Microeconomic Determinants of Underemployment and Unemployment in Ecuador 2019–2022

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ABSTRACT

The aim of this paper is to identify the microeconomic determinants of underemployment and unemployment in Ecuador before and after COVID-19. A multinomial logit model was estimated on the accumulated data from the National Employment, Unemployment and Underemployment Survey for 2019 and 2022. The results show that the average worker has a 59% probability of being in an adequate job, 35% of being underemployed and 6% of being unemployed. These probabilities change significantly depending on the worker's education and experience. In addition, significant differences were evident by gender, ethnicity, role in the home, and marital status. These differences increased after COVID-19. Thus, underemployment and unemployment promote labor inequality in Ecuador. Based on the results, the public policy should be aimed at reducing economic and opportunity inequalities because vulnerable groups were identified in the labor market.

Keywords: Discrete Regression Models, Unemployment, Employment, Human Capital
JEL Classifications: C25, E24, J21, J24, J28, O54

1. INTRODUCTION

The COVID-19 pandemic had a severe impact on employment and the quality of employment in the Ecuadorian labor market. According to the National Institute of Statistics and Censuses (INEC), in the last quarter of 2020, unemployment and underemployment rates reached 5.6% and 24.5%, respectively, while for the same quarter of 2022 these rates were reduced to 3.8 % and 20.8%. INEC defines workers as underemployed when their income is less than the minimum wage (underemployment due to insufficient income) and/or they work fewer hours than the legal working day (underemployment due to insufficient working time) and have the desire and availability to work more hours. In Ecuador, although underemployment has decreased in recent years, it continues affecting to 1 in 5 workers, which is why it has become an important indicator of the quality of employment.

Studies of unemployment and underemployment in Ecuador are scarce. For example, Arellano and Ayaviri (2021) studied the macroeconomic determinants of unemployment through a time series analysis with a vector error correction (VEC) model with which they calculated Granger causality relationships, impulse-response functions and the variance decomposition. According to their results, unemployment is determined by the following factors: the share of the manufacturing sector in GDP, the terms of trade index, capital accumulation, and economic growth. The authors argue that there is a long-term equilibrium relationship between the determinants of unemployment and unemployment in Ecuador.

Unemployment and underemployment have mainly been studied separately; however, some research has addressed both phenomena and found similarities and differences (Wilkins, 2006). Among the factors most related to these two conditions are labor tenure, local labor market conditions, education, business size, types

of employment and area of residence (Sackey and Osei, 2006). Likewise, unemployment has been widely studied from both theoretical and applied perspectives. However, recently it is considered that unemployment, as an indicator, tends to hide what really happens in the labor market in terms of the quality of employment, the use of resources and job satisfaction. For this reason, the analysis of underemployment, its determinants, and consequences, has an increasingly greater presence in the literature, and has revealed that underemployment is one of the conditions of fastest growth in labor markets and with major negative effects on workers.

Therefore, due to the increasing deterioration of the quality of employment and the unemployment, as well as the scarcity of microeconomic studies applied to these problems, the main objective of this research is to identify the microeconomic determinants of unemployment and underemployment in Ecuador before and after the COVID-19 pandemic. To do this, it was estimated an unordered multinomial logit model with data from the ENEMDU 2019 and 2022.

It is important to point out that this paper is distinguished from the current literature in the following aspects: (1) It is updated until 2022; (2) estimates an unordered multinomial response logit model; (3) set of recommendations regarding public policies to reduce inequality among vulnerable groups in the labor market.

This research is organized as follows: section 2 provides a brief review of the specialized literature; section 3 presents the data and its descriptive statistics; section 3 details the methodology that this study will use; section 4 discusses the empirical results; and, finally, section 5 gives conclusions and a set of recommendations regarding public policies on underemployment and unemployment.

