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THE ECONOMICS AND FINANCE EFFECTS OF THE COVID-19 PANDEMIC
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The impact of the COVID-19 pandemic on poverty and inequality in Mexico

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Abstract

The objective is to quantify the effect of the COVID-19 pandemic on employment, poverty and inequality in Mexico. The methodology is based on a probit model to identify individuals at risk of employment loss, whose earnings are set to zero in ENIGH 2018 to match changes in employment and earnings observed in between December 2019 and the May 2020 according to ENOE and ETOE surveys, respectively. MEXMOD, Mexico's microsimulation model, is used to simulate tax-benefit policies based on the pre-COVID and COVID-scenarios. The results show that there was a loss of 12.1 million jobs. Poverty reached 60.16% and extreme poverty reached 29.73%; inequality grew 8.2%. It is recommended to strengthen social policy with extra funding (taxing the rich) to achieve greater redistribution. The limitation is that income distribution is held constant as we do not have ENIGH 2020. The originality is to offer timely measures of poverty and inequality using microsimulation techniques to overcome the lack of data during the pandemic. The research concludes that there are not automatic stabilizers to cope COVID-19 negative effects and cash-transfers are not sufficient to do so.
JEL Classification: C63, D31, E24, H24.

Keywords: COVID-19, microsimulation, income distribution, taxes and benefits, inequality; poverty.

El impacto de la pandemia del COVID-19 en la pobreza y desigualdad en México

Resumen

Objetivo: medir el efecto de la pandemia COVID-19 en el empleo, la pobreza y la desigualdad en México. Metodología: se emplea un modelo probit para identificar a las personas en riesgo de perder el empleo, cuyos ingresos se establecen en cero en la ENIGH 2018 para coincidir con los cambios en el empleo y los ingresos observados entre diciembre de 2019 y mayo de 2020 según las encuestas ENOE y ETOE, respectivamente. MEXMOD, el modelo de microsimulación de México, se utiliza para simular las políticas de impuestos y transferencias basadas en los escenarios pre-COVID y COVID. Resultados: una pérdida de 12.1 millones de empleos, la pobreza llegó al 60.16%, la pobreza extrema al 29.73% y la desigualdad creció un 8.2%. Recomiendaciones: fortalecer la política social con mayor recaudación (gravando a los ricos) para una mayor redistribución. Limitación: la distribución del ingreso se mantiene constante al no contar con la ENIGH 2020. Originalidad: se ofrece medidas oportunas de pobreza y desigualdad utilizando técnicas de microsimulación para superar la falta de datos durante la pandemia. Conclusión: no existen estabilizadores automáticos para combatir los efectos negativos de COVID-19.
Clasificación JEL: C63, D31, E24, H24.

Palabras clave: COVID-19, microsimulación, distribución del ingreso, impuestos y transferencias, desigualdad y pobreza.

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1. Introduction

The COVID-19 pandemic hit Mexico[2] at a time when the country's economy was already showing signs of weakness, having recorded a slight decline in GDP in 2019, at a rate of -0.048%, and a negative variation of 2.2% in the first quarter of 2020 with respect to the same quarter the previous year. A health emergency was declared on March 30th 2020, suspending non-essential activities for up to a month,[3] after which the lockdown was extended until June 2020. Despite this, the country has officially recorded 125,807 COVID-19 deaths as of December 31st, 2020.[4]

Unlike most countries, including Latin America, which expressly designed a battery of public policies and transfers to compensate for the adverse effects on employment and household income, it is also worth noting that the current administration did not add any additional funding to tackle the pandemic beyond what was already allocated in the budget at the beginning of 2020.[5] With this in mind, it is important to analyze the impact on employment, income, inequality and poverty as a result of the fall in economic activity that came with the partial or total shutdown of various sectors of the economy across the country.

A deeper understanding of these effects will lay the groundwork for considering a series of public policy proposals to compensate Mexican households for the lockdown, to determine the Mexican government's capacity to respond to future pandemics and make the corresponding adjustments to current social policy programs. It should be noted that access to health services in Mexico is not equitable and studies have reported high variations in the prevalence of the disease, with the poor having been most severely affected, owing to the fact they are unable to work remotely (Ortiz-Hernández & Pérez Sastré, 2020). Under a context of high-income inequality and high informal employment, as it was the case in Mexico prior to the pandemic, we suggest that the closing of economic activities had an important negative impact on disposable income. Furthermore, due to the lack of social assistance policies to mitigate the effect of the COVID pandemic, the protection against income losses provided by the tax-benefit system were limited.

Thus, the main objective of this research is to quantify the effects of the closure of economic activities on employment and earnings and consequently on poverty, extreme poverty and inequality. Our work is in line with recent studies that have sought to calculate the economic effects of COVID-19. Boltvinik and Damián (2020) calculate the impact of the pandemic on poverty based on losses in the labor market using aggregate data generated by the ENOE. Campos-Vazquez and Esquivel (2021) measure the drop in consumption by branch of economic activity based on the daily record of registered transactions in credit and debit card terminals for the first six months of 2020.

Our study contributes to the literature by using microsimulation techniques to assess the impact of the pandemic on income poverty and inequality, taking into account the role of tax-benefit policies. More precisely, our analysis consists of assessing the impact of employment and earnings

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[2] The first official death from COVID-19 was recorded on March 18th.

[3] Diario Oficial de la Federación (2020) (Official Gazette of the Federation, March 31st, 2020).

[4] Daily report by the Secretariat of Health, Government of Mexico.

[5] This meant that some programs had no new recipients in addition to those already enrolled in 2019 – for example, the Benito Juárez scholarships, which run in tandem with the school year, beginning in September and ending in June, and Tandas para el Bienestar. Both programs began operating last year, in 2019.

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losses on income poverty and inequality between December 2019 and May 2020, when the economy was hit hardest by the pandemic. For this, we first use National Occupation and Employment Survey ENOE and ETOE of December 2019 and May 2020 to quantify changes in employment and earnings per industries. Then, a pre-COVID and a COVID scenarios are generated based on ENIGH 2018 which work as the input database for the tax-benefit microsimulation model: MEXMOD. The pre-COVID scenario is obtained by updating ENIGH 2018 to 2019 prices. The COVID scenario is obtained by nowcasting techniques: imputing changes in employment and earnings per industry in ENIGH 2018 based on a probit model to identify individuals at risk of employment loss in order to match changes in employment and earnings per industry observed between December 2019 and the May 2020. This paper then uses for the very first time, MEXMOD to simulate tax-benefit policies in 2019 and 2020 based on the pre-COVID and COVID-scenarios.

