Effects of the Covid-19 pandemic on income impoverishment in Ecuador

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Abstract

The pandemic increased poverty worldwide. However, the mechanisms affecting its determinants still need to be clarified. This paper studies this problem using a probabilistic model of poverty extended with pandemic incidence variables and applying logistic regression on a household level. For the case of Ecuador, we use the December rounds of the 2019 and 2020 National Survey for Employment, Underemployment and Unemployment (ENEMDU), the administrative record of the Covid-19 epidemiological report, and the administrative record of deaths. The results show that the pandemic's impact on poverty was through the gender gap and labor market structure.

Keywords: income poverty; determinants of poverty; Covid-19; transmission mechanisms; exogenous shock.

1. INTRODUCTION

Globally, the Covid-19 pandemic has caused immense economic and social devastation. In Ecuador, between December 2019 and December 2020, the percentage of people living below the income poverty line increased from 25 to 33%. Therefore, one in three Ecuadorians is income poor. In 2020, 1.4 million people dropped to poverty (National Institute of Statistics and Census [INEC], 2021b).

The Covid-19 pandemic was an external shock for the world economy (Verick et al., 2021). Mandatory confinements were established to control the high incidence of cases and deaths, which led to the paralyzing of productive activities (Verick et al. 2021). This dynamic regressively affected society, given the existence of a vulnerable middle class, whose income was reduced, who work in the informal labor market, who have no saving capacity and who have no effective social protection mechanisms (Castilleja, 2020; Jara et al., 2021). In the case of women, they were affected by confinement, as unpaid care tasks increased due to the fact that children's education and work took place at home (Mideros and Fernandez, 2021). Furthermore, the economic paralysis affected the diverse, productive sectors in different ways, because priority activities were established that never stopped (Economic Commission for Latin America [CEPAL], 2020).

In this context, household income decreased, leading to an increase in the percentage of people subject to income poverty and the factors that influenced the increase in poverty as a result of the pandemic need to be analyzed. The question posed in this paper is the following: To what extent did Covid-19 affect the determinants of income poverty?

First of all, this paper develops a model of determinants of poverty on a household level for Ecuador based on the December 2019 and 2020 rounds of the National Survey of Employment, Unemployment and Underemployment (ENEMDU), carried out by the National Institute of Statistics and Census (INEC) of Ecuador. These are the two closest points of comparison before and after the isolation measures implemented due to the pandemic. The model is extended by incorporating pandemic variables on a regional canton level: number of cases per 100,000 inhabitants, excess deaths per 10,000 inhabitants and Covid-19-related deaths per 10,000 inhabitants. Finally, a model was constructed with interactions between the pandemic incidence variables and those of women, groups and branches of activity to analyze the transmission of economic stagnation to income poverty.

The study is organized as follows: after this introduction, the second section presents the underlying theory in relation to poverty, its determinants, the nature of adverse exogenous shocks and the empirical evidence. The third section presents a contextualization of the crisis in Ecuador, which theoretically identifies the mechanisms of transmission of the pandemic in relation to poverty. The fourth section presents the methodology, data sources and descriptive statistics and the fifth section presents the results. Finally, the conclusions are presented in the sixth section.

2. POVERTY AND ITS DETERMINANTS

Poverty is defined as the "pronounced deprivation of well-being" (Haughton and Khandker, 2009, p. 1). There are several approaches to measuring poverty; measuring poverty by income level determines a poverty line that represents "the cost of a fixed minimum level of economic welfare" (Ravallion, 2016, p. 14). This approach is helpful in analyzing poverty at given moments in time, given that it immediately responds to economic cycles (Núñez et al., 2006), as is the case in this paper.

Focusing on the relationship between poverty and its determinants, Peng et al. (2019, p. 3) establish that they are framed by "macro, community and micro level characteristics". When analyzing the micro level, the factors that affect the probability that a household may be poor are gender of the head of the household, age (Haughton and Khandker, 2009), ethnicity (Canelas and Salazar, 2014), marital status, education level (Peng et al., 2019), occupation (Canelas and Salazar, 2014) and location of the household.

On a community level, poverty is related to access to electricity, proximity to markets, hospitals and schools; to the labor market, land distribution and social capital (Haughton and Khandker, 2009). On a macro level, it is considered that economic, political and social deficiencies in the system restrict opportunities to escape poverty (Bradshaw, 2007).

Negative external shocks can generate poverty. They can be in relation to supply when they reduce a country's productive capacity and in relation to demand when society's consumption and investment capacity are affected (Torres and Fernández, 2021). In the first case, when the supplies needed for production are reduced, companies are forced to reduce personnel in order to remain operational (Torres and Fernandez, 2021). Therefore, there is an increase in unemployment and, consequently, in income, especially for middle-class households without social protection, which are the most affected (Castilleja, 2020). In this context, automatic stabilizers, despite their ability to mitigate the effects of a negative external shock, may promote vulnerability and marginalization of the informal sectors of society when they are not universal, comprehensive and sustainable (Jara et al., 2021).