2. BRIEF LITERATURE REVIEW

Unlike underemployment, unemployment has been widely studied. For example, Hinaunye and Ashipala (2010) investigated the causes of unemployment in Namibia during 1971-2007 from a macroeconomic perspective. The authors estimated an econometric model applying the two-stage procedure of Engle and Granger and found that unemployment has an inverse relationship with aggregate production, particularly when the latter is below its potential level. Furthermore, the authors found evidence of an inverse relationship between the inflation rate and the unemployment rate (Phillips Curve). They also empirically confirmed that the increase in wages produces an increase in unemployment, and that investment significantly reduces unemployment, so their main recommendation is to promote aggregate demand to reduce unemployment.

Similarly, Baah-Boateng (2013) investigated the macroeconomic and microeconomic determinants of unemployment in Ghana and confirmed the existence of an inverse relationship between unemployment and economic growth. However, the author verified that the decrease in unemployment was not inversely proportional to the increase in production because economic growth came from sectors that generates little employment (oil

and mining), while the sectors that generates more employment (agriculture and manufacturing) experienced low growth. To analyze the microeconomic determinants, he estimated a probit model on cross-sectional data and found that women, young workers, and workers with low education are the most prone to unemployment. This finding is compatible with other research, for example, Himali (2020) applied Chi-square tests, binary logistic regressions, and Cox regressions on Sri Lanka microdata to find the microeconomic determinants of unemployment and its duration. He found that women, younger (between 15 and 29 years old) and more educated workers face greater unemployment rates but that as they gain more work experience their probability of being unemployed decreases. In addition, variables such as place of residence and language limitations are also closely associated with unemployment.

In recent years, the employment situation of young workers has worsened considerably in various countries, which is why several investigations have been dedicated to studying its causes and consequences. In this sense, Papík et al. (2022) analyzed youth unemployment in Slovakia, specifically considering young high school graduates, and found through logistic regression models that GDP per capita, the overall unemployment rate, and state exam results are the main determinants of youth unemployment. According to their results, the macroeconomic situation considerably influences youth unemployment, high global unemployment rates increase youth unemployment, and economic growth decreases it. From a microeconomic perspective, they found that the quality of education plays a central role in the labor insertion of young workers, since in recent years the worsening of the quality of high school education in Slovakia largely explains the increase in youth unemployment.

Besides young workers, women also tend to be more affected by unemployment than men. They usually experience a longer duration of unemployment and the older they are, the greater the risk of being unemployed, although education does contribute to reducing their probability of being unemployed (Tansel and Tasci, 2004).

On the other hand, although unemployment continues to be widely studied, recent research has paid special attention to the increase in underemployment and its heterogeneous nature that even occurs in developed countries. In this sense, Barnichon and Zylberberg (2019) for the case of the United States of America found through a search model with an endogenous mechanism that, in the application and hiring processes, highly qualified workers are systematically hired over less qualified competing applicants However, some skilled workers become underemployed to avoid competition with other workers with similar characteristics, and thus end up underemployed at the expense of less skilled workers. Its main conclusions are that underemployment is countercyclical (it increases in recessions), has wage costs and is a persistent state (about 70% of new underemployed were in that situation the previous year). Similarly, Zhu and Chen (2022) studied the determinants of underemployment by gender in China using a probit panel data model and found that women are more affected by underemployment than men, which is explained mainly because

women dedicate many more hours to caring for the home and domestic chores (Wiebe, 1996). However, these authors found that for men the underemployment rate increases with age while for women it remains constant. Furthermore, they demonstrated that underemployment has significant effects on labor income for both men and women. Likewise, education and residence in urban areas reduce the probability of being underemployed for both men and women. On the contrary, Kler et al. (2018) using a panel data probit model with random effects found that in Australia underemployment affects men more than women. They also estimated that about 33% of part-time workers are underemployed, so their results indicate that those most affected by underemployment, in addition to men, are immigrants, young workers and casual contract workers.