Our results show that the largest impact in the labor market was in the informal sector, as 8.7 million informal jobs were lost, while there was only a loss of 3.4 million formal jobs. By type of economic activity, the most important job losses are observed in the construction sector (-39.6 % and -41.3%; for both formal and informal workers respectively), hotels and restaurants (-38% and -33%), and commerce (-36% and -36.2%). The largest decrease for informal workers were found in leisure and culture (-76%). While per capita disposable income decreases on average by 22%, MEXMOD simulations show an important peak on both, poverty, and inequality in May 2020, with income poverty increasing about 16 percentage points and income inequality increasing up to 4 points with a Gini index of 0.528, which represents an alarming step backwards. The effect of tax-benefit policies mitigating the effect of the economic crisis is limited. The microcredit program for small formal businesses, "Crédito a la Palabra", seems to alleviate the impact of the pandemic on per capita incomes at the bottom of the distribution, whereas decline in incomes was not evenly distributed, with greater impact in middle and top deciles.

The remainder of the paper is structured in the following order: Section 2 offers a description of MEXMOD as well as the methods and data bases used in the empirical application. Section 3 present results on employment changes and descriptive statistics prior and during the pandemic, as well as MEXMOD's simulations for changes in income, poverty, extreme poverty and inequality due to COVID-19. The final section offers our main conclusions and policy recommendations.

2. Literature Review

For Mexico and Latin America, studies addressing the economic effects of COVID1-19 using microdata have been developed, here only a handful assessing the effects of the pandemic on employment and economic inequality will be discussed. Among those relevant studies can be found research conducted by Lustig et al. (2020), Jara, Montesdeoca and Tasseva (2021), Corredor, Ríos and Rodríguez (2021), which analyzed the economic effects of COVID19 on employment and consequently on the increase in poverty caused by the closure of non-essential activities.

Lustig, et al (2020) uses microsimulation techniques and national income and expenditure surveys for the four largest countries in Latin America: Argentina, Brazil, Colombia, and Mexico, and findings shows that Argentina and Brazil were the two countries that committed the greatest deal of resources to expand social assistance during the crisis. Meanwhile Colombia and Mexico are seen as the countries with the least support to increase social assistance to deal against the pandemics.

Finally yet importantly, a limited role of COVID emergency transfers in mitigating the impact of the crisis was found in Ecuador (Jara, Montesdeoca and Tasseva, 2021) and Uruguay (Brum and de Rosa, 2021).

Jara, Montesdeoca and Tasseva (2021) uses the tax-benefit microsimulation model for Ecuador –ECUAMOD- to quantify the distributional effects of COVID-19 in that country and the role of tax-benefit policies in mitigating the immediate impact of the economic shocks. Results show a dramatic increase in income poverty and inequality where poverty rate went up from 25.7% in December 2019 to 58.2% in June 2020 and extreme poverty increased from 9.2 to 38.6% as well.

For the specific case of Mexico, Esquivel (2020) presents a complete set of studies to have a clear idea of the impacts on poverty in the country due to the pandemics, where the level even more optimistic would be of 56% of income poverty resulting in 70 million of inhabitants. Also, there are two relevant studies with the use of microdata, in that they attempt to quantify the effects of poverty (Boltvinik and Damián, 2020) and consumption (Campos-Vazquez and Esquivel, 2021).

The former study calculates the increase in poverty through the changes of employment performed and paid during the months in which economic activities were most closed, through aggregate data from the ETOE of the second quarter of the year. While in the later, the drop in consumption was estimated by using the daily record of the aggregate transactions of the terminals at the points of sale for the use of debit and credit cards, in 2020 since according to the authors, in 2019 the average monthly spending on transactions with both types of cards was $187 billion pesos (equivalent to 9 billion USD), representing 8% of GDP and 14% of consumption. A very pronounced drop in daily spending is observed, registering its worst days (middle of April) with a decrease of 35%.

3. Methodology.

Our analysis makes use of nowcasting techniques combined with tax-benefit microsimulation to assess the effect of the COVID-19 pandemic on income poverty and inequality in Mexico. We start by presenting MEXMOD, the tax-benefit microsimulation model for Mexico. Then, we describe the data used in the analysis as well as the nowcasting approach.

MEXMOD, the tax-benefit microsimulation model for Mexico.

As previously mentioned, our analysis makes use of the newly developed model MEXMOD (Llamas and Huesca, 2020), the tax-benefit microsimulation model for Mexico is used to simulate tax-benefit policies and its effect on disposable income before and during the pandemic to assess its impact on poverty and inequality in Mexico.[6] MEXMOD has been implemented on the EUROMOD platform, following the same harmonization protocols as other countries that use the platform for tax-benefit simulations (see EUROMOD 2018).[7]

[6] Access to MEXMOD can be requested at: https://www.ciad.mx/mexmod/en

[7] The EUROMOD platform was created to implement tax-benefit models for all countries of the European Union (Sutherland and Figari, 2013). Recent initiatives have taken advantage of the platform to implement tax-benefit models for developing countries. As part of the SOUTHMOD, microsimulation models have been developed for Tanzania,

Tax-benefit microsimulation models are useful tools to assess the impact of current and hypothetical fiscal policies on income distribution in terms of poverty, inequality, and revenues. MEXMOD allows performing policy simulations at the national level and also provides a harmonized setting for cross-country comparative analysis with other Latin American countries (Arancibia et al., 2019; Bargain, Jara and Rodríguez, 2017), low-income countries (Decoster et al., 2019) and European countries (Sutherland and Figari, 2013), which use EUROMOD as modelling platform.

