVID-19, household per capita income in squared brackets.

In Table 6 presented before, we can see that this hypothetical policy has slightly lower effects on poverty and inequality in comparison to the policies that were actually introduced. In contrast, the incidence of extreme poverty would be between 1 and 2 pp above what was found with the policies that were implemented. In Figure 7, we can see for each income decile before the pandemic, two scenarios: the first corresponds to the baseline scenario and the second to the one in which the pandemic is faced with a single transfer. The share of the fixed transfer represents around 7.5% of the income and its incidence declines until it is less than 1% of the disposable income of the ninth and tenth deciles. At the same time the transfer increases around 100% the share of the cash transfers other than pensions in the disposable income of the household.

Lastly, in aggregate terms the fixed transfer represents, on average 1.5% of the household disposable income and it would have fiscal cost estimated at 0.5 billion, less than the 0.8 billion of the programs introduced by the government.

5. Conclusions

Faced with an aggregate shock in household income as the one caused by COVID-19, the tax and transfer system contributes to reduce the negative effects through the so-called automatic stabilizers. Nevertheless, these automatic transfers might not be enough for the households, as it was evidenced by the complementary packages introduces in developed countries.

In Colombia we do not have proper "automatic stabilizers" and the effect of the emergency policies introduced, primarily protected the income and quality of life of poor and extremely poor households. The vulnerable, but not poor, population benefits marginally from the changes in the unemployment benefits (which becomes a monetary payment rather than in-kind during the emergency period) and mainly from savings of social security contributions in pensions. However, we found that even after the policies were implemented, their disposable income would only represent 84% of their income before the pandemic.

This necessarily translates into a notorious worsening of poverty and inequality indicators, especially due to a significant movement of households from vulnerable to poor, while in the highest deciles of disposable income the impact is lower in both jobs and income. Specific groups in the population are also disadvantaged in a greater proportion, such is the case for women and households without any member in the formal labour market.

Although is true that high informality in Colombia prevents the development of effective automatic stabilizers, this could represent a window of opportunity to advance towards their creation in a discussion of how it looks like the tax and transfer system that the country needs.

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Annex 1

***Familias en Acción* and Jóvenes en Acción Imputation**

The estimation of probit models to determine additional beneficiaries to these programmes include the following variables: dummies for income decile, and the twelve variable that determine the Quality of Live Index ICV in Spanish).

The SISBEN proxy

The CONPES document 3877/2016 establishes the methodology for the SISBEN IV used for the allocation of the conditional cash transfer programmes in Colombia.

In this document the government sets a methodology change from SISBEN III which focuses exclusively on the household quality of life to an index focusing on the household abilities to generate income.

The new methodology takes the household per capita income as reported in the GEIH (y_i) and uses a battery of demographic, labour, dwelling, asset, and health variables (X_i vector) to estimate the quantile regression in equation A1:

$$\ln(y_i) = X_i\beta + u_i \qquad\qquad A1$$

The coefficient vector β obtained from the GEIH allows to make a prediction of income with the information covered in the SISBEN database. Using this prediction, the SISBEN IV index is obtained by dividing the country in the 64 geographical zones resulting from dividing each Department (State) into rural and urban areas and obtaining percentiles of income for each one. This percentile represents the SISBEN IV score.

SISBEN in the Simulation

For our exercise we create the SISBEN score as follows:

1) We take the household per capita income resulting from adding labour and non-labour income (in COLMOD it consists of market income and pensions)

2) For each of the 24 GEIH departments included in the GEIH[18] we divide the population between urban and rural (we exclude Bogotá).

3) We place each household in the income percentile of its geographical zone.

4) We sort each observation according to this percentile and in cases of ties according to the income.

5) We accumulate the sorted population until we reach the totals of each group presented in Table A1

Table A1. SISBEN IV classification

Group	Population	%
A	4.620.949	23.2
B	6.970.163	43.4
C	5.812.900	34.9
D	2.529.287	9.6
Total	**19.933.299**	**100,0**

Source: DNP (2020).

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[18] Here is important to notice that, at the moment of making this exercise we do not have the GEIH for the so called "new departments".

Tabla A2. Cost/Revenue and Beneficiaries/Taxpayers for the different programs introduced by the government

Program	Simulation	
	Ammount (monthly, billion)	**Beneficiaries/Taxpayers (millions)**
Familias en Acción	0.19	2.58
Colombia Mayor	0.10	1.22
Jóvenes en Acción	0.01	0.10
Devolución IVA	0.04	0.90
Ingreso Solidario	0.09	1.18
Bogotá Solidaria	0.05	0.50
Medellín me Cuida	0.02	0.20
Barranquilla Solidaria	0.00	0.09
Cali Seguridad Alimentaria	0.00	0.04
Impuesto de emergencia	0.31	0.11
Subsidio al desempleo	0.10	0.17
Cotizaciones Empleados	0.38	6.82
Cotizaciones Empleadores	1.13	6.82
Cotizaciones Independientes	0.18	1.05

Source: Own calculations bases on GEIH 2019 and COLMOD, monthly values.

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