Similarly to unemployment, underemployment primarily affects young workers due to their relative lack of work experience. In the case of South Africa, Meyer and Mncayi (2021) analyzed the situation of young graduates under 35 years of age and found by applying a binary response logistic regression model that those most affected by underemployment are non-whites, singles and those who reside in rural areas. Another interesting finding from their study is that they showed evidence that career guidance reduces young people's likelihood of being underemployed. Likewise, Ruiz-Quintanilla and Claes (1996) applied a multinomial probit model to find the determinants of underemployment of young adults. They examined two groups (technology office workers and machinery operators) for six European countries (Belgium, England, Italy, Portugal, Spain, and the Netherlands) and found that underemployment is associated with educational level, occupation, work experience and perceptions of labor market that workers have.

Finally, Pratomo (2015) investigated the relationship between underemployment and poverty in Indonesia. He applied a multinomial logit model and found that underemployment affects poor households more, because poorer workers cannot afford to be unemployed, and tend to accept lower quality jobs, but he also found that underemployed workers are more prone to poverty. The author identified that those most affected by underemployment are men, younger workers, agricultural workers, and workers with low education, although she also found underemployed workers with high education. The latter is an indication that the labor market is not capable of absorbing all the qualified worker´s supply. From the macroeconomic perspective, she found that underemployment has a positive relationship with the minimum wage and an inverse relationship with economic growth.

3. NATURE OF DATA AND DESCRIPTIVE STATISTICS

The data comes from the ENEMDU-2019 and ENEMDU-2022 surveys published by INEC. The composition of the analyzed sample is presented in Table 1. Approximately, 48% of the total individuals in the sample and 55% of the total workers are men. The average age is 39 years, and the youngest (18–24 years) have the lowest labor participation (14%), despite this age group represents

Table 1: Descriptive statistics. People from 18 to 65 years old. Ecuador, 2019 and 2022

Personal attributes	2019		2022	
	All	Workers	All	Workers
Male (%)	48.0	55.4	47.7	55.3
Age	38.9	39.7	39.1	39.8
Age groups (%)				
18–24	20.1	14.5	20.2	14.8
25–34	22.2	24.2	21.8	23.9
35–44	21.5	24.4	20.6	23.3
45–54	19.2	21.0	19.6	21.5
55+	17.0	15.9	17.8	16.5
Education (%)				
Illiterate	2.4	2.1	1.9	1.4
Primary	24.4	25.7	21.8	22.6
Secondary	32.2	33.8	32.2	33.6
High school	13.0	10.8	14.2	12.0
College	26.0	25.2	27.3	27.1
Postgraduate	2.0	2.4	2.7	3.3
Ethnicity (%)				
Indigenous	6.3	7.3	6.6	7.5
Black or montubio	6.4	6.3	6.0	5.6
Mixed or white	87.3	86.4	87.4	86.9
Head of household (%)	37.0	44.4	37.1	44.3
Married or free union (%)	56.6	58.7	52.4	54.2
Monthly labor income	-	555.7	-	543.1
Hours worked per week	-	37.9	-	36.4
Activity condition				
Adequate employment	-	68.1	-	60.3
Underemployment	-	24.9	-	31.7
Unemployment	-	7.0	-	8.0
N	290514	216425	216766	162430

Source: Own elaboration with data from the annual ENEMDU of 2019 and 2022

20% of the total sample. The educational level of Ecuadorians improved, since in 2019 around 27% had college or postgraduate education, and in 2022 the participation of this group of workers increased to approximately 30%. Furthermore, the majority of individuals self-identify as mixed or white (87%). Commitments to the home reveal their impact on labor participation, since around 44% of workers are heads of household and around 56% are married or living in a common law union. Labor income and hours worked per week decreased, in 2019 the average income was $555.7 and in 2022 it was $543.0, this is a decrease of $12.6; while the average hours worked experienced a drop of 1.5 hours between 2019 and 2022. Additionally, the data shows a drop in employment and its quality, as adequate employment fell by 7.8% and underemployment and unemployment increased by 6.8% and 1%, respectively. In summary, the description of the sample shows an improvement in the educational level of Ecuadorians and differences in labor participation by gender, marital status, age, and ethnicity. In addition, workers' income, hours worked, and employment status worsened.