MEXMOD is based on data from the National Survey of Household Income and Expenditure (*Encuesta Nacional de Ingresos y Gastos de los Hogares* – ENIGH) for 2014, 2016 and 2018, to simulate Mexican fiscal policies for 2014 to 2020. The model includes simulations of direct and indirect taxes, social insurance contributions and the main cash benefit policies from 2014 to 2020 (see table A.2 from appendix for more information). Simulation results for MEXMOD have been validated against official statistics (see Llamas and Huesca, 2020). Importantly, MEXMOD is a static model meaning that tax–benefit simulations abstract from behavioral reactions of individuals and no adjustments are made for changes in the population composition over time.

In this study, we use MEXMOD to compare changes in disposable incomes and the role of tax-benefit policies between December 2019 and May 2020. More precisely, the pre-COVID and COVID datasets obtained from our adjustment are used as input data for the simulations to obtain disposable income changes prior and during the pandemic and to assess the role of tax-benefit policies in place.

Cash transfers granted by the Mexican government in 2019 and 2020 are simulated in MEXMOD for individuals fulfilling the eligibility rules of the programs. For all programs, the simulations were calibrated to ensure the number of recipients and expenditure on each program matched the official figures reported in official government reports (see Llamas and Huesca, 2020). This adjustment was made for the individual non-contributory old-age pension, the *Benito Juárez scholarships* for all levels of schooling considered, the *Jóvenes Construyendo el Futuro* program, the disability benefit, the *Tandas para el Bienestar* program, and, last but not least, the *Crédito a la Palabra* program.

Once changes on disposable income are obtained from MEXMOD, we proceed to estimate poverty, extreme poverty and inequality indexes under the scenarios mentioned (pre-Covid and Covid). In that sense, we follow official measurement of poverty in Mexico according to the National Council for the Evaluation of Social Development Policy (CONEVAL, by its initials in Spanish for *Consejo Nacional de Evaluación de la Política de Desarrollo Social*), using CONEVAL's poverty lines and equivalence of scale to assure comparison (CONEVAL, 2019). To estimate inequality the standard Gini index is used, which is widely known allowing for comparison with other studies and properties of easy interpretation.

Data

Three datasets are used in our analysis: (i) the National Survey of Occupation and Employment (ENOE) of December 2019, herein ENOE-2019; (ii) the Telephone Survey of Occupation

Mozambique, Zambia, Ecuador, Ghana, Ethiopia, Viet Nam and Uganda (Decoster et al., 2019). Similar initiatives have been recently undertaken for Latin American countries (Arancibia et al., 2019) and Employment (ETOE) of May 2020, herein ETOE-2020;[8] and (iii) the National Survey of Household Income and Expenditure (*Encuesta Nacional de Ingresos y Gastos de los Hogares* – ENIGH) of 2018, herein ENIGH-2018.

ENOE-2019 and ETOE-2020 provide detailed information of socio-demographic characteristics, employment, and labor market incomes at individual level. These data are therefore used to assess the impact of the COVID-19 pandemic on employment and earnings between December 2019 and May 2020. ENIGH 2018 also contains information on socio-demographic characteristics and employment at individual level but, in addition, it contains detailed information about different sources of income, such as labor market incomes, capital income, income from property, remittances, public pensions and social benefits. This detailed information is needed to simulate taxes and benefits in MEXMOD (all monetary variables are in Mexican pesos on a monthly basis at national level -see table A.1 from appendix-).

Information on employment and earnings changes from ENOE-2019 and ETOE-2020 is used to adjust ENIGH-2018 data with the same unit of analysis, following nowcasting techniques, which are discussed in the next subsection.

Nowcasting and labor market adjustments

Nowcasting refers to the estimation of current indicators based on past microdata combined with other more aggregate current sources of information (Rastrigina et al., 2016). In our case, nowcasting techniques are required because ENIGH is collected only every two years. In this sense, the most recent data available for the simulation of tax-benefit policies and to assess poverty and inequality prior to the pandemic is ENIGH-2018. Moreover, there is no available ENIGH capturing the labor market and income situation during the period when the economy was most affected by COVID-19, that is May 2020. For this reason, nowcasting techniques are used to adjust ENIGH-2018 and create two datasets capturing the situation in December 2019 and May 2020. The approach used to build these datasets is described below.

First, a pre-COVID dataset is created based on ENIGH-2018. This is done by updating all monetary variables in ENIGH-2018 to 2019 values, using variable-specific deflators such as the Consumer Price Index. Note that only monetary variables are updated, meaning the labor market characteristics and the income distribution is assumed to be fixed to that observed in 2018. Then, a COVID-data set is created based on ENIGH-2018. This is done following a number of steps. The first step consists of calculating employment and earnings losses by industry for formal and informal employees and self-employed workers based on data from ENOE-2019 and ETOE-2020. The second step consists in applying the changes in employment and earnings into ENIGH-2018. For this, we use ETOE-2020 to estimate a probit model of the probability of having positive earnings on a sample of individuals reporting their labor market status as employees or self-employed workers, separately for formal and informal workers. The estimation captures the fact that some individuals became unemployed or inactive but also that some individuals despite reporting being in work, had no

[8] ETOE (*Encuesta Telefónica de Ocupación y Empleo*) refers to a set of telephone surveys conducted over the months of April, May and June as a result of the pandemic, which enabled the National Institute of Statistics and Geography (INEGI) to collect data and monitor employment and wage behavior adequately in the second quarter in Mexico ((https://www.inegi.org.mx/investigacion/etoe/).

earnings during the pandemic due to the impact of lockdown measures. Then, the estimated coefficients are applied to ENIGH 2018 data to select those individuals who remain as earners matching employment changes calculated based on ENOE-2019 and ETOE-2020 (first step above).

More precisely, the estimated model with ETOE-2020 follows a probabilistic normal distribution, $\Phi(.)$. The dependent variable is equal to 1 if individual *i* has positive earnings, zero otherwise. The model is estimated separately depending of formality status j, where j=1 if the worker is in formal employment, and j=2 if the worker is in informal employment, as shown in equation (1):

$$P(y_{ij} = 1|x_{ij}, z_{ij}) = \Phi(\beta_{j0} + \beta_{j1}X'_{ij} + \varepsilon_{ij} \quad (1)$$

Where vector X_i' includes as regressors individuals characteristics such as gender, age, marital status (being married), level of education, hours of work, industry of work and a dummy for living in rural areas. The results of the full set of models are shown in the Appendix.

