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Abstract

This paper aims to assess the role of tax-benefit policies in mitigating the effects of the COVID-19 crisis on the distribution of household disposable income in Colombia, Ecuador and Peru. Tax-benefit microsimulation and nowcasting techniques are used to adjust 2019 microdata to reflect the labour market and earnings situation observed in official labour force surveys collected during the pandemic. Our results show a sharp drop in household disposable income and a dramatic increase in poverty and inequality during the second quarter of 2020, with the national poverty headcount increasing by 73% in Colombia and more than doubling in Ecuador and Peru. By the end of 2020, the economy recovers but poverty and inequality remain above the pre-pandemic levels. COVID-related policies cushion the effect of the crisis at the bottom of the distribution, and their effect on poverty and inequality largely depends on the generosity of the benefits

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implemented. By contrast, automatic stabilisers mitigate the impact of the income shock at the top of the distribution due to the effect of social insurance contributions and personal income tax, whereas social assistance programmes in place before the pandemic fail to act as automatic stabilisers due to their design as proxy means-tested benefits.

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1. Introduction

The COVID-19 pandemic has resulted in an international crisis with large socioeconomic effects. According to projections from the Economic Commission for Latin America and the Caribbean (ECLAC), by the end of 2020 poverty could have increased on average by 4.4 percentage points (pp) from 30.3% to 34.7% and extreme poverty by 2.5 pp from 11% to 13.5% which translates to an increase of 22 million persons in poverty compared with 2019 (ECLAC 2020). The income loss was highly unequal, and therefore the pandemic was expected to increase the Gini coefficient by around 5.6% above what was registered in 2019. The pandemic also brought a significant deterioration of labour market indicators in 2020: unemployment rates climbed 2.5 pp on average, while the occupation and participation rates decreased by 10 and 9.5 pp, respectively (ECLAC 2021).

The pandemic has highlighted the lack of a safety net for vulnerable populations in the event of negative income shocks. As a result, governments in the region have implemented a variety of policies to mitigate the impact of the crisis, but with important differences in coverage and generosity (ECLAC 2021). For these reasons, it is essential to provide evidence on the effectiveness of government interventions to alleviate the economic impact of COVID-19 and on possible reforms to current social protection programs to ensure a sustainable and adequate social welfare systems in the long-term in each country.

The aim of this paper is to assess, from a comparative perspective, the role of tax-benefit policies in mitigating the effects of the COVID-19 crisis on the distribution of household disposable income in three Andean countries: Colombia, Ecuador and Peru. Prior to the pandemic, these countries were characterised by limited fiscal capacity, low spending in social protection and higher levels of poverty and inequality compared to other countries in the region, making them more likely to suffer more from the COVID crisis.[2] Our analysis compares changes in household disposable incomes between December 2019 and the second quarter of 2020, when the three economies were hit the hardest. To capture the recovery experienced in each country, we also estimate results for the last quarter of 2020. Considering the difficulties of obtaining detailed income information for these periods due to limitations in data collection during the lockdowns in each country, our COVID datasets (second and fourth quarter of 2020) are created using nowcasting techniques to adjust labour market and earnings information in 2019 household survey data to match the available information for 2020. Then, we use harmonized tax-benefit microsimulation models for the three countries, and decompose changes in household disposable income into the effects of: (i) earnings losses due to COVID-19, (ii) pre-crisis tax-benefit policies (i.e. automatic stabilisers), and (iii) COVID-related tax-benefit measures implemented by the governments.

Our results show a sharp drop in mean household disposable income during the second quarter of 2020 compared to December 2019, representing a 25.7% decrease in Colombia, 43% in

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[2] Government spending in social protection in 2018 represented 5.5% of GDP in Colombia, 2.5% of in Ecuador and 2.9% in Peru, compared to 4.1% of GDP on average in Latin America, which remains low compared to 12% of GDP in OECD countries (ECLAC 2021). In terms of taxes, the average tax-to-GDP ratio in 2019 was 19.7% in Colombia, 20.1% in Ecuador and 16.6% in Peru, which is below the 22.9% average in Latin America, which in turn remains substantially low compared to 33.8% in the OECD (OECD et al. 2021).

Ecuador and 49.3% in Peru. By the end of 2020, the economy slightly recovered, which translated into smaller drops in household income of 11.8% in Colombia, 18.2% in Ecuador and 21.9% in Peru, compared to December 2019. Our decomposition shows that COVID-related policies cushion the effect of the crisis at the bottom of the distribution, although to different extents across countries depending on the generosity of the emergency cash transfers, with the largest effect observed in Peru during the second quarter of 2020. As emergency transfers were targeted to poor households (mainly those in the first decile) they failed to provide income protection to household in the middle of the income distribution, who were the most affected by the crisis. Moreover, despite the protection provided by the emergency policies to poor households, only Colombia maintained them throughout the year. Automatic stabilisers also play a role by cushioning the income shock at the top of the distribution due to the effect of social insurance contributions and personal income tax. Poverty and inequality also rise sharply during the second quarter of 2020. The Gini coefficient increases by 0.07 points in Colombia, 0.133 points in Ecuador, and 0.126 points Peru. The poverty headcount increases by 19.3pp in Colombia, 34.5pp in Ecuador and 36.5pp in Peru. Poverty and inequality decrease by then end of 2020 but remain above the levels observed before the pandemic.

Our study contributes to the literature in two main respects. First, we complement the growing literature assessing the impact of the COVID-19 pandemic on household incomes in developing countries. In particular, we focus on three Latin American countries with limited fiscal capacity to expand social protection and provide evidence of the impact on poverty and inequality at the point when their economies were hit the hardest and by the end of the first year of the pandemic. Second, while most studies for Latin America focus on the role of expanded social protection in mitigating the impact of the COVID crisis, we use detailed tax-benefit models to consider also the role played by automatic stabilisers. Assessing the role of automatic stabilisers and COVID emergency transfers from a comparative angle allows discerning which type of policy interventions have been the most effective in cushioning the effect of the pandemic on household incomes in view of providing insights into potential pathways to reform tax-benefit policies to enhance social protection.

This paper is structured as follows. Section 2 provides a brief overview of the literature on the distributional effects of the COVID-19 pandemic. Section 3 discusses the main characteristics of tax-benefit systems in the countries under analysis. Section 4 introduces our methodology: the microsimulation models as of 2019 and the COVID-19 policies implemented for 2020, the data, the details of the nowcasting exercise and the framework used to decompose the distributional effects during the pandemic. Section 5 presents the main results of the analysis. Finally, Section 6 concludes.

2. An overview of the distributional effects of the COVID-19 pandemic

The COVID-19 pandemic has had a significant economic impact worldwide. Since the outbreak of the pandemic, several studies have focused on assessing its impact on the income distribution and the role of tax-benefit instruments in protecting households, especially in Europe and Latin America. In many cases, the lack of large household survey data covering the period of the pandemic (at the time of writing) has prompted the use of microsimulation techniques and different approaches to nowcast incomes, based for instance on information about economic

sectors shutdown by law, macroeconomic statistics, or adjusting household surveys prior to the pandemic with models estimated in (often limited) data collected during the pandemic.

For Europe, Figari and Fioro (2020) analyse the extent to which the Italian welfare system provided monetary compensation to people losing their jobs due to the pandemic in March of 2020. Through assigning people randomly to unemployment by economic sector to match aggregate data on occupation shares subject to shutdown by law and the use of the tax-benefit microsimulation model EUROMOD, they find that a fall of 32.7% in market income translates to a 11.8% fall in disposable income considering the tax-benefit policies in place prior to the pandemic and the emergency transfers enacted by the Italian government. Brewer and Tasseva (2020) take a similar approach for the United Kingdom, analysing how the UK policy response to COVID-19 affected household incomes between April and May of 2020. The authors use the tax-benefit microsimulation model UKMOD and household survey data collected during the pandemic to update labour market and earnings information in the (pre-COVID) reference survey used for the simulations. They find that the tax-benefit system in place prior to the pandemic would have been inadequate to ensure income protection to the UK population, whereas new policies implemented during the pandemic strengthened the safety net. Subsequently, other studies have performed similar analysis for specific countries (e.g. Beirne et al. 2020 and O'Donoghue et al. 2020 using sectoral statistics for Ireland; Bronka et al. 2020 using sectoral forecasting for the UK) or a set of EU countries (e.g. Canto-Sanchez et al. 2021 combining law-based and micro-based updating; Almeida et al. 2021 using macroeconomic projections and reweighting).