Table 2 presents the working conditions of Ecuadorians according to socioeconomic group. Gender differences are clear, men have better working conditions than women before and after COVID-19 pandemic. The percentage of workers in adequate jobs decreased for both genders in 2022, but the percentage of women in adequate jobs is 5% lower than men; likewise, underemployment and unemployment affect women around 3%

Table 2: Labor condition for socioeconomic group. Ecuador, 2019 and 2022

Socioeconomic group	2019			Total (%)	2022			Total (%)
	Adequately employed	Underemployed	Unemployed		Adequately employed	Underemployed	Unemployed	
Gender								
Male	70.4	24.0	5.6	100	62.4	30.8	6.8	100
Female	64.4	26.3	9.3	100	57.1	33.0	9.9	100
Age group								
18–24	43.8	37.1	19.1	100	35.8	43.4	20.8	100
25–43	70.8	21.1	8.1	100	62.0	28.5	9.5	100
35–44	73.1	22.6	4.3	100	65.7	29.0	5.3	100
45–54	72.1	24.3	3.6	100	64.9	31.0	4.1	100
55–65	70.6	25.7	3.7	100	62.7	32.8	4.5	100
Education								
Illiterate	36.7	59.2	4.1	100	28.0	65.6	6.4	100
Primary	57.7	38.9	3.4	100	46.2	49.3	4.5	100
Secondary	68.7	25.6	5.7	100	58.9	34.8	6.3	100
High school	43.9	37.4	18.7	100	37.6	42.7	19.7	100
College	80.4	12.0	7.6	100	73.7	17.8	8.5	100
Postgraduate	91.9	4.7	3.4	100	89.6	6.8	3.6	100
Ethnicity								
Indigenous	54.1	41.2	4.7	100	41.6	52.0	6.4	100
Black or montubio	48.8	42.9	8.3	100	46.3	40.8	12.9	100
Mixed or white	70.1	22.8	7.1	100	62.1	30.0	7.9	100
Role in household								
Head of household	74.4	22.3	3.3	100	66.0	30.0	4.0	100
Another role	62.1	27.2	10.7	100	55.0	33.2	11.8	100
Marital status								
Married or free union	74.4	21.5	4.1	100	67.5	28.0	4.5	100
Not married	59.3	29.5	11.2	100	51.9	36.0	12.1	100

Source: Own elaboration with data from ENEMDU 2019 and 2022

more than men. The youngest workers (18–24 years old) have the worst working condition among the age groups, only 43.8% of them had adequate employment in 2019 and 35.8% were in such a condition in 2022. Also, differences are observed in working conditions by educational level, workers with low education show the highest percentages of underemployment and workers with high school and college education have the highest percentages of unemployment.

Similarly to other socioeconomic groups, employment status differs by ethnicity, indigenous workers are the most affected by underemployment, since by 2022 a little more than half were underemployed, while unemployment mainly affected blacks or montubio (12.9%). Heads of household and those who are married have higher percentages of adequate employment relative to their counterparts with other household roles and who are not married. In summary, the descriptive analysis reveals that the labor condition (adequate employment, underemployment, and unemployment) of workers in the Ecuadorian labor market differs substantially according to their personal attributes (gender, age, education, ethnicity, marital status, and role in the home) and that, after the pandemic, underemployment and unemployment increased and affected mainly the most vulnerable groups.

4. ECONOMETRIC METHODOLOGY

To identify the microeconomic determinants of underemployment and unemployment in Ecuador, an unordered multinomial response logit model was estimated. This model is used when the dependent variable is discrete and takes more than two values. This variable is unordered when there is no natural order between the alternatives (means of transportation, university courses, occupations, etc.). This model allows to analyze, ceteris paribus, how changes in the elements of X (covariates) affect response probabilities. Since the probabilities must sum to unity, the response probability of the base category is determined once we know the probabilities for the other alternatives (Wooldridge, 2010).