The estimated coefficients are then applied to ENIGH 2018 to predict the probability of having positive earnings in order to select the workers who remain as earners in the COVID scenario.[9] The share of workers that retains positive earnings and changes in mean earnings are calculated by industry and formality status based on the December 2019 ENOE and the May 2020 ETOE (see Section 4). With this information, we modify the labor market status and earnings of workers in ENIGH 2018 to match the proportion of formal and informal earners per industry and mean earnings reflected in the changes between December 2019 and May 2020. The workers remaining as earners are those with the highest predicted probabilities of having positive earnings. This provides a database that reflects changes in income due to the pandemic.[10]

Finally, the pre-COVID and COVID datasets created are used to simulate tax-benefit policies and its effect on disposable income in 2019 and 2020 in Mexico using MEXMOD in order to assess the impact of the pandemic on poverty and inequality and the role of tax-benefit policies in mitigating the impact of the crisis.

Modelling assumptions

The following assumptions are made as part of the modelling to assess the impact of the COVID pandemic:

Assumption 1: The income distribution in the 2019 pre-COVID scenario is considered fixed as it was in 2018, according to ENIGH 2018.

Assumption 2: The income distribution in the COVID scenario depends on adjusted ENIGH data based on employment and earnings changes from ENOE December 2019 and ETOE May 2020. Labor market adjustments depend on a probabilistic model. Earnings adjustments depend on earnings changes by industry, employment status (employee versus self-employed) and

[9] We calculate the predictions based on each worker's characteristics, multiplied by the coefficients plus a random component to account for unobserved factors influencing the risk of becoming a non-earner (Li and O'Donoghue 2014).

[10] The methodology is based on recent studies that use microsimulation techniques for European and Latin American countries (Brewer and Tasseva, 2020; Jara, Montesdeoca and Tasseva, 2021).

formality status (formal versus informal). *Assumption 3*: Cash transfers in place in the 2019 scenario do not cover additional beneficiaries in the COVID scenario, so the number of beneficiaries of transfers in place in 2019 remain the same in 2020.

First of all, assumption (1) is of great importance as in our pre-COVID scenario we are departing from the same distribution of income as it was in 2018, this can lead to some degree of bias in our results, but trends in changes are well captured because of assumption (2) and (3).

As Mexico did not introduce new safety nets to fight against the lockdown effects, these arguments lead us to state the next hypothesis. Tax-benefit policies are likely to have limited impact in alleviating the increase in poverty and inequality generated by income losses due to the pandemic, specifically in the absence of social spending programs, post-COVID-19, designed to compensate for disposable income losses.

4. Results

Changes in employment and labor income due to COVID-19

Our study considered the month of May 2020 as a benchmark as it was when the economy was hit the hardest by the pandemic and lockdown measures. Figure 1 shows the changes that occurred in the labor market in Mexico as a result of the pandemic, based on occupation and employment surveys (ENOE and ETOE) at the end of 2019 and in May 2020.

The chart shows the impact on workers with income (earners) and workers in employment but without income (non-earners) in both the formal and informal sectors, the unemployed, and the non-working or inactive population (excluding full-time students, pensioners or individuals with a disability).[11] Changes in unemployment are insignificant since unemployment tends to be more of a permanent status in Mexico, and instead workers left jobless joined the ranks of the inactive population.

This shift affected, above all, Mexicans working in the informal sector, where 8.7 million jobs were lost. The formal sector, meanwhile, lost 3.4 million workers, a figure that, while not insignificant, is to some extent a reflection of the fact that there were “winners and losers” across sectors of the economy and the private sector did, to some degree and insofar as possible, heed the president’s call not to lay off essential workers or reduce their pay.

[11] According to INEGI (2020), an unemployed person is someone aged 15 and over, who was not in employment during the reference of week but actively seeking a job in the same period. Whereas an inactive person refers someone aged 15 and over, who was not in employment during the reference of week but actively seeking a job in the last month (economically inactive population includes students, housewives, pensioners or retirees, disabled and other inactive)

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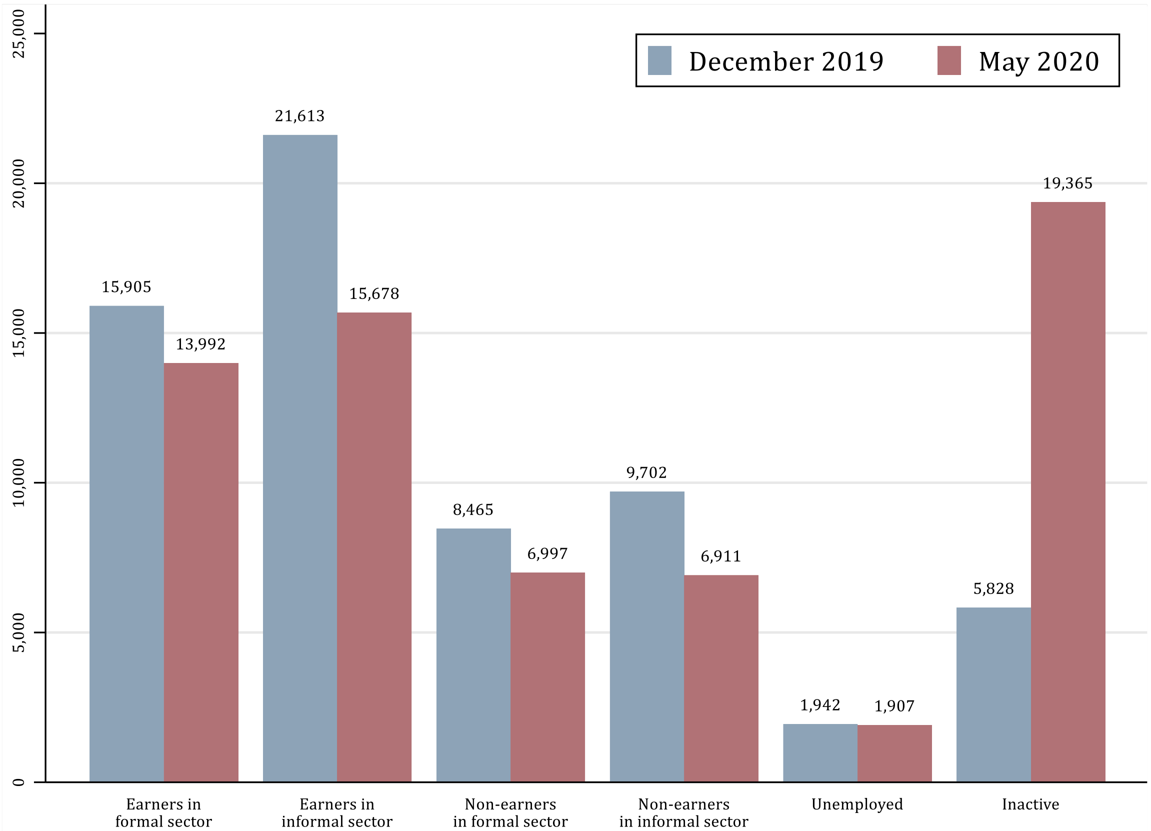