As far as demand is concerned, in the event of a reduction in workers' incomes, household consumption also diminishes (Hernández, 2020); thus, households that could not save are left vulnerable and unable to meet their basic needs (Castilleja, 2020). This dynamic is evidence that an external shock has a regressive effect on the economy when there is no effective social protection policy (Akter and Mallick, 2013).

Mideros et al. (2021) constructed a model of determinants for poverty for 2020 in Ecuador. The authors found that a female head of the household is associated with a higher probability of poverty than a male head (Mideros et al., 2021). When the head of the household self-identifies as an ethnic minority, there is a higher probability of being poor compared to mixed-race heads of the household (Mideros et al., 2021). If the head of the household is unemployed, there is a greater probability of poverty (Mideros et al., 2021).

Morán and Lozano (2018) researched the determinants of rural poverty in Ecuador and found that a high level of education reduces the risk of poverty. A person who lives in the highlands is more likely to be poor than someone living on the coast. On the other hand, in rural Ecuador, it is established that being employed, in any form, constitutes a mitigating factor for poverty (Morán and Lozano, 2018). In addition, when an individual participates in agricultural activities, they are more likely to be poor than someone employed in the public or private sector (Morán and Lozano, 2018).

Using scenario methodology, Correa et al. (2020) established that in Ecuador, because of the Covid-19 pandemic, if total household income is reduced by 20%, income poverty would increase to 34.7%. On a regional level, the Economic Commission for Latin America and the Caribbean (CEPAL, 2021b) established that, income poverty would be 33.7% due to the pandemic On a global level, the World Bank (2020) established that, by the end of 2020, Covid-19 would increase the number of people in poverty from 88 to 115 million.

3. CONTEXTUALIZATION OF THE 2020 CRISIS IN ECUADOR

As a result of the increase in infections and deaths caused by the Covid-19 pandemic, compulsory confinement was imposed in Ecuador, which led to the paralysis of economic activity. As a result, the Ecuadorian economy decreased by 7.8% by the end of 2020 (Banco Central del Ecuador [BCE], 2021). Companies stopped selling, liquidity contracted and unemployment increased from 3.8% to 5% between 2019 and 2020 (BCE, 2021).

This dynamic reduced household consumption, which, between the fourth quarter of 2019 and 2020, registered a negative variation of 6.7% (BCE, 2021). In this context, automatic stabilizers can alleviate the economic effects of the crisis. However, Jara et al. (2021) showed that the Family Protection Bond, the Human Development Bond and unemployment benefits had a limited effect on the social protection of the population due to the eligibility schemes and the high level of informality of society.

One of the transmission mechanisms of Covid-19 in relation to poverty is the gender gap, given that in Ecuador, women were more affected than men (Organization for Economic Cooperation and Development [OECD], 2020). As a result of the pandemic, there was an overload of unpaid care work, which fell on women and resulted from confinement, school closures and compulsory work at home (Esteves, 2020; OECD, 2020). In addition, the most affected economic activities were female labor-intensive sectors (CEPAL, 2021a; Mideros and Fernandez, 2021). Therefore, due to the pandemic, women's incomes were reduced, their participation in the labor market decreased and their quality of life deteriorated (Esteves, 2020).

Another transmission mechanism of Covid-19 in relation to poverty is the structure of the labor market. The BCE (2020) identified the losses due to the pandemic by branch of activity according to the variation rate of Gross Added Value (GAV). The sectors that were most affected were: accommodation and food services, with a 26.2% decline in GAV, followed by education and health and social services, with a 15.1% reduction and transportation and storage, with a 13.6% decrease (BCE, 2020). In contrast, the industries with the smallest losses were: agriculture, livestock, hunting and forestry, with a 3.1% reduction in GAV and communications, with a 1.4% decrease (BCE, 2020).

4. METHODOLOGY

This study analyzes the probability of being poor on a household level since this is the unit of identification of poverty in Ecuador. In this respect, the characteristics of the male or female head of the household were taken as determinants. The endogenous variable is binary because there are only two values: 1 when the head of a household is poor and 0 when he/she is not. In order to analyze the determinants of poverty, together with indicators of pandemic incidence, a binary response model, such as the logit model, is required (Wooldridge, 2010).

$$P(x) = G(\beta_0 + \beta_1 x_1 + .. + \beta_k x_k) = G(\beta_0 + x\beta) \quad (1)$$

In this equation, x_k represents the set of independent variables, in this case, the determinants of poverty. β_k are the estimated coefficients for each exogenous variable and *G* represents the cumulative distribution function for a random logistic variable (Wooldridge, 2010):

$$G(z) = \frac{exp(z)}{[1 + exp(z)]} = \Lambda(z) \quad (2)$$

G is between 0 and 1 for all real numbers *z*. Meanwhile, to optimally interpret the results, the marginal effects produced by each exogenous variable on the endogenous binary variable must be analyzed (Greene, 2012). To obtain the effect of an explanatory variable x_j on *P(x)*, the partial derivative is obtained (Babu et al., 2014):

$$\frac{\partial P(x)}{\partial x_j} = g(\beta_0 + x\beta)\beta_j \quad \text{where} \quad g(z) = \frac{\partial G}{\partial z}(z) \quad (3)$$

When indicating that the cumulative distribution function is strictly increasing, the partial effect of x_j on *P(x)* has the same sign as the estimated coefficient for that explanatory variable. Therefore, by obtaining the estimate of β_j from the logit model, only the dynamics of the relationship between the exogenous and endogenous variable can be established, whereas by estimating the marginal effects, the magnitude of the probabilistic relationship can be defined (Babu et al., 2014).