For Latin America, Brum and De Rosa (2020) nowcast poverty in Uruguay for the second quarter of 2020 based on household survey data prior to the pandemic updated with information on changes in formal employment and earnings from administrative data and forecasts of GDP contraction. Their findings show that the poverty rate grew more than 38% during the first trimester of the COVID-19 crisis and that cash transfers implemented by the government had a positive but limited effect in mitigating this poverty spike. Jara et al. (2021) for Ecuador and Huesca et al. (2021) for Mexico also nowcast the impact of the pandemic on the income distribution, using pre-COVID household survey data adjusted with information from households surveys collected during the pandemic. Their results show that average household disposables incomes dropped by 41% and 2%, the Gini coefficient increased by 13 and 4 percentage points, and poverty reached around 60% coming from 26% and 44%, in Ecuador and Mexico respectively. Corredor et al. (2021), Cuesta and Pico (2020) and Nuñez (2020) quantify the effects that lockdown measures and emergency policies had on the distribution of income in Colombia. The first study finds that 6.2 million of jobs were lost due to the lockdown, which translates into an average reduction in household disposable income of 16.5%. They also find that poverty and inequality indicators worsen markedly due to many vulnerable households becoming poor. Cuesta and Pico (2020) obtain similar results and suggest that a universal basic income program would be better suited to mitigate the increase in poverty. Nuñez (2020) finds that the effects of the COVID-19 shock on employment, income and poverty are devastating. Extreme poverty more than doubles and moderate poverty increases about 60%. Lastly, Lustig et al. (2021) compare the effect of the pandemic on household incomes in Argentina, Brazil, Colombia and Mexico. This study randomly assigns income losses within sectors deemed non-

essential, aligning these adjustments with macroeconomic estimates on per capita gross income. The authors find that expanded social assistance had significant effects in mitigating the impact of the economic shock in Brazil and Argentina, but only small effects in Colombia (whereas no emergency social assistance programmes were implemented in Mexico).

3. Tax-benefit policies before and during the pandemic in the countries under analysis

This section briefly reviews the pre-COVID tax-benefit systems present in December 2019 in Colombia, Ecuador, and Peru, and the policies implemented by national governments to mitigate the impact of the COVID-19 crisis. The review focuses on direct taxes, social insurance contributions, and cash transfers as our analysis will look at changes in household disposable income.

3.1. Tax-benefit systems prior to the pandemic (2019)

Table A1 in Appendix A presents a summary of the parameters of the employee social insurance contributions in the countries under analysis. In Colombia, contribution rates of 8% to 10% apply depending on employment income, whereas in Ecuador they vary (9.45% or 11.45%) depending on the sector of activity. In Peru, a single rate of 13% applies to employees affiliated to social security. In all countries, formal employees (i.e. employees affiliated to social security) need to pay social insurance contributions at least on the basis of the minimum wage, whereas maximum levels of payment (i.e. a ceiling) exist only in Colombia. Finally, employee social insurance contributions are deducted from labour income for the purpose of personal income tax payments in Colombia and Ecuador, but not in Peru.

In terms of self-employed social insurance contributions (Table A2 in Appendix A), contribution rates of 28.5% or 30.5% apply in Colombia depending on self-employment income, whereas a single rate of 20.6% applies in Ecuador. In Colombia, however, contribution rates apply only to 40% of self-employment gains. In Peru, fixed amounts between 0.15 and 0.23 times the minimum wage depending on age apply to self-employed health insurance contributions. In all countries except Peru, formal self-employed need to pay social insurance contributions at least on the basis of the minimum wage, whereas maximum levels of payment (i.e. a ceiling) exist only in Colombia. As it was the case for employees, self-employed social insurance contributions are deducted from labour income for the purpose of personal income tax payments in Colombia and Ecuador, but not in Peru.

Table A3 in Appendix A summarizes the main parameters of the personal income tax in the countries under analysis. The main differences that arise across countries relate to the level of the lowest and highest tax band limits. In all countries, a 0% tax rate applies to incomes below the lowest tax band limit. The lowest tax band is reached at incomes equivalent to 2.3 annualized minimum wages in Peru, whereas the exempted threshold is higher in Colombia, representing 3.8 annualized minimum wages. The top tax rates are similar across countries, ranging from 30% in Peru to 35% in Ecuador. However, the level of income at which these rates start being applied varies widely from 14.4 annualized minimum wages in Colombia, to 16.9 and 24.4 annualized minimum wages in Peru and Ecuador, respectively. Additionally, a number of tax deductions are

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available in the design of personal income tax in the countries under analysis, which are mostly composed of expenditures in health, housing and education.

Finally, Table A4 presents the characteristics of the main cash transfer programs in each country. In all countries, at least two population groups are targeted: families with children and elderly adults. Additionally, specific programmes are in place in Ecuador for individuals with disabilities and their carers. A common trait of social assistance programmes in the countries under analysis (and more generally in the region) is their design as proxy means-tested benefits, meaning that eligibility to the benefits is not assessed with respect to household income but with respect of a composite welfare index based on information about the dwelling and the household. As a result, the main social assistance programmes in place before the pandemic do not provide automatic protection in the event of economic shocks, i.e. do not act as automatic stabilisers. In terms of generosity, benefit amounts are the highest in Ecuador, where the maximum amount of social assistance for families can represent up to 106% of median per capita household disposable income in the country depending on the number of children in the family. A generous benefit for carers of individuals with disability is also in place in Ecuador, *Bono Joaquín Gallegos Lara*, which provides a monthly benefit equivalent to 170% of median per capita household disposable income. In terms of coverage, around 27% of households are beneficiaries of social assistance benefits in Colombia, 21% in Ecuador and 10% in Peru.

3.2. COVID-related tax-benefit policies

To mitigate the impact of the COVID-19 pandemic in the economy, national governments in the countries under analysis implemented a variety of measures. In what follows, we present the main COVID-related tax-benefit policies in each country.

Colombia. Policies implemented by the Colombian government consisted of five types of measures: (i) an increment (i.e. bonus) for beneficiaries of the three main social assistance programmes (*Familias en acción, Jóvenes en Acción and Colombia Mayor*); (ii) two new cash transfer called *Ingreso Solidario* targeted to households not covered by the main social programs and the so-called TVA reimbursement (*devolución del IVA*) programme, a cash transfer targeted at some beneficiaries of the main social assistance programmes, to mitigate the regressivity of VAT on households living in poverty and extreme poverty; (iii) changes in the unemployment subsidy (*Mecanismo de protección al cesante*) targeted to formal workers who made payments to Family Compensation Fund; (iv) a transitory tax for government officials or pensioners with monthly incomes higher than 10 million COP (*Impuesto Solidario*);[3] and (v) a reduction in pension contribution rates from 16% to 3% for self-employed workers, from 4% to 0.75% for employees, and from 12% to 2.25% for employers.

The bonus for beneficiaries of social assistance benefits consisted of a payment 145,000 COP for *Familias en Acción* (56% of median per capita disposable income) benefiting 2.5 million families and a payment of 356,000 COP for *Jovenes en acción* (39% of median per capita disposable income benefiting 297,000 persons. *Ingreso Solidario* consisted of a monthly payment of COP80,000 (19% of median per capita disposable income) and covering three million

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[3] The emergency tax (*Impuesto Solidario*) was in force until August 2020, when it was abolishes after being deemed unconstitutional by the Constitutional Court of Colombia.

households. The TVA reimbursement programme consisted of a payment of COP37,500 (7% of median per capita disposable income), benefitting one million households. Food baskets were also delivered by subnational governments with programs such as "*Bogotá Solidaria*", "*Calí Seguridad Alimentaria*", "*Medellín me Cuida*" and "*Barranquilla es Solidaria*". Finally, lines of credit were open to support small businesses.

Ecuador. The main policy introduced by the Ecuadorian government to mitigate the effect of the COVID-19 crisis was the Family Protection Grant (*Bono de Protección Familiar*). The programme consisted of a cash transfer of US$120 paid in two monthly instalments (i.e. US$60 each month, representing 42.6% of per capita household disposable income) and targeting two population groups under a two-stage process. In the first stage, the poorest 400,000 households in the country are targeted and payments are made in April and May 2020. The conditions to be eligible are: (i) being affiliated to the rural workers or unpaid work social security regimes, (ii) earning less than US$400 per month (equivalent to the legal minimum wage), and (iii) having no household members who receive contributory or non-contributory benefits or pensions (Presidencia de la República 2020a). In the second stage, the programme targets 500,000 additional households, excluding stage one beneficiaries with payments made in May and June 2020. The conditions to be eligible are: (i) that the household head earns less than US$501.60 per month (equivalent to the official cost of a survivor basket of food and services) and (ii) that no member of the household receive contributory or non-contributory benefits or pensions (Presidencia de la República 2020b).