In the multinomial response model, the outcome, y_i, for individual i is one of m alternatives. Therefore, $y_i = j$ if the result is the alternative j, $j = 1, 2, …, m$. The values $1, 2, …, m$ are arbitrary and the order of the values does not matter. The probability that the result for individual i si j, considering the explanatory variables, x_i is given by:

$$p_{ij} = \Pr(y_i = j) = F_j(x_i, \theta), \quad j = 1, …, m \quad i = 1, …, N \quad (1)$$

where different functional forms of F_j correspond to different multinomial models (Cameron and Trivedi, 2009).

The parameters of the multinomial model are generally not directly interpretable, that is, a positive coefficient does not mean that an increase in the regressor leads to an increase in the probability that outcome j is selected (Cameron and Trivedi, 2009). Therefore, to evaluate the changes in the probability of occurrence of alternative j, the marginal effects must be estimated; that is, for individual i, the marginal effect (ME) of a change in the k-th regressor on the probability that alternative j occurs is

$$ME_{ijk} = \frac{\partial \Pr(y_i = j)}{\partial x_{ik}} = \frac{\partial F_j(x_i, \theta)}{\partial x_{ik}} \qquad (2)$$

For each explanatory variable, there will be m marginal effects corresponding to the m probabilities.

If F_j is a logistic distribution function, the model is called multinomial logit model (MLM):

$$p_{ij} \frac{\exp(x_i \beta_j)}{\sum_{j-1}^{m} \exp(x_i \beta_j)}, \qquad j = 1, 2, \ldots, m. \qquad (3)$$

For the MLM, the marginal effects are expressed as:

$$\frac{\partial p_{ij}}{\partial x_i} = p_{ij} \left(\beta_j - \bar{\beta}_i \right) \qquad (4)$$

Where $\bar{\beta}_i = \sum_l p_{i,l} \beta_l$ is a weighted average probability of β_i. The multinomial response logit model allowed us to calculate the probability of labor condition (adequate employment-underemployed-unemployed) of workers in Ecuador before and after the COVID-19 pandemic and identify its determinants; that is, those characteristics with the greatest and least impact on those probabilities. The model is given by:

$$\Pr_j \left(\text{labor condition} = j | X \right) = \, (X, \beta), \qquad j = 1, 2, 3. \qquad (5)$$

where labor condition = 1 means that the worker is adequate employed, 2 is underemployed, 3 is unemployed; and X represents a set of covariates that include education, age, ethnicity, gender, marital status, and household role.

5. UNORDERED MULTINOMIAL LOGIT ESTIMATION AND DISCUSSION OF THE EMPIRICAL RESULTS

This section presents the results of the multinomial logit models applied to the annual data of the ENEMDU 2019 and 2022 to identify the determinants of the working condition of workers in Ecuador before and after COVID-19.

Table 3 shows the results of the multinomial logistic regression estimated for 2019. All the variables in the model are statistically significant except variable *high school* as a determinant of unemployment. The base category of the model is the adequately employed worker. According to the results, education is a negative determinant of underemployment and unemployment; that is, workers with high education are less likely to be underemployed and unemployed than to be adequately employed. Also, the age of the worker is a negative determinant of underemployment and unemployment, implying that underemployment and unemployment mainly affects younger workers (18–24 years old). These two results suggest that the best jobs (adequately employed)

in the labor market value the worker's education and experience. Furthermore, the results show that the Ecuadorian labor market treats workers differently depending on their gender and ethnicity. Women are more likely to be underemployed or unemployed than men; likewise, workers self-identified as indigenous, black or montubio are more likely to be underemployed or unemployed than mixed workers. Finally, married workers and heads of household are more likely to be adequately employed than their counterparts, suggesting that commitments to the home lead workers to obtain better jobs.