In this model, the determinants of poverty of the head of the household are gender, age, marital status, ethnic self-identification, level of education, area of residence, size of the home and occupational group. Based on this model of determinants, a comparison is made between the marginal effects for the years 2019 and 2020, to identify whether there were changes in the relationship between these characteristics and the probability of being in poverty.

Secondly, the model of determinants is extended with the Covid-19 incidence variables referring to the morbidity and mortality generated by this disease (see Annex A). These variables are constructed on a territorial level and allow us to analyze the overall effect of the presence of the disease on the probability of poverty.

Thirdly, a model is presented with interactions between the gender variable and occupational group with the pandemic variables. Finally, a model is made substituting the occupational group by the branch of activity (see Annex B) and their respective interactions with the Covid-19 incidence variables. Thus, we evaluate the existence of channels of pandemic affectation by gender, occupational group and branch of activity.

Data

This research uses the ENEMDU for December 2019 and 2020, which allows for comparison between the immediate pre- and post-pandemic points. The ENEMDU aims to "provide information on the economic activity and sources of income of the Ecuadorian population" (INEC, 2020a, p. 5).

The survey is conducted every quarter in March, June, September and December, and includes national, urban and rural representation. In 2020, due to the pandemic, it was published only twice: in September and December (INEC, 2020a and 2021a). The survey has a two-stage stratified probabilistic sampling model. In the first, "the Primary Sampling Units (PSU) are selected by stratum and in the second, occupied dwellings are selected within each of the PSUs" (INEC, 2020b, p. 6).

Based on the ENEMDU, determinants concerning the personal characteristics of the head of the household and dwelling are incorporated. However, in this paper, an extension of the model is carried out, including variables from Covid-19 on a regional canton level. These variables allow us to estimate the economic impact of the pandemic, since the higher the number of cases and deaths, the more severe the isolation and the greater the economic stagnation. Therefore, the Covid-19 variables constitute approximations of the intensity of economic stagnation. As clarification, we are not seeking to establish causality between the rate of those affected by the virus and the probability of poverty.

To construct the Covid-19 incidence variables, we used the statistical registry of general deaths, compiled by the INEC, based on the administrative record of deaths prepared by the General Directorate of Civil Registry, Identification and Cedulation. This database contains the number of deaths on a national level from January 1 to December 31, 2019 and 2020. The aim is to construct the variable of deaths related to Covid-19 per 10,000 inhabitants and the variable of excess deaths per 10,000 inhabitants.

The third source is the administrative record of epidemiological reports from the Ministry of Public Health (MPH) from March 13 to December 31, 2020, which provides the number of Covid-19 cases. The constructed variable is the number of infections per 100,000 inhabitants.

Descriptive statistics

Table 1 shows the descriptive statistics of income poverty on a household level and for each determining factor. Based on the ENEMDU, from 2019 to 2020, income poverty increased from 18.7% to 25.8% of households. In addition, poverty in households with a female head of household increased from 28.2% in 2019 to 31.5% in 2020.

Table 1. Descriptive statistics of poverty by income of the head of household and its determinants

Variables	2019					2020				
	Observations	Mean	Standard deviation	Minimum	Maximum	Observations	Mean	Standard deviation	Minimum	Maximum
Poverty of the head of house-hold	16 858	0.19	0.39	0	1	8.631	0.26	0.44	0	1
Demographic characteristics										
Female	17 001	0.28	0.45	0	1	8 756	0.32	0.47	0	1
Age	17 001	51.51	15.89	15	99	8 756	51.42	15.87	14	98
Age squared	17 001	2 905.89	1 745.35	225	9 801	8 756	2 895.71	1 728.61	196	9 604
Marital status										
Divorced	17 001	0.04	0.21	0	1	8 756	0.05	0.22	0	1
Widowed	17 001	0.098	0.29	0	1	8 756	0.10	0.31	0	1
Single	17 001	0.09	0.3	0	1	8 756	0.09	0.29	0	1
Ethnic characteristics										
Afro-Ecuadorian	17 001	0.05	0.23	0	1	8 756	0.04	0.2	0	1
Montubios	17 001	0.08	0.28	0	1	8 756	0.05	0.22	0	1
Indigenous	17 001	0.08	0.28	0	1	8 756	0.1	0.3	0	1
Level of Education										
None or literacy center	17 001	0.06	0.24	0	1	8 756	0.06	0.23	0	1
Primary or basic education	17 001	0.43	0.49	0	1	8 756	0.44	0.5	0	1
Secondary or high school education	17 001	0.34	0.47	0	1	8 756	0.35	0.48	0	1
Household characteristics										
Lives in Guayaquil or Quito	17 001	0.29	0.45	0	1	8 756	0.27	0.45	0	1
Urban	17 001	0.70	0.46	0	1	8 756	0.71	0.46	0	1
Household size	17 001	3.73	2.03	1	28	8 756	3.77	2.05	1	14
Social protection										
Social Security	17 001	0.44	0.5	0	1	8 756	0.4	0.49	0	1
Activity groups										
Technical, professional or office workers	13 404	0.70	0.25	0	1	6 624	0.51	0.22	0	1
Services and commerce	13 404	0.18	0.38	0	1	6 624	0.17	0.38	0	1
Agricultural and livestock	13 404	0.26	0.44	0	1	6 624	0.3	0.46	0	1
Operators and craftsmen	13 404	0.16	0.36	0	1	6 624	0.15	0.36	0	1
Machinery operators	13 404	0.10	0.3	0	1	6 624	0.09	0.29	0	1
Not classified	13 404	0.15	0.36	0	1	6 624	0.15	0.36	0	1