Some other policies were implemented as a result of the COVID-19 pandemic. For instance, the possibility of reducing working hours and, correspondingly wages, in the public and private sector. However, this policy does not apply universally. Food baskets were also delivered by subnational governments on demand and without allocation rules. Finally, lines of credit were open to support small businesses from foreign aid from international organizations.

Peru. The Peruvian government implemented four cash transfer policies that aimed at providing support to face the lockdown and possible loss of employment: (i) *Bono Independiente*; (ii) *Bono Rural*; (iii) *Bono Yo me Quedo en Casa*; and (iv) *Bono Familiar Universal*. The objective of these programmes was to benefit households living in poverty and extreme poverty according to the SISFOH (*Sistema de Focalización de Hogares*). *Bono Independiente* was paid in April 2020 and consisted of a lump sum payment of 760 soles (124% of median per capita household disposable income) for self-employed workers in poor households, covering 773,288 households. *Bono Yo me Quedo en Casa* was paid in April 2020 and consisted of a lump sum payment of 380 Soles (62% of median per capita household disposable income) for poor households living in areas at highest sanitary risk from the pandemic, covering 2,726,712 households. *Bono Rural* was paid in May 2020 and consisted of a lump sum payment of 760 Soles for poor households living in rural areas and who had not received any other economic support. The programme covered 966,222 rural households. *Bono Familiar Universal* was paid in May 2020 and consisted of a lump sum payment of 760 soles targeting household without formal incomes. It benefitted 992,895 households.

Additionally, the government authorized workers to withdraw part of their private pension fund from the AFP (*Administradoras de Fondo Pensiones*) and the CTS (*Compensación de Tiempo de Servicios*). According to government data for March 2021, 3,756,412 workers withdrew 25% of their stock

of their AFP. Finally, an extension to the annual declaration and payment of income tax for 2019, and the automatic refund of payments in excess of 2019 were introduced by the national government.

4. Methodology

Our study makes use of nowcasting techniques and microsimulation models based on representative household microdata, to assess the role tax-benefit policies in mitigating the distributional effects of COVID-19 in Colombia, Ecuador and Peru. This section starts by presenting the tax-benefit microsimulation models used in the analysis. Then, it discusses the data adjustment made to capture the labour market situation during the second quarter and fourth quarters of 2020. Finally, we describe the method used to decompose changes in household disposable income into the contribution of earnings losses, automatic stabilisers and COVID-related policies.

4.1 Tax-benefits models

Our study makes use of harmonised tax-benefit microsimulation models for Colombia, Ecuador and Peru: COLMOD, ECUAMOD and PERUMOD, respectively. The models combine detailed country specific coded policy rules with nationally representative household microdata to simulate direct taxes and cash transfers for the household population of Ecuador, Colombia and Peru respectively.[4] The models have been implemented under a common language using the EUROMOD platform to ensure comparability across countries. EUROMOD-based models are static in the sense that the simulation of the taxes and benefits does not take into account possible behavioural reactions of individuals and there are not changes in the population composition over time (Sutherland & Figari, 2013). Simulation results for the models used in the analysis have been validated against official statistics (see Jara and Montesdeoca (2020) for Ecuador, Rodriguez et al. (2019) for Colombia, and Torres and Chang (2021) for Peru).

The models are used to simulate the main tax and benefit components of household disposable income in 2019 and 2020 in the countries under analysis. The 2019 and 2020 simulations include (i) employee social insurance contributions, (ii) self-employed social insurance contributions, (iii) personal income tax, and (iv) the main cash transfer programs in each country prior to the pandemic (see Section 3). Social insurance contributions and personal income tax are simulated only for workers reporting affiliation to social security.[5] In addition, the 2020 simulations include the main COVID-related measures implemented in each country (see Section 3). In Colombia, we simulate all COVID-related bonuses to the main social assistance programmes (*Familias en acción, Jóvenes en acción* and *Colombia mayor*), the new cash transfers introduced (*Ingreso Solidario* and *Devolución del IVA*), the unemployment subsidy (*Mecanismo de protección al cesante*), the transitory tax (*Impuesto solidario)*, and the reduction in pension contribution rates. In Ecuador, the Family

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Protection Grant is simulated. In Peru, all COVID-related cash transfers are simulated: *Bono Independiente, Bono Rural, Bono Yo me Quedo en Casa* and *Bono Familiar Universal*.

4.2 Data

Our analysis is based on representative household survey data from Colombia, Ecuador and Peru for 2019 and 2020. Data from Colombia comes from the Great Integrated Household Survey (*Gran Encuesta Integrada de Hogares*, GEIH). Data from Ecuador comes from the National Survey of Employment, Unemployment and Underemployment of Urban and Rural Households for (*Encuesta Nacional de Empleo, Desempleo y Subempleo de Hogares Urbanos y Rurales*, ENEMDU). Data from Peru comes from National Households Survey (*Encuesta Nacional de Hogares*, ENAHO). The income concepts have been harmonized in the tree datasets with the aim of allowing comparability in the simulations results. Table 1 summarizes the information about the data used in the analysis.

Table 1. Data Sources and Microsimulation Models

Country	Data Source	Period of data collection	Number of individuals	Microsimulation model
Colombia	Gran Encuesta Integrada de Hogares (GEIH)	Q4 2019	186,727	COLMOD
		May 2020	65,481	
		Q4 2020	184,790	
Ecuador	Encuesta Nacional de Empleo, Desempleo y Subempleo de Hogares Urbanos y Rurales (ENEMDU)	Dec. 2019	59,183	ECUAMOD
		May/June 2020	37,406	
		Dec. 2020	30,636	
Peru	Encuesta Nacional de Hogares (ENAHO)	Q4 2019	28,599	PERUMOD
		Q2 2020	27,614	
		Q4 2020	27,191	

Source: Authors' elaboration based on household surveys.

To locate the period when the economy was hit the hardest by the pandemic, we look at the evolution in the number of earners over 2020. Figure 1 presents the share of people who reported having positive earnings in the data relative to the working age population in the countries under analysis from December 2019 to December 2020. In all three countries, the number of earners dropped sharply during the second quarter of 2020, when national governments implemented lockdown measures to contain the spread of the virus. In Colombia, the percentage of earners relative to the working age population fell from 52% in December 2019 to 34% in May 2020. The drop was sharper in Ecuador and Peru, where the percentage of earners fell from 54% to 31% and 56% to 32%, respectively, between December 2019 and June 2020.

The Figure further shows the recovery experienced by the end of 2020, when the percentage of earners increases but remains below the levels observed prior to the pandemic. In our analysis, we focus on changes in household disposable income in the second and fourth quarter of 2020 compared to the situation at the end of 2019, prior to the COVID-19 outbreak. The sections below detail the methodology used to compare these three scenarios.

Figure 1. Share of earners relative to the working age population

Source: Authors' elaboration based on household surveys

4.3 Nowcasting 2020 incomes

The pandemic affected data collection in the countries under analysis, forcing statistical agencies to reduce sample sizes of official surveys and, in some cases, to resort to phone interviews. Household survey data prior to the pandemic contains detailed information on demographics, employment, earnings, income from capital and property, private transfers, pensions, and cash transfer programmes. On the contrary, data for 2020 in most cases only contains demographic, employment, and earnings information.

To overcome this limitation, we use nowcasting techniques: we adjust the information on earnings and labour market status in 2019 household survey data to match the available information for 2020. More precisely, our approach consists on three steps. First, we estimate a probability model to determine if an individual reporting positive earnings in the 2019 database is predicted to remain as earner in 2020. We refer to this step as an adjustment at the extensive margin. Second, conditional on having predicted positive earnings, we update the individual earnings to match those prevailing in 2020. We refer to this step as an adjustment at the intensive margin. Finally, the adjusted microdata is used as input of our tax-benefit simulations to obtain the distribution of household disposable income in the second and fourth quarter of 2020, taking into account the tax-benefit policies that were in place during these periods.

In our adjustment at the extensive margin, for each COVID scenario (second and fourth quarter of 2020), we estimate a probit model of the probability of having positive earnings pooling observations from 2019 and 2020 (i.e. two regressions per country with pooled data from Q4-2019 and Q2-2020, and Q4-2019 and Q4-2020). The dependent variable is equal to one if an individual in the working age population reports positive earnings, zero otherwise. We include as regressors a vector of demographics including: age, age squared, dummies for woman, region, rural, head of the household, educational level, whether the observation is in education, and

whether the observation has a partner in the household. We further include a dummy for 2020 and interactions between this dummy and the vector of characteristics. The estimation results are presented in Table B1 in Appendix B.