The determinants of the labor condition in Ecuador for 2022 are presented in Table 4. All variables are statistically significant except the *indigenous* variable as a determinant of unemployment. This result could suggest that after the COVID-19 pandemic, indigenous workers accepted low-quality jobs to avoid unemployment. The results of the model show that workers with more education are less likely to be underemployed and unemployed than to be in an adequate job. Younger workers are more prone to underemployment and unemployment than more experienced workers. In addition, it was found that women, indigenous, black or montubio are more likely to be underemployed or unemployed. Finally, married workers and heads of household are more likely to be adequately employed than their unmarried counterparts with another role in the home.

In summary, the results of the logistic regression models show that the Ecuadorian labor market values considerably the main components of human capital (education and work experience) in terms of labor condition. The most educated and experienced workers get the best jobs. Additionally, these results provide robust evidence that young workers, women, indigenous, black and montubio are in worse working conditions than the rest of workers. Finally, the evidence indicates that the microeconomic determinants of the working condition in Ecuador did not change after COVID-19.

Evidence of unequal labor market treatment of workers is reinforced by obtaining their probabilities of being adequately employed, underemployed, or unemployed based on their personal attributes (Table 5). Gender inequalities are clear and increased after the pandemic. In 2019, women had a 32% probability of being underemployed or unemployed while men had a 26% probability of finding themselves in such situations; furthermore, before COVID-19, women were 6% less likely to have an adequate job than men. The scenario worsened for women in 2022, since their probability of being underemployed or unemployed was 42% (10% more than in 2019) while for men a probability of 34% (8% more than in 2019). Likewise, the gender gap in the probability of obtaining an adequate job was 8%, that is, in 2022 the probability of obtaining am adequate job was 2% lower for women than for men. These results show that, although men also face poor working conditions, women are in worse conditions and that COVID-19 further deteriorated their probabilities of obtaining adequate jobs.

Similarly, before COVID-19, non-head-of-household workers were more likely to be underemployed or unemployed (32%) than their head-of-household counterparts (24%), and after

Table 3: Determinants of adequate Employment, underemployment, and unemployment. People from 18 to 65 years old. Ecuador, 2019

Variables	Underemployed				Unemployed			
	Coefficient	Robust Standard error	z	P-value	Coefficient	Robust Standard error	z	P-value
Primary	−0.6624027	0.056087	−11.81	0.000	−0.5399128	0.1374583	−3.93	0.000
Secondary	−1.349.877	0.056108	−24.06	0.000	−0.5136832	0.1354726	−3.79	0.000
High School	−1.397.966	0.0622789	−22.45	0.000	−0.2152013	0.1391478	−1.55	0.122
College	−2.417.115	0.0573759	−42.13	0.000	-0.7649145	0.1357309	−5.64	0.000
Postgraduate	−3.357.759	0.0866633	−38.74	0.000	−1.349.985	0.1547558	−8.72	0.000
25_34	−0.7404652	0.0271644	−27.26	0.000	−0.8464557	0.035056	−24.15	0.000
35_44	−0.768413	0.0292977	−26.23	0.000	−1.258.608	0.0422512	−29.79	0.000
45_54	−0.6885659	0.030408	−22.64	0.000	−131.775	0.0467769	−28.17	0.000
55_65	−0.6654741	0.03267	−20.37	0.000	−1.196.834	0.0532626	−22.47	0.000
Male	−0.2692761	0.0144053	−18.69	0.000	−0.5098213	0.0225418	−22.62	0.000
Indigenous	0.5500501	0.0280523	19.61	0.000	−0.2132189	0.0621937	−3.43	0.001
Black or montubio	0.7323469	0.0246221	29.74	0.000	0.4896516	0.0435294	11.25	0.000
Mixed or white	−0.5081211	0.0140479	−36.17	0.000	−0.7096972	0.023718	−29.92	0.000
Head of household	−0.3361755	0.0154515	−21.76	0.000	−0.6738763	0.0281501	−23.94	0.000
Constant	1.636.766	0.0619396	26.43	0.000	0.0606488	0.1390958	0.44	0.663
N	147778							
Pseudo R squared	0.1039							
Chi-squared prob.	0.0000							