Source: estimates by authors based on ENEMDU 2019 and 2020.

According to the activity group, heads of households who were agricultural workers increased in 2019 and 2020 from 26.4% to 30.4%, respectively, while in the service and commerce sector from 17.7% to 17.5%, respectively. Technicians, professionals or office employees registered 7 and 5%, respectively. Annexes A and B present descriptive statistics for the Covid-19 incidence and branch of activity variables, respectively.

5. RESULTS

Table 2 shows the results of two different specifications (with and without occupation characteristics) of the model of poverty determinants for 2019 and 2020. Among the demographic characteristics, we can see that, in 2019, being a female head of household is associated with a 1.4 percentage point (pp) higher probability of poverty compared to male heads of household and, by 2020, this probability becomes 6.2 pp greater, compared to male heads of household, showing an increase in the gender poverty gap.

Table 2. Marginal effects of poverty determinants for head of household 2019 and 2020

Determinants of poverty by income of the head of household	*2019*		*2020*	
	Marginal effects	*Marginal effects*	*Marginal effects*	*Marginal effects*
Demographic characteristics				
Woman	0.04207***	0.01387***	0.06121***	0.06209***
	0.00043	0.00051	0.00045	0.00057
Age	-0.00526***	-0.00292***	-0.00485***	-0.00168***
	0.00006	0.00008	0.00007	0.00009
Age squared	0.00003***	0.00001***	0.00002***	-0.000013***
	0.0000006	0.0000008	0.0000007	0.0000009
Marital status				
Divorced	-0.03111***	-0.04822***	0.01519***	-0.02716***
	0.00111	0.00138	0.00099	0.00142
Single	0.00022***	-0.01861***	-0.00651***	-0.01100***
	0.00067	0.00076	0.00071	0.00083
Widower	-0.04583***	-0.02774***	-0.02485***	0.00990***
	0.00071	0.00086	0.00074	0.00093
Ethnic characteristics				
Afro-Ecuadorians	0.06814***	0.01729***	0.07988***	0.05440***
	0.00064	0.00073	0.00082	0.00095
Montubios	0.00855***	0.00538***	0.00185***	0.01816***
	0.00057	0.00062	0.00077	0.00082
Indigenous	0.08880***	0.06768***	0.16880***	0.13817***
	0.00050	0.00051	0.00053	0.00059
Level of Education				
None or literacy center	0.25647***	0.09330***	0.33985***	0.15703***
	0.00102	0.00123	0.00115	0.00134
Primary or basic education	0.22533***	0.09777***	0.30940***	0.13565***
	0.00080	0.00097	0.00086	0.00100
Secondary or high school	0.14684***	0.06088***	0.23311***	0.10061**
	0.00081	0.00095	0.00087	0.00098

Determinants of poverty by income of the head of household	*2019*		*2020*	
	Marginal effects	*Marginal effects*	*Marginal effects*	*Marginal effects*
Household characteristics				
Lives in Guayaquil or Quito	-0.07941***	-0.06382***	-0.05150***	-0.03109***
	0.00049	0.00057	0.00050	0.00057
Urban	-0.06513***	-0.03339***	-0.04948***	-0.00316***
	0.00038	0.00045	0.00044	0.00053
Household size	0.03806***	0.03608***	0.04428***	0.04505***
	0.00009	0.00009	0.00010	0.00011
Social protection				
Social Security		-0.12075***		-0.12443***
		0.00041		0.00047
Activity group				
Technician, professional or office employees		-0.03661***		0.03106***
		0.00198		0.00261
Services and trade		0.061665***		0.13693***
		0.00158		0.00196

Agriculture and Livestock		0.16605***		0.31266***
		0.00160		0.00194
Officials, operators or crafts-men/women		-0.05170***		0.18035***
		0.00162		0.00198
Machinery operators		-0.01880***		0.19116***
		0.00171		0.00199
Not classified		0.13540***		0.24156***
		0.00161		0.00197
Remarks	4633253	3716525	4636217	3599605
Pseudo R^2	0.1871	0.2552	0.1727	0.2328

Notes: All estimates include a constant variable for territorial control: the parish code (not reported). Robust standard errors are presented. ***p < 1%; **p < 5%; * p < 10%.