The estimated coefficients are then used to predict the probability of being an earner in 2020 for individuals in the 2019 data. For this, the 2020 dummy is set to one for individuals in 2019 and the predictions are based on each person's characteristics multiplied by the coefficients plus a random component that accounts for unobserved factors that may tip people into being an earner or not. The addition of the random term means that we do not completely exclude groups with low (deterministic) probability from being earners (Li and Donoghue 2014). Based on these predicted probabilities, we move individuals from being earners in 2019 to having zero earnings in 2020 in order to match the number earners by industry and formality status (formal or informal) observed in the 2020 data. Figure B1 shows the total number of earners (top of the bars) per industry in December 2019 and the second or fourth quarter of 2020, distinguishing between formal (blue bars) and informal earners (red bars). Table B2 in Appendix B compares the characteristics of earners in the observed 2020 data (Q2 and Q4) and those of our 2019 data adjusted by changes in the number of earners to match information from the second and fourth quarter of 2020.

In our second step (adjustment at the intensive margin), for those individuals that are predicted to remain as earners, we adjust their earnings so that the mean earnings per industry, employment status (employee versus self-employed), and formality status (formal versus informal) in the adjusted microdata reflects the information of mean earnings for these categories in the second and fourth quarter of 2020. Note that in reality some workers within these categories might not have experienced changes to their earnings, however, the data does not allow us to identify these workers and a further disaggregation by individual characteristics (e.g. gender, education) reduces the number of observations in each category.[6]

Based on the adjusted microdata reflecting the employment and earnings situation in the second and fourth quarter of 2020, we run tax-benefit simulations to obtain the distribution of household disposable income before and during the pandemic, and we compare these distributions by means of decomposition techniques, which are detailed in the next section.

4.4 Decomposing changes in the distribution of household disposable income

To compare the distribution of household disposable income before and during the COVID-19, we follow the decomposition approach proposed by Bargain and Callan (2010), extended by Paulus and Tasseva (2020), and recently applied to the context of the COVID-19 crisis in the UK by Brewer and Tasseva (2020) and in Ecuador by Jara et al. (2020). The method consists of simulating three counterfactual scenarios in each country and for each COVID scenario: (i) 2019 tax-benefit policies applied to 2019 data; (ii) 2019 policies applied to adjusted data reflecting the situation in the second (fourth) quarter of 2020; and (iii) 2020 policies, including COVID-related measures, applied to adjusted data reflecting the situation in the second (fourth) quarter of 2020. Based on these three scenarios, the decomposition allows isolating the distributional effects of:

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[6] In practice, adjustments at the intensive margin are made only for categories where mean earnings have changes by more than 5% between December 2019 and the second and fourth quarter of 2020.

(i) earnings losses due to COVID-19, (ii) pre-crisis tax–benefit policies (i.e. automatic stabilizers), and (iii) COVID-related emergency measures implemented by the government. This section follows closely Jara et al. (2020) to describe the decomposition approach.

Let y represent pre-crisis gross market income, $t(y)$ income tax and SICs, and $b(t, y)$ government cash transfers. Then, household disposable income in the pre-crisis baseline scenario is given by:

$$B = y - t(y) + b(t, y) \tag{1}$$

Now, let y' represent gross market income under the crisis reflecting a scenario with higher unemployment and lower earnings, $t(y')$ denote income tax and SICs after the drop in earnings, and $b''(t, y')$ represent government cash transfers after the earnings drop and benefit changes, e.g. newly introduced cash transfers. Then, the household disposable income under the crisis is given by:

$$D = y' - t(y') + b''(t, y') \tag{2}$$

A welfare index, I, such as mean income or a measure of inequality or poverty, can be calculated on the basis of the distribution of disposable income under the pre-crisis and crisis scenarios. The total difference Δ in the welfare indicator I between the pre-crisis and crisis scenarios can be represented by:

$$\Delta = I[y' - t(y') + b''(t, y')] - I[y - t(y) + b(t, y)] \tag{3}$$

The difference in the distribution of disposable income, as summarized by index I, can be decomposed into the contribution of the change in the tax–benefit rules ('policy changes effect') and the contribution of 'other effects' not directly linked to policy changes, such as the changes in the underlying gross market income distribution due to the economic shock[7]. Formally, this can be represented as:

$$\Delta = \{I[y' - t(y') + b''(t, y')] - I[y' - t(y') + b(t, y')]\} \text{ (policy changes)}$$

$$+ \{I[y' - t(y') + b(t, y')] - I[y - t(y) + b(t, y)]\} \text{ (other effects)} \tag{4}$$

Following Paulus and Tasseva (2020), for additively decomposable measures only, such as mean incomes, we can further decompose the 'other effects' into the effect of earnings changes and the effect of automatic stabilizers[8]. Equation (4) can be rewritten as:

$$I[y' - t(y') + b''(t, y')] - I[y' - t(y') + b(t, y')]\} \quad \text{(policy changes)}$$

$$+ \{I[y'] - I[y]\} \quad\quad\quad\quad\quad\quad\quad\quad\quad\quad \text{(earnings changes)}$$

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[7] Note that, in order to make amounts from two periods comparable when the policies of one period are applied to the population of the other in the counterfactuals, policy parameters and/or market incomes are usually adjusted by a factor capturing the evolution in nominal levels (Bargain and Callan 2010; Paulus and Tasseva 2020). The adjustment factor becomes particularly relevant for distant periods of time. Here, we consider two consecutive years and assume the adjustment factor equals one.

[8] For non-additively decomposable measures, such as poverty and inequality indicators, the decomposition in equation (5) also includes a non-zero residual term (see Paulus and Tasseva 2020 for a discussion).

$$+ \{I[t(y)] - I[t(y')]\} \qquad \text{(taxes and SICs as automatic stabilizers)}$$

$$+ \{I[b(t, y')] - I[b(t, y)]\} \qquad \text{(benefits as automatic stabilizers) (5)}$$
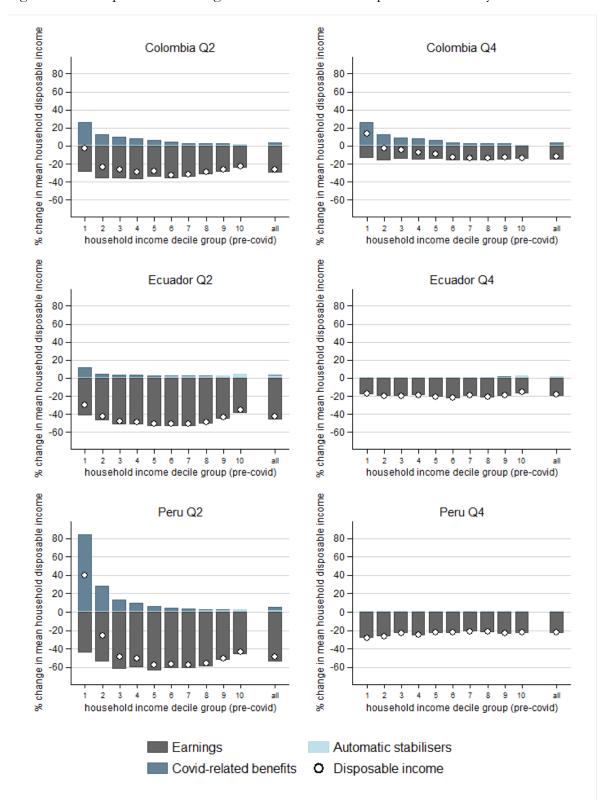
5 Distributional effects of the COVID-19 pandemic

This section presents the decomposition of changes in household disposable income between December 2019 and the second and fourth quarter of 2020. We first discuss the effects on household disposable income, disentangling changes due to earnings losses, automatic stabilizers, and COVID-related emergency policies. Then, we present the results of the impact of the crisis on income poverty and inequality.

5.1 Changes in mean disposable income

Figure 2 presents the percentage change in mean household disposable income per capita by decile of household disposable income and for the whole population in each country under analysis. Deciles are based on household disposable income per capita in the pre-COVID scenario (December 2019 baseline). The changes reflect the difference between the pre-COVID and the COVID scenarios. We present results for the second (Q2) and last quarter (Q4) of 2020 in the first and second column of the Figure, respectively. The change in disposable income is decomposed into the effects of (i) earning losses, (ii) COVID-related policies and (iii) automatic stabilizers.