Figure 1. Changes in the Mexican labor market between December 2019 and May 2020 (thousands of individuals).
Source: Own work based on ENOE 2019-4 and ETOE 2020.

Figure 2 shows the change in the number of formal and informal earners between December 2019 and May 2020. A substantial fall is observed in the number of income earners, both for formal and informal workers, with the latter subject to the greatest change. The heaviest losses in earners in both markets (formal and informal) are found in the construction sector (-39.6 % and -41.3% respectively), hotels and restaurants (-38% and -33%), and commerce (-36% and -36.2%). In the formal sector, further substantial drops are observed in mining and manufacturing (-18.5%) and transport and communications (-18.3%). These results are consistent with the drop in consumption by sector calculated by Campos-Vázquez and Esquivel (2021) for the first semester of the year, with consumption in tourism, transportation, and food services at the end of July reported to be between 60% and 70% of what would have been expected resulting from COVID-19 lockdowns.

In contrast, the greatest changes in the informal market are found in the leisure and culture sector (-76%) and financial intermediation (-37%). Agriculture exhibited a two-way behavior, in that the number of earners fell by 24% in the informal sector whereas the number of formal earners rose by 44%. Financial intermediation also performed well in the formal market, with a 16.9% increase, as did real estate (6.9%). Lastly, government was the only sector to respond dynamically, with an increase of almost 70% (formal employment) and 14% (informal employment). In sum, as noted above, the greatest change in the number of earners occurred in the informal market, which no doubt serves to cushion the most adverse effects on the labor market and paves the way for a faster recovery, as has been recorded in the final months of 2020.

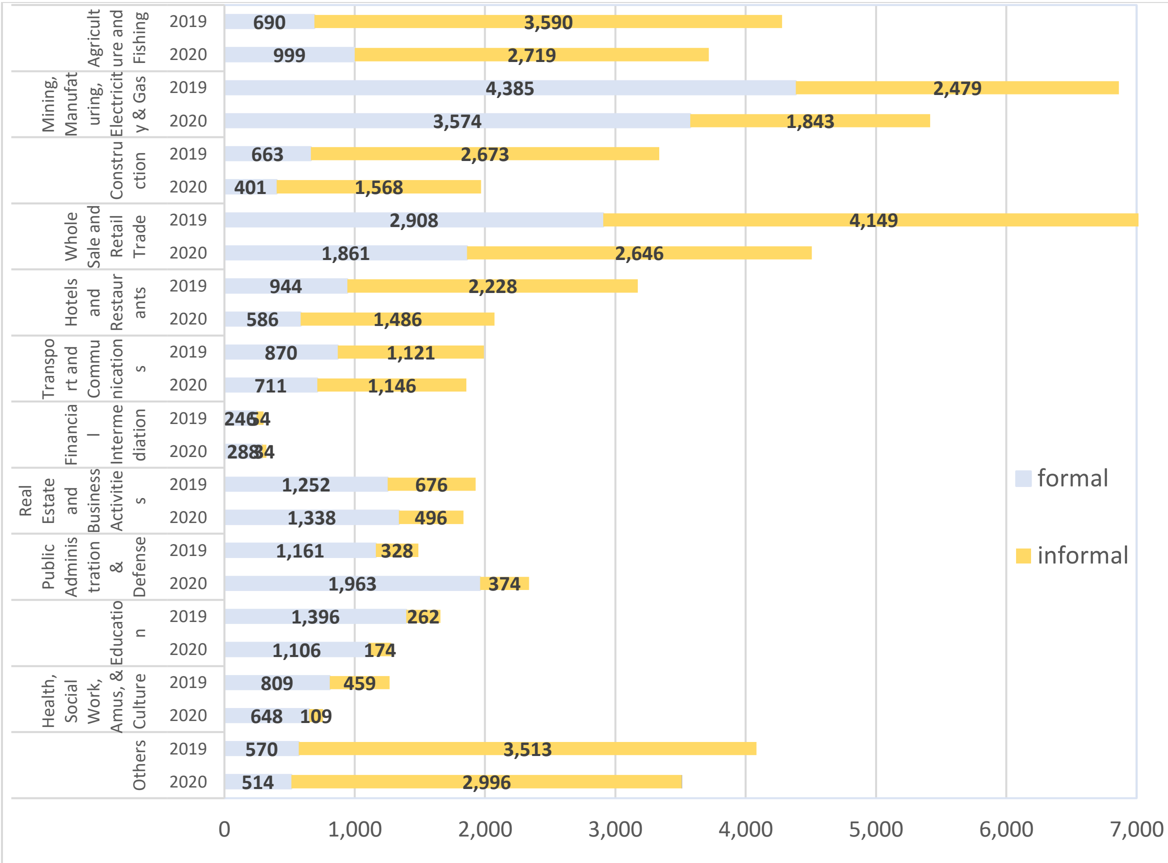

Figure 2. Number of formal and informal earners in December 2019 and May 2020 (in thousands of workers).

Source: Own work based on ENOE 2019 Q4 and ETOE May 2020.