Source: Estimates by authors based on the ENEMDU, the Ministry of Public Health (MPH) and the General Death Statistics (EGD).

Meanwhile, as far as indigenous heads of household are concerned, the probability of being poor in 2019 is 6.8 pp higher compared to those of mixed race. However, by 2020, it increased to 13.2 pp compared to those of mixed race. The fact that the head of household self-identifies as Afro-Ecuadorian, in 2019 is related to a 1.7 pp higher probability of being poor, compared to mixed-race heads of household; but by 2020, this probability becomes 5.4 pp higher, compared to mixed-race heads of household, indicating a possible increase in ethnicity inequality factors.

In order to determine whether the change in the marginal effect for 2020 is statistically significant, the z-hypothesis test was used between specifications 1 and 3 and 2 and 4. The change is found to be 99% significant when the head of household is female (z1 - 3 = 30.8 and z2 - 4 = 63.0); indigenous (z1 - 3 = 30.8 and z2 - 4 = 63.0); Afro-Ecuadorian (z1 - 3 = 11.3 and z2 - 4 = 31. 0); no education or literacy center level (z1 - 3 = 54.2 and z2 - 4 = 35.0); primary or basic education (z1 - 3 = 71.6 and z2 - 4 = 27.3); secondary or high school (z1 - 3 = 72. 6 and z2 - 4 = 29.1); lives in Guayaquil or Quito (z1 - 3 = 39.9 and z2 - 4 = 42.1), resides in an urban area (z1 - 3 = 26.9 and z2 - 4 = 43.5); is a technician, professional or office employee (z2 - 4 = 20. 7); services and trade worker (z2 - 4 = 29.9); agricultural worker (z2 - 4 = 58.3); officials, operators or craftsmen or women (z2 - 4 = 90.7); machine operator (z2 - 4 = 80.0); and unclassified (z2 - 4 = 41.7). The coefficient variation accounts for a change in poverty conditions before and after the pandemic.

Table 3 presents three specifications of the model of determinants for poverty extended with the pandemic incidence variables on a regional canton level. It is established that a one-unit increase in Covid-19 cases per 100,000 population increases the probability of being poor by 0.0002 pp. A one-unit increase in excess deaths per 10,000 population increases the probability of poverty by 0.001 pp. A one-unit increase in Covid-19 related deaths per 10,000 population increases the probability of being poor by 0.001 pp.

Table 3. Marginal effects of poverty determinants with Covid-19 variables

Determinants of poverty by head of household income	*2020*		
	Marginal effects	*Marginal effects*	*Marginal effects*
Demographic characteristics			
Woman	0.06281***	0.06106***	0.06114***
	0.00057	0.00057	0.00057
Age	-0.00159***	-0.00175***	-0.00115***
	0.00009	0.00009	0.00009
Age squared	-0.00001***	-0.00001***	-0.00002***
	0.0000009	0.0000009	0.0000010
Marital status			
Divorced	-0.02867***	-0.03229***	-0.03820***
	0.00142	0.00141	0.00143
Single	-0.01221***	-0.01457***	-0.01518***
	0.00084	0.00083	0.00084
Widower	0.00889***	0.01098***	0.00711***
	0.00093	0.00092	0.00094
Ethnic characteristics			
Afro-Ecuadorians	0.05409***	0.05761***	0.05695***
	0.00100	0.00095	0.00099
Montubios	0.01851***	0.02206***	0.03396***
	0.00082	0.00082	0.00084
Indigenous	0.13760***	0.13933***	0.13993***
	0.00059	0.00059	0.00060
Level of Education			
None or literacy center	0.15737***	0.15480***	0.15274***
	0.00134	0.00134	0.00132
Primary or basic education	0.13649***	0.13470***	0.12824***
	0.00100	0.00100	0.00100
Secondary school or high school	0.10111***	0.10301***	0.10101***
	0.00098	0.00098	0.00098

Determinants of poverty by head of household income	*2020*		
	Marginal effects	*Marginal effects*	*Marginal effects*
Household characteristics			
Lives in Guayaquil or Quito	-0.03221***	-0.07251***	0.00387***
	0.00058	0.00076	0.00066
Urban	-0.00220***	-0.00263***	0.00387***
	0.00053	0.00053	0.00054
Household size	0.04513***	0.04578***	0.04533***
	0.00011	0.00011	0.00011
Social protection			
Social Security	-0.12467***	-0.12799***	-0.13237***
	0.00047	0.00047	0.00048
Activity group			
Technicians, professionals or office employees	0.03054***	0.02472***	0.04372***
	0.00260	0.00260	0.00276
Services and trade	0.13669***	0.13873***	0.15674***
	0.00196	0.00195	0.00215
Agriculture and Livestock	0.31295***	0.31481***	0.33418***
	0.00193	0.00193	0.00213