For the second quarter of 2020, our results show that, on average, household disposable income (white circles) drops sharply as a result of the COVID-19 pandemic. Mean household disposable income drops by 25.7% in Colombia, 43% in Ecuador and 49.3% in Peru. The fall in household income largely reflects the earnings losses (dark grey bar) resulting from the crisis, which represent 29.5% of household disposable income in Colombia, 46.5% in Ecuador and 54.6% in Peru. Therefore, on average, COVID-related policies (dark blue bars) and automatic stabilizers (light blue bars) play only a minor role in cushioning the impact on earnings reduction on household income, accounting together for an increase in household disposable income of 3.8% in Colombia, 3.5% in Ecuador and 5.3% in Peru. The effect of COVID-related policies is larger than that of automatic stabilisers in Colombia and Peru, accounting for 2.6% of baseline income compared to 1.3% in Colombia, and 3.7% compared to 1.6% in Peru. In Ecuador, automatic stabilisers pay a larger role, representing 2.6% of baseline income, whereas COVID-related policies represent only a 0.9%. Differences in the effect of COVID-related policies and automatic stabilisers across countries are explained by differences in the design of tax-benefit instruments, which we discuss more in detail in the next sections.

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Figure 2. Decomposition of changes in mean household disposable income by income decile

Notes: Changes in income are based on per capita household disposable income before the pandemic.
Source: Authors' elaboration based on microsimulation models COLMOD, ECUAMOD and PERUMOD.
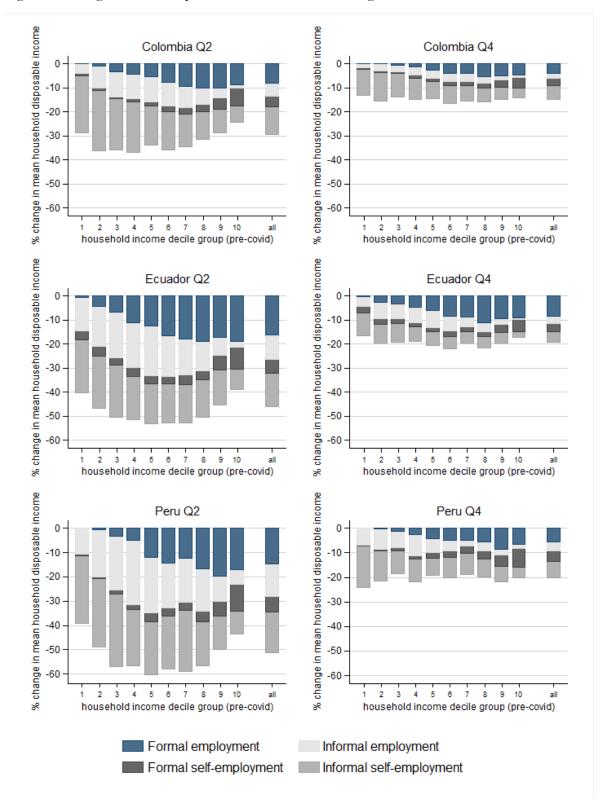
Figure 2 also shows a U-shaped pattern in the change of mean household disposable income across the income distribution for all countries in the second quarter of 2020. The pattern implies that households in the middle of the income distribution experienced larger drops in earnings compared to those at the bottom, and is consistent with results by Lustig et al. (2020). In terms of COVID policies and automatic stabilisers, we also find a similar pattern across countries but with varying magnitudes on the effects of these instruments. In all countries, the contribution of automatic stabilizers increases with income and they mitigate the effect of the economic shock mostly through their effect in the top decile of the distribution, where they represent 4.2% of baseline income for Ecuador, 2.4% for Peru and 1.9% for Colombia. On the contrary, COVID-related policies play an important role at the bottom of the distribution.

Results for the last quarter of 2020 depict the extent to which the economy has recovered in each of the countries under analysis. In all countries, we still observe a drop in mean household disposable income in the last quarter of 2020 relative to December 2019. However, the magnitude of the fall in earnings is smaller than that observed in the second quarter. For Colombia, we observe a drop of mean disposable income of 11.8%. In Ecuador and Peru, mean disposable income decreases, on average, by 18.2% and 21.9%, respectively. Compared to the second quarter, we observe that COVID-related policies pay a role in mitigating the impact of the economic shock only in Colombia. This is because this is the only country where COVID-policies were maintained until the end of 2020. In Ecuador, the Family Protection Grant was paid in two instalments during the months of April to June 2020 with no other expanded social protection programmes implemented after that period. In Peru, all COVID-related benefits were designed as lump sum payments implemented during the second quarter of 2020 with no further emergency policies. The role of automatic stabilisers remains limited in all countries, driven by their effect at the top of the income distribution.

The remainder of this section now turns to the effect of specific income sources and tax–benefit instruments on changes in household disposable income. More precisely, we assess separately the effect of losses in employment versus self-employment earnings, and the contribution of taxes, SICs and benefits to changes in household disposable income, distinguishing between COVID-related policies and automatic stabilisers.

Earnings losses. Figure 3 shows the change in disposable income accrued to the change in earnings from four different sources: formal employment (dark blue bar), informal employment (light grey bar), formal self-employment (black bar) and informal self-employment (dark grey bar). Relative to 2019, we observe a drop in all four income sources across countries and as a result, changes in earnings from these four sources always contribute to a reduction in household disposable income. The magnitude of the contribution of each income source to changes in disposable income varies across countries and decreases over time.

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Figure 3. Change in mean disposable income due to earnings losses

Notes: Changes in income are based on per capita household disposable income before the pandemic.
Source: Authors' elaboration based on microsimulation models COLMOD, ECUAMOD and PERUMOD.
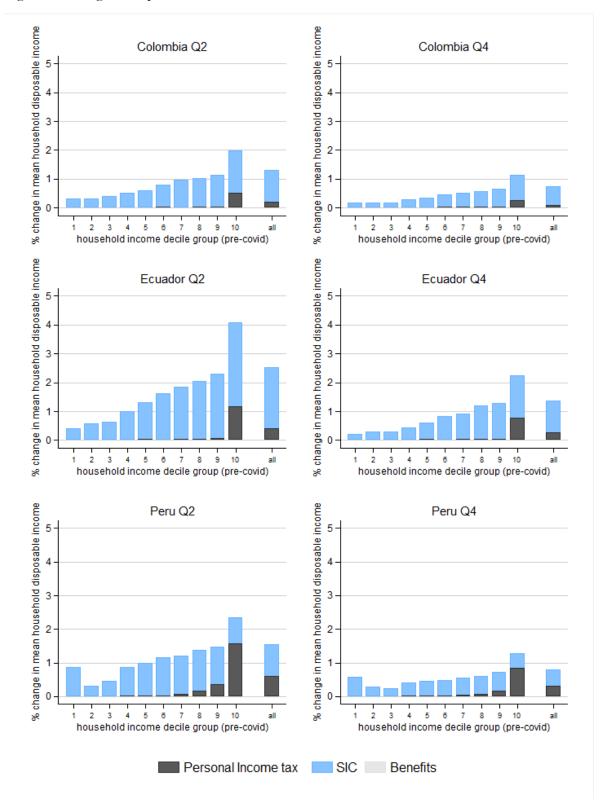
For the second quarter of 2020, some similar patterns are observed across countries. On average, for the whole population in each country, the income sources accounting for the largest reduction in household disposable income are formal employment and informal self-employment earnings. The former (latter) accounts for an 8.2% (11.5%) reduction in household disposable income in Colombia, 16.6% (13.9%) in Ecuador and 15% (16.9%) in Peru. In Peru, the contribution of changes in informal employment earnings to the drop in household disposable income is also important, representing 13.7% of the reduction in disposable income, whereas the contribution is smaller in Ecuador (9.9%) and Colombia (5.3%). Finally, the contribution of formal self-employment earnings to the drop in household disposable income is the smallest in all countries, representing on average a 4.5% to 6.5% reduction in disposable income, for the whole population in each country.

Figure 3 also shows similar patterns in the role of the different income sources across the income distribution in the second quarter of 2020. In all countries, losses in formal employment and formal self-employment earnings are larger at the top of the income distribution, which is explained by the concentration of informal work at the bottom of the distribution. In fact, changes in informal employment and informal self-employment earnings account for a larger reduction of household disposable income in the bottom half of the income distribution.

In the last quarter of 2020, the drop in earnings from all four sources reduces as the economy recovers due to the relaxation of lockdown measures. The pattern observed in the second quarter, in terms of the contribution of the different income sources to the reduction of household income, is preserved (but with smaller magnitudes in the drop of disposable income). On average, for the whole population in each country, the income sources accounting for the largest reduction in household disposable income continue to be formal employment and informal self-employment earnings. The pattern of the four income sources across the income distribution also prevails, with formal earnings playing a larger role at the top of the distribution and informal earnings accounting more for the drop of disposable income at the bottom of the distribution.