Simulating changes in per capita disposable income, poverty, and inequality due to COVID-19

The drop in mean per capita disposable income is shown in Figure 3 (white circles), which classifies households by per capita disposable income deciles prior to the pandemic.[12] A general downward trend in disposable income following the shutdown of the economy can be observed across all deciles, with an average change of -22%. However, this decline is not evenly distributed, with a greater drop observed in the middle and top deciles. This is somewhat similar to results found for Ecuador (Jara, Montesdeoca and Tasseva, 2021), Colombia (Corredor, Ríos and Rodríguez, 2021) and Argentina, Brazil, Colombia, and Mexico (Lustig et al., 2020), where the middle strata experienced the greatest loss of income.

[12] In EUROMOD based models, disposable income is the sum of gross market income and transfers, minus taxes, employees' social security contributions, and self-employed social security contributions. Per capita disposable income is obtained by aggregating disposable income at the household level and dividing it by the total number of members of the household.

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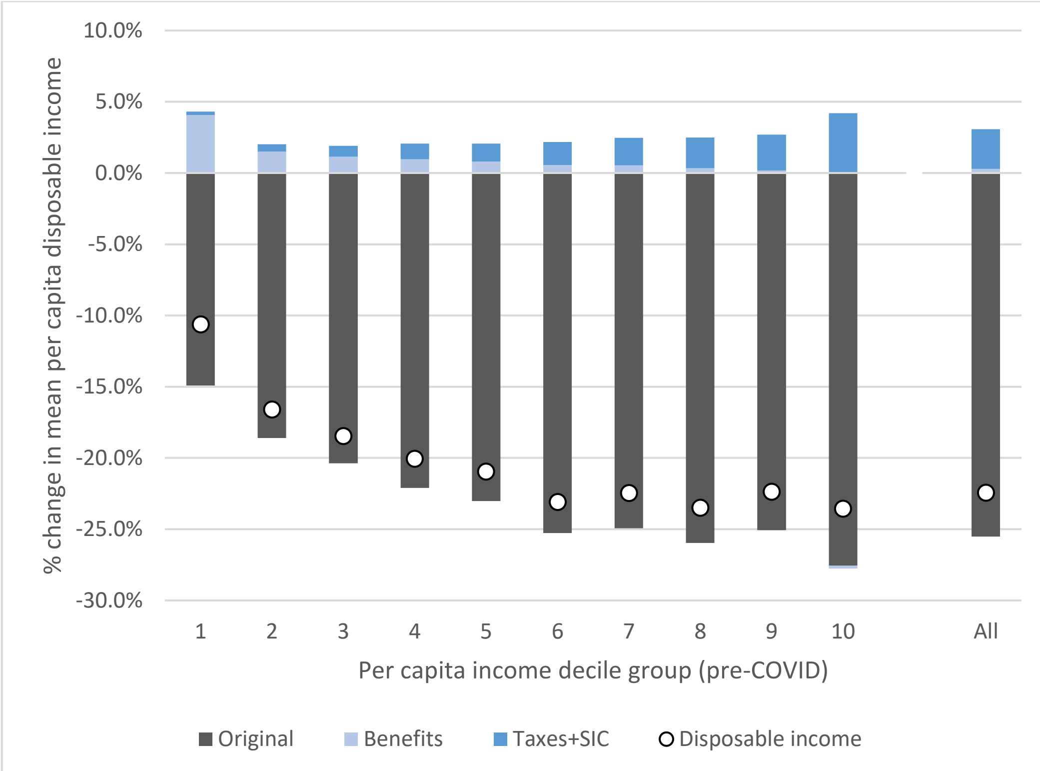

Figure 3. Change in average disposable per capita income by income decile
Source: Own work based on ENIGH 2019, 2020, and MEXMOD v1.1.

Although the other four countries mentioned above put in place social programs in response to COVID-19 that aimed to cushion the impact on income for the lower deciles, there were no such programs in Mexico. Three factors can be put forward to hypothesize why deciles 1 and 2 saw a smaller decline of 10.5% and 16.6% respectively: 1) Before COVID-19 emerged, the new administration had promoted a recovery of the minimum wage, which was one of the lowest in Latin America. This led to a cumulative real increase in the minimum wage of 41% in the two years of the current administration nationwide and 104% for cities in the northern border region.[13] These wage policies have had positive effects on the first quintile, which includes workers earning between one and two minimum wages. 2) Agricultural activities have a substantial impact on the first quintile and did not shut down at all. 3) A new program, *Crédito a la Palabra* began in 2020, according to its operation rules it was taken up more widely in the lower deciles, which had an impact on small-scale family businesses and self-employed workers. Although *Crédito a la Palabra* is not a COVID-related benefit, its effect is captured in our analysis as we compared the situation at the end of 2019 to that in May 2020 so that it was already included in the latter year.

Table 1 presents the results of the impact of COVID-19 on income poverty by using two scenarios according to the type of income concept: a) Scenario A for disposable income and b) Scenario B for post-fiscal income. The former is in line to the official income concept in CONEVAL (2019, 2020a); meanwhile the latter includes indirect taxation (VAT, excise taxes payments). Both

[13] CONASAMI. National Minimum Wage Commission. (https://www.gob.mx/conasami)

scenarios include all the set of current cash transfers (those indeed, not included in CONEVAL calculations).[14]

Table 1. Microsimulation of the impact of COVID-19 on poverty in Mexico (percentages).

Year	MEXMOD Scenario A (a)		MEXMOD Scenario B (b)		CONEVAL (c)		Ratio (a) / (c)	
	Extreme poverty	Poverty	Extreme poverty	Poverty	Extreme poverty	Poverty	Extreme poverty	Poverty
2018	12.46	45.45	15.72	50.05	16.8	48.8	0.74	0.93
	[0.002]	[0.004]	[0.002]	[0.004]				
2019	11.65	39.69	14.14	44.30	n.a.	n.a.	-	-
	[0.002]	[0.004]	[0.002]	[0.004]				
2020	26.44	56.07	29.73	60.16	n.a.	n.a.	-	-
	[0.002]	[0.004]	[0.002]	[0.004]				
2020 without COVID-19	12.06	40.28	14.50	45.00	n.a.	n.a.	-	-
	[0.003]	[0.004]	[0.003]	[0.003]				

Note: Bootstrap standard errors in brackets. The results for 2020 are given for a scenario taking into account the declines in employment and income observed between December 2019 and May 2020. The results for 2020 without COVID-19 show the trends had there been no economic crisis due to the pandemic.