Officers, operators or craftsmen	0.17961***	0.17778***	0.19672***
	0.00198	0.00198	0.00218
Machinery operators	0.19108***	0.18869***	0.21037***
	0.00199	0.00199	0.00218
Not classified	0.24206***	0.24384***	0.26370***
	0.00197	0.00196	0.00216
Covid-19 variables			
Cases per 100,000 inhabitants	0.000002***		
	0.0000003		
Excess deaths per 10,000 inhab-itants		0.00001***	
		0.0000001	
Covid-related deaths19 per 10,000 inhabitants			0.00001***
			0.0000001
Remarks	3 593 521	3 599 605	3 504 745
Pseudo R^2	0.2333	0.2344	0.2365

Notes: All estimates include a constant variable for territorial control: the parish code (not reported). Robust standard errors are presented. ***p < 1%; **p < 5%; * p < 10%.
Source: Estimates by the authors based on ENEMDU, MPH and EGD.

Thus, in line with Correa et al. (2020), Suryahadi et al. (2020), CEPAL (2021b) and the World Bank (2020), the increase in the variables that approximate the effects of economic stagnation increases the probability of being poor. However, the variable of deaths related to Covid-19 per 10,000 inhabitants is of lower quality, given that in Ecuador, "a large underreporting far from the reported number is observed" (Sacoto, 2021, p. 58). Therefore, in Tables 4 and 5, this variable is no longer reported.

Table 4 presents the marginal effects of the extended model of the determinants of poverty, with the Covid-19 incidence variables and the corresponding interactions based on the activity group and female head of household variables. For female heads of household, an increase of one unit in the number of excess deaths per 10,000 inhabitants and infections per 100,000 inhabitants is related to a higher probability of poverty compared to male heads of households affected and unaffected by the pandemic.

Table 4. Marginal effects of the determinants of poverty with the Covid-19 variables and their interactions with activity groups

Determinants of poverty by income of the head of household	*2020*	
	1	*2*
	Marginal effects	*Marginal effects*
Demographic characteristics		
Woman	-0.03782***	0.02751***
	0.00104	0.00063
Age	-0.00198***	-0.00188***
	0.00009	0.00009
Age squared	-0.000009***	-0.00001
	0.0000009	0.0000009
Marital status		
Divorced	-0.04954***	-0.04692***
	0.00138	0.00139
Single	-0.02938***	-0.00171***
	0.00084	0.00084
Widower	0.00855***	0.01577***
	0.00093	0.00091
Ethnic characteristics		
Afro-Ecuadorians	0.05852***	0.05768***
	0.00096	0.00095
Montubios	0.00975***	0.01870***
	0.00082	0.00082
Level of Education		
None or literacy center	0.15330***	0.16036***
	0.00134	0.00134
Primary or basic education	0.13301***	0.13496***
	0.00101	0.00102
Secondary school or high school	0.09887***	0.10500***
	0.00099	0.00100
Household characteristics		
Lives in Guayaquil or Quito	-0.03858***	-0.07810***
	0.00058	0.00078
Urban	-0.00193***	-0.00187***
	0.00053	0.00053
Household size	0.04416***	0.04484***
	0.00011	0.00011
Social protection		
Social Security	-0.12719***	-0.13042***
	0.00047	0.00047
Activity group		
Technicians, professionals or office employees	-0.13470***	0.026656***
	0.00593	0.00357
Services and trade	0.11628***	0.16482***
	0.00354	0.00242
Agriculture and Livestock	0.34877***	0.33965***
	0.00337	0.00236
Officers, operators or craftsmen	0.23002***	0.20741***
	0.00348	0.00242
Machinery operators	0.15865***	0.19401***
	0.00354	0.00245
[illegible]	[illegible]	[illegible]

Not classified	0.25631***	0.27920***
	0.00344	0.00241
Covid-19 variables on a regional canton level		
Cases per 100,000 inhabitants	-0.000012***	
	0.000002	
Excess deaths per 10,000 inhabitants		0.000012***
		0.0000006
Interactions with Covid-19 variables		
Interaction with women	0.00009***	0.000026***
	0.0000008	0.0000002
Interaction with technicians, professionals or office employees.	0.00009***	-0.000002***
	0.000003	0.0000008
Interaction with services and commerce	0.00002***	-0.000007***
	0.000002	0.0000006
Interaction with farmers	-0.00004***	-0.00002***
	0.000002	0.0000006
Interaction with operators and craftsmen	-0.000038***	-0.000008***
	0.000002	0.0000006
Interaction with machine operators	0.00003***	0.000004***
	0.000002	0.0000006
Interaction with unclassified	-0.000009***	-0.00002***
	0.000002	0.0000006
Remarks	3 593 521	3 599 605
Pseudo R^2	0.2414	0.2387

Notes: All estimates include a constant variable for territorial control: the parish code (not reported). Robust standard errors are presented. ***p < 1%; **p < 5%; * p < 10%.