Automatic stabilizers. Figure 4 presents the change in mean household disposable income due to automatic stabilisers (i.e. automatic reductions in personal income tax, SICs, and automatic increases in benefits due to changes in earnings) under our COVID scenarios. Our results show that in all three countries and for the two COVID periods analysed, SICs provide the largest automatic stabilisation, for the whole population. SICs account for a 1.1% (0.6%) increase in household disposable income in the second (last) quarter of 2020 in Colombia, a 2.1% (1.1%) increase in Ecuador, and a 0.9% (0.5%) increase in Peru. In Colombia and Ecuador, the contribution of SICs as an automatic stabilizer increases along the income distribution and is largest for the top income decile. In Peru, the contribution of SICs also increases with income but a large effect is also observed in the first income decile. The latter is explained by the design of self-employed health insurance contributions as fixed payment amounts (i.e. not proportional to earnings), which are assumed to stop when self-employed workers enter unemployment.

Figure 4. Change in disposable income due to automatic stabilisers

Notes: Changes in income are based on per capita household disposable income before the pandemic.
Source: Authors' elaboration based on microsimulation models COLMOD, ECUAMOD and PERUMOD.

In all countries, the effect of personal income tax as an automatic stabiliser is smaller than that of SICs. The contribution of personal income tax also increases with income and it plays a role mostly in the top decile. In Peru, personal income tax accounts for a larger reduction in disposable income than SICs in the top income decile. The cross-country pattern holds for both, the second and fourth quarters of 2020, with a smaller role of SICs and personal income tax in the last quarter due to the smaller reduction in earnings compared to the second quarter. Note that the modest contribution of personal income tax as an automatic stabiliser is explained by the prevalence of informal employment but also by the design of personal income tax in these countries, which is characterized by high exempted thresholds and the presence of deductions for personal expenditures (see Table A3 in Appendix A).

Finally, Figure 4 provides evidence on the lack of benefits acting as automatic stabilisers in the countries under analysis. In particular, the main social assistance programmes in each country (see Table A4 in Appendix A) fail to provide automatic stabilisation at the bottom of the income distribution due their design as proxy means-tested benefits. Eligibility for the main social assistance programmes in the countries under analysis (and in many countries in the region) is based on composite indices including information about housing and household characteristics and therefore do not depend directly on income to react automatically to earnings shocks. For Ecuador, Jara et al. (2020) show that the unemployment insurance benefit (*seguro de desempleo*), which is not simulated in our analysis, plays a role as automatic stabiliser. However, the contribution of this instrument to protecting household incomes is extremely modest as it covers only formal employees and for a period of up to five months.

COVID-related policies. By design, COVID-related policies have a greater effect at the bottom of the income distribution, as they were mostly aimed at providing income protection to poor households in each country. This pattern holds for all countries in the second quarter of 2020 as depicted in Figure 3 (above). In the second quarter, COVID-related policies increase mean disposable income of the first income decile group by 26.1% in Colombia, 11.3% in Ecuador and 83% in Peru. Note, however, that the shock absorber effect of COVID-related policies drops largely for the second decile group (and onwards), where it accounts for a 12.6%, 4%, and 28.1% increase in disposable income for Colombia, Ecuador and Peru, respectively. The large effect observed in Peru, particularly in the first decile, is due to the design of COVID-related benefits as generous one-off lump sum payments during the months of April and May 2020. Only in this country, losses in earnings for households in the first income decile are fully compensated and additional income protection is provided. The small effect observed in Ecuador is explained by the relatively low monthly payment of the Family Protection Grant (i.e. US$60 each month), which was paid during two months over the second quarter of 2020. COVID-related reforms in Colombia encompassed a variety of policies and were in place throughout the second, third and fourth quarters of 2020. For instance, in addition to the cushioning effect of COVID-related benefits, the reduction in social insurance contributions rates in Colombia also increases household disposable income, especially at the top of the distribution as depicted in Figure B2 in the Appendix. By contrast, the emergency tax (*Impuesto Solidario)* decreases mean disposable income of the top income decile, counteracting the effect of the personal income tax as an automatic stabiliser.

For the last quarter of 2020, the effect of COVID-related policies in Colombia remains the same, as all COVID-related reforms were kept in place since the start of the pandemic. In contrast, no effect is observed in Ecuador and Peru at the end of 2020, as COVID-related policies in these countries were limited to the second quarter of 2020 and our simulations assume that the additional resources from COVID emergency policies are fully consumed during the second quarter.

From a policy perspective, two important findings can be drawn from this section. First, there is a lack of benefits acting as automatic stabilisers in the event of a negative income shock in the countries under analysis. In particular, social assistance benefits do not act as automatic stabilisers due to their design as proxy means-tested benefits, which is a characteristic of most cash transfer programmes in the region. Second, COVID-related policies contributed to cushioning the effect of the crisis at the bottom of the income distribution. However, no emergency policies were put in place to absorb the negative income shock for the middle class, which suffered the most from the reduction in earnings, implying that emergency transfers did not compensate income losses of households vulnerable to economic shocks (e.g. households slightly above the poverty line) and consequently a large group of them fell into poverty as presented in the next section.

5.2 Impact on income poverty and inequality

We now turn to the effect of the COVID-19 pandemic on income inequality and poverty, which is shown in Tables 2 and 3. We start by comparing poverty and inequality levels in the pre-COVID baseline with those under the COVID-scenarios of the second and fourth quarter of 2020 (Table 2). Then, we decompose the total change in income poverty and inequality into the contribution of COVID-related policies and other effects (Table 3). 'Other effects' include the combined impact of earning changes and automatic stabilisers.

The first column for each country in the Table 2 presents inequality and poverty indicators under the pre-COVID scenario and the next two columns presents the difference between the COVID scenario in the second (Total changes Q2) and fourth (Total changes Q4) quarters and the pre-COVID scenario. Our results show that poverty and inequality increased sharply in the second quarter of 2020 in the three countries under analysis. As the economy recovers, poverty and inequality levels decrease in the last quarter of 2020, but they remain higher than those observed prior to the pandemic.

In the second quarter of 2020, the country experiencing the largest rise in income inequality is Ecuador, with an increase of 0.133 points in the Gini coefficient. A sharp rise in inequality is also observed in Peru, with an increase of 0.126 points in the Gini coefficient. In Colombia, the increase in inequality is also sizeable but smaller than in the other two countries, representing 0.07 points rise in the Gini coefficient. Inequality decreases in the last quarter compared to the second quarter of 2020, but the Gini coefficient remains 0.01, 0.038 and 0.042 points higher than in 2019 in Colombia, Ecuador and Peru, respectively. The pattern remains broadly similar when inequality is measured by the Theil index.

Table 2. Changes in income inequality and poverty during the COVID-19 pandemic

	Colombia			Ecuador			Peru		
	Pre-COVID scenario	Total change Q2	Total change Q4	Pre-COVID scenario	Total change Q2	Total change Q4	Pre-COVID scenario	Total change Q2	Total change Q4
Inequality									
Gini	0.497	0.070	0.010	0.461	0.133	0.038	0.460	0.126	0.042
Theil	0.481	0.115	0.013	0.395	0.225	0.058	0.379	0.241	0.069
Poverty									
FGT0 (%)	26.6	19.3	5.8	25.7	34.5	12.3	28.2	36.5	11.9
FGT1 (%)	10.0	13.2	3.1	9.6	25.5	7.2	13.1	25.6	8.9
Extreme poverty									
FGT0 (%)	6.9	14.1	2.7	9.2	31.3	8.5	13.6	29.6	9.9
FGT1 (%)	2.4	7.9	1.5	3.6	19.1	4.5	6.4	17.9	6.8

Note: Total change refers to the difference between poverty or inequality in the COVID scenario and the 2019 baseline scenario. Poverty and inequality indicators are based on per capita household disposable income. The 2019 national poverty and extreme poverty lines are used in each country.
Source: Authors' elaboration based on microsimulation models COLMOD, ECUAMOD and PERUMOD.

In terms of poverty, the impact of the crisis is also large. Table 2 compares statistics on absolute poverty and extreme poverty headcounts (FGT0) and gaps (FGT1). Our results show significant increases on poverty during the second and fourth quarter of 2020. For Ecuador and Peru poverty headcounts increase by 34.5 and 36.5 percentage points (pp), respectively, in the second quarter relative to levels before the pandemic. Despite the recovery by the end of 2020, the poverty headcounts in Ecuador and Peru remain 12.3pp and 11.9pp higher than at the end of 2019. For its part, Colombia's poverty headcount increases by 19.3pp in the second quarter and by 5.8pp in the fourth quarter of 2020, relative to the pre-COVID scenario. Extreme poverty also increases strikingly in all three countries, with a rise of 14.1pp (2.7pp) in Colombia, 31.3pp (8.5pp) in Ecuador and 29.6pp (9.9pp) in Peru during the second (last) quarter of 2020. A similar pattern is observed in terms of the poverty gap.