Source: Own work based on MEXMOD v1.1 and CONEVAL (2020).

By using disposable income, poverty fell in scenario A in 2019 compared to 2018 and, without the pandemic; it would have remained stable between 2019 and 2020 with a total poverty level of 40%. In the context of COVID19 lockdown, it can be seen how our estimates shows a seemingly same rate presented in Esquivel (2020) of 56% in total poverty and regardless the source or Institution involved in the calculations.

When we use the post-fiscal income figure in scenario B (adding indirect taxes) total poverty in the country without COVID19 scenario would be of 50.05% in 2018 to 45.0% in 2020. In addition to the three factors mentioned above, the innovative result in the fall of poverty between 2018 and 2019 can also be explained by a major restructuring of social programs in 2019 with the current government, which are simulated in MEXMOD. Extreme poverty, meanwhile, would have fallen from 15.7% to 14.5% without COVID-19. However, when the impact of COVID-19 is taken into account, total poverty exceeds initial levels, reaching 60.16%, and extreme poverty rebounds to more than double the level recorded in 2018, at 29.73% of the population, well over the initial level of 15.7%.

Among the aspects to be highlighted, the universalization of non-contributory pensions aimed at the elderly, its amount was doubled ($ 65 usd per month) and its coverage expanded. In addition, similar support began to be given to people with some type of disability. Increase in the

[14] It is relevant to mention that CONEVAL's calculation of poverty assumes a homogeneous decline of 5% across all income levels holding constant the impact from the old cash transfers in the survey ENIGH 2018 (CONEVAL, 2020b).

coverage of scholarships to basic, secondary and higher education. "Jóvenes Construyendo el Futuro", aimed at young people without work experience and who do not study, its coverage of the scholarship is focused, with priority to graduates of schools for rural teachers, intercultural and agrarian universities.

Although our poverty results are higher than those estimated by CONEVAL (2020b) it can be inferred an underestimation of their figures compared to our scenario B, with an increase ranging from 7.2 to 7.9%; whereas MEXMOD prediction with post-fiscal income would represent an increase of 10.11 points.

The chart shows how social policy has been beneficial in the 2018-2020 period, but the pandemic has reversed all the progress achieved in the first year of the current administration.

As far as inequality is concerned, the MEXMOD calculations follow the trend of the official CONEVAL figure in 2018. The indices in Table 2 show how inequality has behaved since the last official year of reference, 2018. In the short-term inequality is not subject to sudden changes due to the fact that it is a structural phenomenon. According to scenario A (by using disposable income), inequality increases from 0.487 in 2018 to 0.520 in 2020 with the pandemic; while results from scenario B (the post-fiscal income) are 0.493 and 0.528, respectively. Evidence shows an alarming step backwards reducing inequality, reaching levels even higher than those observed during the crisis of 2008 and subsequent years. [15] [16]

Table 2. Microsimulation of the impact of COVID-19 on inequality in Mexico (Gini Index)

Year	MEXMOD Scenario A (a)	MEXMOD Scenario B (b)	CONEVAL (c)	Ratio (a) / (c)
2018	0.487 [0.004]	0.493 [0.004]	0.469	0.988
2019	0.483 [0.004]	0.488 [0.004]	n.a.	-
2020	0.520 [0.004]	0.528 [0.004]	n.a.	-
2020 without COVID-19	0.479 [0.004]	0.484 [0.004]	n.a.	-

Note: Bootstrap standard errors in brackets. The results for 2020 are given for a scenario taking into account the declines in employment and income observed between December 2019 and May 2020. The results for 2020 without COVID-19 show the trends had there been no economic crisis due to the pandemic.

Source: MEXMOD v1.1 and CONEVAL (2020).

As a point of comparison, the study carried out for Ecuador by Jara, Montesdeoca and Tasseva (2021) using the microsimulation model ECUAMOD, also shows an important fall in household incomes and a sharp increase in poverty and inequality. Their findings show that tax-benefit policies had little impact in mitigating the effect of the pandemic on poverty and inequality. COVID-19

[15] The Gini index simulated by MEXMOD for 2018 was 0.493, just higher than the official figure of 0.469. The major advantage offered by the simulator is that it becomes possible to obtain indices for the years in which no ENIGH survey was conducted. One interesting finding is that without COVID-19, the Gini index would be 0.484.

[16] According to CONEVAL (2020a), Gini Index values were 0.505 and 0.509 in 2008 and 2010, respectively.

transfers cushioned to some extent the drop in earnings at the bottom of the distribution, but the middle class was left unprotected. The pattern is therefore similar to that observed in Mexico, however, no COVID transfers were implemented in the latter, where a small cushioning effect at the bottom of the distribution might had come indirectly from *Crédito a la Palabra,* which began in 2020.

Our results are also in line with recent research by Lustig et al. (2020), which points to larger losses in the middle of the income distribution. However, there are two important differences between our study and that of Lustig et al. (2020). First, their study simulates the annualized impact of the pandemic, whereas we look at the effect during the period when the economy was hit the hardest. Our simulated impact of the pandemic is therefore larger. Second, our analysis considers all changes in tax-benefit policies, which includes the most recent and complete set of cash transfers in force in 2019 and 2020. Despite it is beyond the scope of the research as we did not apply disaggregated analysis, we might expect a cushioning effect of *Crédito a la Palabra* program at the bottom of the distribution.

Empirical evidence discussion on the grounds

Lastly, the Mexican state has announced that it will not resort to public debt to promote infrastructure and short-term social development, as many countries around the world have done, in a desire to boost domestic demand and revive the economy sooner. This shows that, despite the government's initial aim to strengthen social policy, without the necessary revenues and improved conditions on the labor market, the path to recovering economic growth and reducing inequality will be piecemeal, lengthier, and without redistribution under a progressive fiscal policy.

These policy reforms should be achieved by closing the gap on the tax-burden between the wealthier and the middle incomes by removing the loopholes; otherwise, the Mexican treasury will remain one of the worst performing collectors of tax revenue in Latin America leaving the country in a revenue trap without exceeding 14 GDP points of revenues only from taxes.