Source: Estimates by the authors based on ENEMDU, MPH and EGD.

Consequently, economic stagnation exacerbated the gender gap. This is due to the excessive burden of unpaid care work, which resulted from confinement, the closure of educational establishments and the establishment of work at home (Gutiérrez et al., 2020; Malaver et al., 2021). In addition, it significantly affected the highly feminized productive sectors,[1] which deteriorated women's quality of life, income, and participation in the labor market (CEPAL, 2021a; Esteves, 2020).

Utilizing the interaction with the activity group variables shows that one mechanism of transmission of Covid-19 in relation to poverty is the form of participation in the labor market. As a result of the pandemic, the probability of heads of household working as technicians, professionals or office employees, in services and commerce, and as machine operators being poor increased.[2] Meanwhile, heads of household working in the agricultural sector and unclassified sectors decreased their probability of being poor since these occupations maintained greater stability in their pre-pandemic situation. This is because, unlike the rest of the activities, the agricultural sector was never prohibited from operating, making it one of the least affected by the economic paralysis (BCE, 2020).

Table 5 presents the marginal effects of the model for determinants of poverty extended with the variable of cases per 100,000 inhabitants, excess deaths per 10,000 inhabitants and the respective interactions with branches of activity. When heads of household work in the manufacturing industry, the probability of poverty is 8.8 pp lower compared to heads of household who work in agriculture, forestry and fishing. If heads of household work in commerce, the probability of being poor is 7.7 pp lower than those working in agriculture, forestry and fishing. When heads of household work in the accommodation or entertainment sectors, the probability of poverty is reduced by 26.6 pp, compared to heads of household working in agriculture, forestry and fishing.

Table 5. Marginal effects of the determinants of poverty with the Covid-19 variables and their interactions with the branches of activity

Determinants of poverty by income of the head of household	*2020*	
	1	*2*
	Marginal effects	*Marginal effects*
Demographic characteristics		
Woman	-0.04984***	0.02820***
	0.00106	0.00065
Age	-0.00270***	-0.00258***
	0.00009	0.00009
Age squared	-0.000004***	-0.000007
	0.0000009	0.0000009
Marital status		
Divorced	-0.03171***	-0.02722***
	0.00138	0.00138
Single	-0.02294***	-0.01566***
	0.00083	0.00082
Widower	0.00786***	0.01143
	0.00091	0.00090
Ethnic characteristics		
Afro-Ecuadorians	0.08413***	0.08390***
	0.00099	0.00100
Montubios	0.01612***	0.02850***
	0.00082	0.00081
Indigenous	0.14842***	0.14452***
	0.00059	0.00060
Level of Education		
None or literacy center	0.18990***	0.19266***
	0.00131	0.00131
Primary or basic education	0.17001***	0.16903***
	0.00095	0.00095
Secondary school or high school	0.11776***	0.11795***
	0.00093	0.00094

Determinants of poverty by income of the head of household	*2020*	
	1	*2*
	Marginal effects	*Marginal effects*
Household characteristics		
Lives in Guayaquil or Quito	-0.04721***	-0.08848***
	0.00058	0.00079
Urban	-0.00612***	-0.00528***
	0.00055	0.00055
Household size	0.04722***	0.04776***
	0.00011	0.00011
Social protection		
Social Security	-0.11807***	-0.12132***
	0.00047	0.00047
Branch of activity		
Mining and quarrying	-0.68639***	-0.53136***
	0.00723	0.00725
Manufacturing industries	-0.13983***	-0.08849***
	0.00139	0.00083

Electricity supply or water distribution	-0.32416***	-0.36348***
	0.00834	0.00630
Construction or real estate activity	-0.23982***	-0.21366***
	0.00181	0.00116
Trade and repair of vehicles	-0.10773***	-0.07655***
	0.00122	0.00074
Transportation and storage	-0.13307***	-0.07478***
	0.00142	0.00092
Lodging or entertainment	-0.32408***	-0.26611***
	0.00256	0.00150
Information and communication	0.06129***	-0.02532***
	0.00587	0.00386
Professionals, scientists, technicians or public servants	-0.05290***	-0.05008***
	0.00245	0.00140
Defense or activities of extraterritorial organizations	-0.71284***	-0.57187***
	0.00748	0.00576
Teaching or social service	-0.41145***	-0.33508***
	0.00452	0.00288
Other service activities or activities in households	-0.06158***	-0.04871***
	0.00191	0.00127