Finally, Table 3 presents the results of decomposing the total change in inequality and poverty into the effects of COVID-related policies and other effects. Our analysis shows that for all three countries in the two periods considered, other effects, which capture changes in earnings but also automatic stabilisers, explain most of the total change in disposable income inequality and poverty. COVID-related policies play a mild role in mitigating the effect of the shock on income inequality during the second quarter of 2020, contributing to a 0.023 percentage points decrease in the Gini coefficient in Colombia, 0.012 points in Ecuador and 0.046 points in Peru.

The effect of COVID-related policies in mitigating the impact of the crisis on income poverty is the largest in Peru, where COVID-emergency benefits contribute to a 3.4pp reduction in the poverty headcount and a 7pp reduction in the extreme poverty headcount, during the second quarter of 2020. The large effect of COVID-related policies in Peru is explained by the generous lump sum payments of the benefits implemented to by the national government. During the second quarter, COVID-related policies contribute to a 3pp reduction in the poverty headcount and a 3.9pp reduction in the extreme poverty headcount in Colombia, whereas the effect of the COVID Family Protection Grant was limited in Ecuador, representing a 0.7pp reduction in the poverty headcount and a 1.2pp reduction in the extreme poverty headcount.

Table 3. Decomposing the change in income inequality and poverty

	Colombia Q2			Ecuador Q2			Peru Q2			Colombia Q4		
	Total change	COVID-related policies effects	Other effects	Total change	COVID-related policies effects	Other effects	Total change	COVID-related policies effects	Other effects	Total change	COVID-related policies effects	Other effects
Inequality												
Gini	0.070	-0.023	0.092	0.133	-0.012	0.144	0.126	-0.046	0.172	0.010	-0.019	0.029
Theil	0.115	-0.034	0.149	0.225	-0.013	0.238	0.241	-0.070	0.311	0.013	-0.036	0.049
Poverty												
FGT0(%)	19.3	-3.0	22.3	34.5	-0.7	35.2	36.5	-3.4	39.9	5.8	-3.4	9.2
FGT1(%)	13.2	-3.5	16.7	25.5	-1.6	27.1	25.6	-6.3	31.9	3.1	-2.7	5.7
Extreme poverty												
FGT0(%)	14.1	-3.9	18.0	31.3	-1.2	32.5	29.6	-7.0	36.6	2.7	-3.0	5.7
FGT1(%)	7.9	-3.4	11.3	19.1	-2.0	21.2	17.9	-7.4	25.4	1.5	-1.7	3.2

Note: poverty and inequality indicators are based on per capita household disposable income. The 2019 national poverty and extreme poverty lines are used in each country.
Source: Authors' elaboration based on microsimulation models COLMOD, ECUAMOD and PERUMOD.

In the last quarter of 2020, COVID-related policies remain in place only in Colombia. The contribution of COVID-related policies in the last quarter of 2020 is similar to that observed in the second quarter, accounting for a 3.4pp reduction in the poverty headcount and a 3pp reduction in the extreme poverty headcount.

6 Conclusions

In response to the COVID-19 crisis, Latin American governments implemented lockdown measures and adopted policies aimed to protect lives and avoid financial hardship. Contrary to developed economies, Latin American countries (and developing countries in general) have limited fiscal capacity and rely on commodity prices. This reduces the scope of social assistance programmes to provide income protection, making countries in the region more vulnerable to economic shocks. For these reasons, we study the role of tax-benefit policies in mitigating the economic impact of the COVID-19 pandemic in Colombia, Ecuador and Peru. The economies of our countries under analysis were hardly hit by the pandemic compared to other countries in the region.

More precisely, this paper aimed to assess the cushioning effect of tax-benefit policies during the COVID-19 pandemic in Colombia, Ecuador, and Peru. Our analysis consisted in comparing changes in household disposable income before and during the COVID-19 pandemic. For the latter, we consider two scenarios: the situation during the second quarter of 2020, when the economy was hit the hardest due to the implementation of lockdown measures; and the situation at the end of 2020, when the economy slightly recovers. The pre-COVID scenarios are based on household survey data from December 2019, whereas the COVID scenarios are derived using micro-based nowcasting techniques, adjusting 2019 data to reflect the labour market and earnings situation observed in household surveys collected during the pandemic. Subsequently, the tax-benefit models COLMOD, ECUAMOD and PERUMOD are used to decompose changes in the distribution of household disposable income into the effects of (i) earning losses, (ii) COVID-related policies and (iii) automatic stabilisers.

Our results show that mean household disposable income fell dramatically in the second quarter of 2020 compared to December 2019, representing a 25.7% decrease in Colombia, 43% in Ecuador and 49.3% in Peru. As lockdowns were relaxed, household income recovered by the end of 2020, translating into smaller drops of 11.8% in Colombia, 18.2% in Ecuador and 21.9% in Peru, compared to December 2019. Our results further show that, in all countries, the shock was larger at the middle of the income distribution, with a U-shaped pattern in the change of disposable income across the distribution. Decomposition results show that COVID-related policies help mitigate the impact of the pandemic at the bottom of the distribution, although to different extents across countries depending on the generosity of the emergency cash transfers. COVID-related policies increase mean disposable income of the first income decile group by 26.1% in Colombia, 11.3% in Ecuador and 83% in Peru, during the second quarter of 2020. By contrast, automatic stabilizers cushion the income shock at the top of the distribution due to automatic reductions in social insurance contributions and income tax payments. The large reduction in household disposable income in the second quarter translates into a sharp increase in income inequality and poverty in all countries. The Gini coefficient increases by 0.07 points in Colombia, 0.133 points in Ecuador, and 0.126 points Peru. The poverty headcount increases

by 19.3pp in Colombia, 34.5pp in Ecuador and 36.5pp in Peru. The extent to which COVID-related policies mitigate the effect of the shock on income poverty and inequality depends on the generosity of the benefit. The effect of COVID-related policies is the largest in Peru during the second quarter of 2020. In the absence of COVID-related policies the Gini coefficient in Peru would have been 0.046 points higher and the poverty and extreme poverty headcount would have increased 3.4pp and 7pp more, respectively. By the end of 2020, only Colombia preserved the implemented COVID-related policies providing income support throughout the year.

From a policy perspective, our analysis provides a number of relevant findings. First, in terms of social protection prior to the pandemic in the countries under analysis, there are no benefits acting as automatic stabilisers in case of economic shocks due to their design as proxy means-tested benefits. As a result, these countries need to rely on national governments implementing emergency policies to provide income protection in the event of economic shocks, as it has been the case under the COVID-19 pandemic. The implementation of emergency transfers was challenging because, overnight, governments had to reach populations who had not previously received social assistance benefits and were not included in governments registers. This highlights the need to rethink and enhance social protection in the region. Second, the COVID-19 pandemic and lockdown measures implemented to contain the spread of the virus have had long-term economic consequences, with poverty and inequality indicators remaining higher than prior to the pandemic by the end of 2020. However, the only country which maintained COVID-related policies throughout the year was Colombia, meaning that households in Ecuador and Peru were largely left unprotected to face the effect of the crisis after lockdown measures were relaxed. Finally, households in the middle of the income distribution have been the most affected by the economic impact of the pandemic. However, no emergency cash transfer policies were implemented to mitigate the effect of the crisis for this group of the population. As the pandemic has unveiled the limitations of social protection in Latin American countries, efforts should be made to rethink and redesign social protection in the region in order to develop a sustainable welfare system in the long-term.

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Appendix A. Characteristics of tax-benefit systems in Colombia, Peru and Ecuador (2019)

Table A1. Characteristics of employee social insurance contributions in the countries under analysis (2019)

Country	Rate	Floor	Ceiling	Tax deductible
Colombia	8% or 10%	8% of minimum wage	10% of 25 minimum wages	Yes
Ecuador	9.45% or 11.45%	9.45% of minimum wage	-	Yes
Peru	13%	13% of minimum wage	-	No

Source: Authors' elaboration based on the 2019 legislation of employee social insurance contributions in each country.

Table A2. Characteristics of self-employed social insurance contributions in the countries under analysis (2019)

Country	Rate	Floor	Ceiling	Tax deductible
Colombia	28.5% or 30.5%	28.5% of minimum wage	30.5% of 25 minimum wages	Yes
Ecuador	20.6%	20.6% of minimum wage	-	Yes
Peru	Fixed amounts between 0.15 and 0.23 times the minimum wage	0.15 times the minimum wage	0.23 times the minimum wage	No

Source: Authors' elaboration based on the 2019 legislation of self-employed social insurance contributions in each country.