The empirical findings from MEXMOD offers two fashionable ways to produce poverty and inequality estimations, one that follows the disposable income concept as it is done in CONEVAL with some degree of underestimation; and the second, which includes indirect taxation and a more reasonable level closer to the poverty reality in the country. This novel microsimulator will allow anticipating poverty estimates before the income and expenditure survey is carried out, and be able to make adjustments on the social policy agenda.

5. Conclusions and policy recommendations

The COVID-19 pandemic in Mexico has likely worsen wellbeing indicators, causing a substantial increase in extreme poverty and inequality. This will stall the social progress achieved under the current administration with an increase of 4 points in the Gini index, bringing it to 0.528.

Putting MEXMOD's tax-benefit model innovation on the table, the paper highlights options to measure the effects of a new social policy agenda in Mexico despite new income and expenditure survey is still yet to come. Besides, since social security contributions, taxes and the most significant transfers are simulated, only information on household and individual characteristics are needed to determine how many beneficiaries would recieved the simulated subsidies and support tax burden.

Unlike in other countries such as Argentina, Brazil, Colombia, Uruguay, or Ecuador, in Mexico no action plan was implemented to address the economic crisis and stabilize the negative impact on the population and on businesses but the current use of the public policies package already in action during the same year. Also notable is the lack of a contributory unemployment insurance benefit in Mexico that could serve as an automatic stabilizer of per capita income in adverse shocks like job losses (like in Ecuador does).

The current administration based its support on a set of social policies designed in 2019, and one new policy in 2020 called *Crédito a la Palabra*, which has, to some degree (and without having been designed to that effect), served to alleviate the negative impacts of the economic shutdown this year. This has undoubtedly prevented a decline in income and poverty levels much greater than the figures reported in this study. Nonetheless, the lack of benefits acting as automatic stabilizers is patently clear and leaves the poor vulnerable, together with the middle-income distribution deciles, who have been hard hit by the crisis.

Our results show that extreme poverty increases the most from 2019 to 2020, jumping from 14.14 to 29.73%, over 15.6 percentage points, while total poverty level increases from 44.30 to 60.16% of the population, almost 16 points. When the estimates come from disposable income, total income poverty is 56%, figure possibly understated to the real values and close or equal to the most recent estimates by many institutions and academic experts in the field.

This shows that social policy needs to be bolstered with extra funding (by removing the loopholes) to achieve greater redistribution potential and reduce poverty. As it was observed during the first year of the López Obrador administration, which should go hand in hand with improvements in raising direct taxes, as the procedure to raise additional revenue starts to become worn down from budget cuts and the fight against corruption. This will equip the government with stronger social protection from within, enabling it to make use of automatic stabilizers in fiscal policy, in addition to welfare programs, and accelerate the improvement of human capital and the employability of the poorest segments of the population. This would need to occur alongside redistributive fiscal measures conducive to a formalization of jobs in the current context of the health crisis, which would in turn help to strengthen the social security system in the country, improving access for all.

Our evidence highlights the fact that the increase in poverty and inequality due to COVID-19 is not the result of an increase in unemployment, but rather two factors: 1) the substantial decline in the number of income earners, who have become inactive; and 2) the drop in earnings, which amounts to around 22% of mean per capita disposable income.

Based on the findings from MEXMOD, considering a counterfactual scenario without the pandemic, there would have been no descent into extreme poverty or general poverty between 2019 and 2020; rather, poverty would have stagnated. This surely compels us to revisit the country's social policy to understand the factors that have prevented further positive results. Under the current circumstances, a publicly available tax-benefit model as MEXMOD represents a powerful tool for policy analysis. The model could, for instance, be used to assess the impact of hypothetical policy reforms aimed at reducing the current levels of poverty and inequality in the country. Both, tax reforms and reforms to cash transfers can be analyzed jointly in the model to assess their effects on disposable incomes, poverty an inequality.

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Appendix

Table A1. Marginal effects from PROBIT of being formal/informal earner in Mexico during the COVID pandemic in May 2020.

Variables	(1) Formal earner	(2) Informal earner
female	0.164*	0.149*
Age	0.00498	0.0263*
Age^2	-0.000182+	-0.000443*
married	0.0579	-0.128*
No schooling or basic education	base	base
Middle schooling	-0.151*	-0.194*
High schooling	-0.392*	-0.444*
Rural	0.190*	0.341*
Hours of work <= 20	base	base
Hours of work > 20 & <40	-0.126*	0.0690
Hours of work = 40	-0.234*	0.229*
Hours of work > 40	-0.0476	0.151*
Not applicable	base	base
Agriculture and Fishing	0.825*	0.359+
Mining, Manufacturing and Utilities	0.697*	0.259
Construction	0.686*	0.569*
Wholesale and retail trade	0.591+	-0.00904
Hotels and restaurants	0.696*	0.221
Transport and communication	0.561+	0.346
Financial intermediation	0.751*	0.0971
Real estate and business activities	0.680*	0.161
Public administration and defense	0.709*	0.705*
Education	0.730*	0.503+
Health and social work	0.557+	0.265
Other	0.511	0.577*
_cons	0.121	-0.210
N	5883	3010

p-value statistics: $^{+}$ $p < 0.10$, * $p < 0.05$

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Table A.2. MEXMOD basic statistics
(Monthly Mexican pesos)

Variable	Observations	2019				2020				Δ Mean
		Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	
Disposable income	125,189,618	3,988	8,428	0	1,345,261	3,027	7,061	0	1,279,129	-24.11
Market income	125,189,618	4,344	11,465	0	2,055,489	3,241	9,879	0	1,969,586	-25.39
Earnings	125,189,618	3,817	7,593	0	391,157	2,790	5,608	0	289,371	-26.89
Benefits	125,189,618	465	1,680	0	124,100	478	1,631	0	119,343	2.62
Taxes	125,189,618	754	3,450	0	710,228	639	3,132	0	690,456	-15.16
Social Security Contributions	125,189,618	68	170	0	5,128	53	142	0	5,273	-22.36

Source: Authors' elaboration using MEXMOD v1