Determinants of poverty by income of the head of household	*2020*	
	1	*2*
	Marginal effects	*Marginal effects*
Covid-19 variables		
Cases per 100,000 inhabitants	-0.00006***	
	0.0000006	
Excess deaths per 10,000 inhabitants		-0.000004***
		0.0000003
Interactions with Covid-19 variables		
Interaction with mining and quarrying	0.00009***	-0.00057***
	0.000002	0.00004
Interaction with manufacturing	0.000063***	0.00002***
	0.000001	0.0000004
Interaction with electricity supply or water distribution	-0.00004***	-0.000006***
	0.000005	0.000001
Interaction with construction or real estate activities	0.00004***	0.00001***
	0.000001	0.0000004
Interaction with trade and vehicle repair	0.00004***	0.000008***
	0.0000009	0.0000004
Interaction with transportation and storage	0.00007***	0.00002***
	0.000001	0.0000004
Interaction with accommodation or entertainment	0.00007***	0.00002***
	0.000002	0.0000007
Interaction with information and communication	-0.00022***	-0.00021***
	0.000007	0.000006
Interaction with professionals, scientists, technicians, or public servants.	-0.00002***	-0.00002***
	0.000002	0.0000005
Interaction with defense or activities of extraterritorial organizations	0.00016***	0.00004***
	0.000003	0.000001
IInteraction with teaching or social service	0.00009***	0.00002***
	0.000003	0.0000008
Interaction with other service activities or	0.00004***	0.000014***

household activities	0.000001	0.0000004
Interaction with women	0.00009***	0.00002***
	0.0000008	0.0000002
Remarks	3 569 371	3 575 455
Pseudo R^2	0.2559	0.2551

Notes: All estimates include a constant variable for territorial control: the parish code (not reported). Robust standard errors are presented. ***p < 1%; **p < 5%; * p < 10%.

Source: Estimates by the authors based on ENEMDU, MPH and EGD.

Furthermore, it is noted that one of the transmission mechanisms of Covid-19 in relation to poverty was the structure of the labor market. For heads of household working in manufacturing, construction, transportation and storage, accommodation or entertainment, defense, teaching or social service and other private activities, an increase in the Covid-19 variables is associated with a higher probability of poverty compared to heads of household working in the agriculture, forestry and fishing sector. This dynamic is due to the fact that, unlike agriculture, forestry and fishing, these activities were completely paralyzed during confinement, and their reactivation has been slow because they involve physical proximity and agglomeration (BCE, 2020; CEPAL, 2020).

6. CONCLUSIONS

In this paper, we analyzed the effect of Covid-19 on the determinants of poverty in Ecuador by applying a model of determinants for December 2019 and 2020. As a result of the analysis, it was found that the coefficients were higher in 2020, suggesting an increased poverty dynamic related to the pandemic.

To capture the effect of the economic paralysis, an extension of the model of determinants was carried out, including variables of pandemic incidence on a territorial level. This allowed us to identify a positive relationship between the Covid-19 variables and the probability of poverty.

When the interactions between the pandemic incidence variables, the activity group, the branch of activity and the gender of the head of household were analyzed, it was determined that the channels of transmission of the pandemic in relation to poverty could be found in the determinants of gender gap, participation and structure of the labor market.

This study contributes new empirical evidence to the literature on income poverty by incorporating an extension of the model of determinants for poverty due to external shocks. It also contributes to empirical evidence for the Ecuadorian case, showing that the economy's structure increases the vulnerability of specific population groups, which are linked to certain occupational groups and branches of activity.

Against this backdrop, a structural change in the labor market is needed to promote economic inclusion and reduce labor informality to increase social security coverage and establish public policies for prioritized sectors. This will allow for better protection conditions for future crises caused by external effects on the economy, such as the Covid-19 pandemic.

Annex A

Table A1. Descriptive statistics of the Covid-19 incidence variables

	2020				
Covid 19 Variables	*Remarks*	*Media*	*Standard deviation*	*Minimum*	*Maximum*
Cases per 100,000 inhabitants	8 749	1177.0438	744.4	83.82	8818.700
Excess deaths per 10,000 inhabitants	8 756	1 491.772	2 438.943	-24.096	7177.657
Deaths related to Covid-19	8 540	1 141.57	2 241.295	0.004	6637.549

Source: Estimates by the authors based on MPH and EGD.

Annex B

Table B1. Descriptive statistics of the branch of activity variables

Variables		2020			
Branch of activity	Remarks	Media	Standard deviation	Minimum	Maximum
Mining and quarrying	8 631	0.26	0.44	0	1
Manufacturing industries	6 624	0.10	0.30	0	1
Electricity supply or water distribution	6 624	0.01	0.08	0	1
Construction or real estate activity	6 624	0.07	0.26	0	1
Trade and repair of vehicles	6 624	0.18	0.38	0	1
Transportation and storage	6 624	0.07	0.26	0	1
Lodging or entertainment	6 624	0.05	0.22	0	1
Information and communication	6 624	0.01	0.08	0	1
Professionals, scientists or public servants	6 624	0.01	0.08	0	1
Defense or extraterritorial organization activities	6 624	0.04	0.20	0	1
Teaching or social service	6 624	0.04	0.20	0	1
Other service activities or activities in households	6 624	0.05	0.22	0	1

Source: Estimates by the authors based on the ENEMDU.

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[1] Accommodation, commerce, manufacturing and paid domestic work.

[2] Compared to heads of household who are managers, intellectuals or belong to the Armed Forces