Table A3. Main Characteristics of personal income tax in the countries under analysis (2019)

Country	Tax unit	Lowest tax band limit	Highest tax band limit	Lowest tax rate (%)	Highest tax rate (%)	Tax deductions
Colombia	individual	3.8	14.4	0	33	Expenditures in education, health, and mortgage payments
Ecuador	individual	2.4	24.4	0	35	Expenditures in food, clothing, education, health, and housing
Peru	individual	2.3	16.9	0	30	Housing rents and health expenditures

Source: Authors' elaboration based on the 2019 legislation of personal income tax and the legal minimum wages in each country.
Note: Tax bands are expressed in terms of annualized minimum wages in each country.

Table A4. Main Characteristics of cash transfer programmes in the countries under analysis (2019)

Country	Name	Income test	Max amount per month (% of median)	Subject to income taxes and SICs
Colombia	(i) Familias en acción	Proxy means-tested	COP 240.000 (56%)	neither
	(ii) Jóvenes en acción	Proxy means-tested	COP 170.000 (39%)	neither
	(iii) Colombia Mayor	Proxy means-tested	COP 110.000 (25%)	neither
Ecuador	(i) Bono de Desarrollo Humano	Proxy means-tested	Families: US$ 150 (106%) Elderly: US$ 100 (71%) Disability: US$ 50 (35%)	neither
	(ii) Bono Joaquín Gallegos Lara	Proxy means-tested	US$ 240 (170%)	neither
Peru	(i) Juntos	Proxy means-tested	S/ 100 (16%)	neither
	(ii) Pensión 65	Proxy means-tested	S/ 250 (41%)	neither

Note: Amounts in parenthesis expressed in percentage of median per capita household disposable income in each country in 2019.
Source: Authors' elaboration based on the 2019 legislation of cash transfer programmes.

Appendix B. Tables and Figures

Table B1. Marginal Effects for Probit regressions

VARIABLES	(1) Colombia-Q2	(2) Colombia-Q4	(3) Ecuador-Q2	(4) Ecuador-Q4	(5) Peru-Q2	(6) Peru-Q4
Male	0.172***	0.188***	0.267***	0.289***	0.188***	0.187***
	(0.00191)	(0.00157)	(0.00526)	(0.00484)	(0.00545)	(0.00509)
Age	0.00315***	-0.00185**	0.0233***	0.0246***	0.0260***	0.0265***
	(0.00106)	(0.000796)	(0.000658)	(0.000634)	(0.000717)	(0.000690)
Age squared	-2.90e-05***	2.89e-05***	-0.000267***	-0.000282***	-0.000287***	-0.000301***
	(2.17e-06)	(2.63e-06)	(6.86e-06)	(6.52e-06)	(7.19e-06)	(6.82e-06)
Head of household	0.121***	0.134***	0.183***	0.196***	0.205***	0.188***
	(0.00254)	(0.00212)	(0.00574)	(0.00577)	(0.00750)	(0.00711)
Has a partner	0.0240***	0.0296***	-0.00684	-0.0263***	0.0236***	0.0161**
	(0.00286)	(0.00231)	(0.00727)	(0.00631)	(0.00814)	(0.00775)
Educ – Primary	0.0453***	0.0476***	-0.000630	-0.00563	0.0656***	0.0481***
	(0.00504)	(0.00433)	(0.00973)	(0.00951)	(0.0129)	(0.0120)
Educ – Lower Secundary	0.0266***	0.0253***	-	-	0.0732***	0.0624***
	(0.00528)	(0.00452)			(0.0125)	(0.0117)
Educ – Upper Secundary	0.0763***	0.0724***	0.0315***	0.0213**	-	-
	(0.00510)	(0.00436)	(0.0103)	(0.0102)		
Educ – Post Secondary	-	-	0.101***	0.0995***	0.112***	0.129***
			(0.0159)	(0.0159)	(0.0127)	(0.0120)
Educ – Vocational or professional	0.155***	0.142***	0.159***	0.132***	0.217***	0.219***
	(0.00518)	(0.00442)	(0.0109)	(0.0107)	(0.0135)	(0.0127)
Educ - Tertiary	-	-	-	-	0.417***	0.376***
					(0.0212)	(0.0194)
Currently studying	-0.243***	-0.257***	-	-0.0568***	-0.154***	-0.189***
	(0.00330)	(0.00282)		(0.00944)	(0.00850)	(0.00859)
Urban	0.0340***	0.0138***	-0.0467***	-0.0937***	0.0102**	-0.0325***
	(0.00320)	(0.00263)	(0.00391)	(0.00399)	(0.00476)	(0.00483)
2020	-0.195***	-0.0581***	-0.27336***	-0.0490***	-0.235***	-0.0593***
	(0.00203)	(0.00148)	(0.0036817)	(0.00373)	(0.00402)	(0.00407)
Region dummies	YES	YES	NO	NO	NO	NO
Pseudo R-squared	0.2755	0.2694	0.2482	0.2480	0.2732	0.2369
Observations	209,515	308,534	57,477	53,486	41,472	42,102

Note: Dependent variable equals one if the person reports having earnings, sample is working age population. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
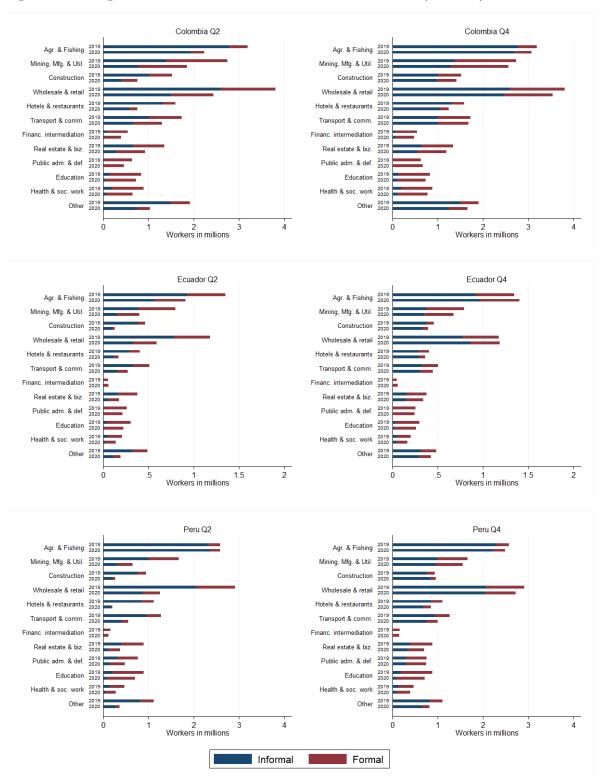Source: Authors' elaboration based on household surveys.

Table B2. Comparison of original 2020 and nowcasted 2020 data based on 2019.

	Colombia			
	Observed-Q2	Nowcast-Q2	Observed-Q4	Nowcast-Q4
Share of male	0.632	0.657	0.610	0.629
Share of Self-employment	0.428	0.427	0.485	0.463
Share of Skilled	0.312	0.312	0.289	0.280
	Ecuador			
	Observed-Q2	Nowcast-Q2	Observed-Q4	Nowcast-Q4
Share of male	0.659	0.693	0.639	0.658
Share of Self-employment	0.360	0.364	0.440	0.397
Share of Skilled	0.247	0.270	0.194	0.205
	Peru			
	Observed-Q2	Nowcast-Q2	Observed-Q4	Nowcast-Q4
Share of male	0.635	0.622	0.572	0.568
Share of Self-employment	0.452	0.451	0.451	0.434
Share of Skilled	0.253	0.230	0.225	0.218

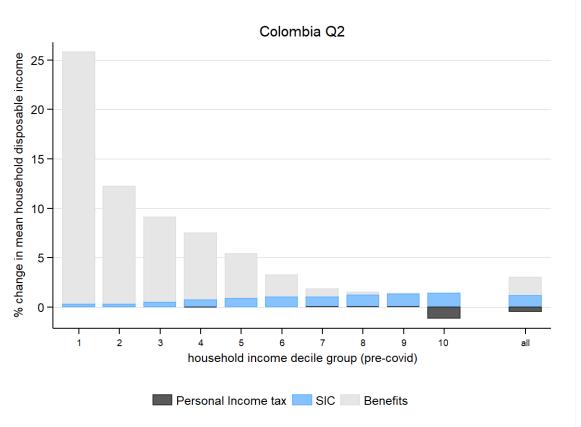Note: Skilled is defined as having education above secondary level.

Source: Authors' elaboration based on household surveys.

Figure B1. Changes in the number of formal and informal earners by industry

Source: Authors' elaboration based on household surveys.

Figure B2. Change in mean disposable income due to COVID-related policies in Colombia (Q2)

Notes: Changes in income are based on per capita household disposable income before the pandemic.
Source: Authors' elaboration based on microsimulation models COLMOD, ECUAMOD and PERUMOD.