Source: Own elaboration with data from ENEMDU 2019

Table 4: Determinants of adequate employment, underemployment, and unemployment. People from 18 to 65 years old. Ecuador, 2022

Variables	Underemployed				Unemployed			
	Coefficient	Robust standard error	z	P-value	Coefficient	Robust standard error	z	P-value
Primary	−0.5932891	0.0829981	−7.15	0.000	−0.6866752	0.159369	−4.31	0.000
Secondary	−1.284518	0.0827227	−15.53	0.000	−0.8928849	0.1574089	−5.67	0.000
High school	−1.560217	0.088105	−17.71	0.000	−0.7065034	0.1615465	−4.37	0.000
College	−2.397346	0.0835905	−28.68	0.000	−1.248943	0.1577581	−7.92	0.000
Postgraduate	−3.412678	0.0994558	−34.31	0.000	−1.994186	0.1734426	−11.5	0.000
25_34	−0.7676246	0.0302107	−25.41	0.000	−0.8753847	0.0398269	−21.98	0.000
35_44	−0.8939101	0.0329263	−27.15	0.000	−1.245934	0.047563	−26.2	0.000
45_54	−0.8748541	0.0341726	−25.6	0.000	−1.402743	0.052568	−26.68	0.000
55_65	−0.8012736	0.0362674	−22.09	0.000	−1.195481	0.0575066	−20.79	0.000
Male	−0.2993887	0.015384	−19.46	0.000	−0.4360117	0.0249296	−17.49	0.000
Indigenous	0.6510094	0.0303167	21.47	0.000	0.0699183	0.0596349	1.17	0.241
Black or montubio	0.3976168	0.0300801	13.22	0.000	0.7829739	0.0446818	17.52	0.000
Mixed or white	−0.5120643	0.0151858	−33.72	0.000	−0.7946212	0.026367	−30.14	0.000
Head of household	−0.2590411	0.0163042	−15.89	0.000	−0.6885506	0.0291377	−23.63	0.000
Constant	2.155532	0.0880599	24.48	0.000	0.7307275	0.1621339	4.51	0.000
N	112193							
Pseudo R^2	0.1026							
Chi-squared prob.	0.0000							

Source: Own elaboration with data from ENEMDU 2022

COVID-19, their relative position worsened since their probability of being underemployed or unemployed was 41% (9% more than in 2019) and for heads of household it was 33% (9% more than in 2019). This means that, mainly, spouses and children are much more likely after COVID-19 to not get a job or to work in inadequate jobs. Also, different probabilities were estimated depending on the marital status of the worker, those who were not married experienced an increase in their probability of being underemployed or unemployed, in 2019 it was 35% and by 2022 it was 44%; while for married people it went from 24% to 31%, respectively. Unmarried workers are, on average, twice as likely to be unemployed as married workers and face an average 8% greater probability of being underemployed relative to married workers. Simply put, unmarried workers, presumably younger workers, endure worse conditions than their married counterparts in the Ecuadorian labor market.

The worker's education is a determinant of his or her employment status in the Ecuadorian labor market; those with low (high) schooling are more (less) prone to underemployment and less (more) likely to have adequate jobs. The differences between groups of workers by educational levels are wide, for example, for

Table 5: Estimated probabilities of labor condition by socioeconomic group. Ecuador, 2019 and 2022

Socioeconomic group	2019			2022		
	Adequately employed	Underemployed	Unemployed	Adequately employed	Underemployed	Unemployed
Gender						
Female	0.68	0.25	0.07	0.58	0.34	0.08
Male	0.74	0.21	0.05	0.66	0.28	0.06
Role in household						
Head of household	0.76	0.20	0.04	0.67	0.28	0.05
Another role	0.68	0.25	0.07	0.59	0.32	0.09
Marital status						
Married	0.76	0.20	0.04	0.69	0.26	0.05
Not married	0.65	0.27	0.08	0.56	0.35	0.09
Education						
Illiterate	0.37	0.58	0.05	0.27	0.66	0.08
Primary	0.53	0.43	0.04	0.40	0.54	0.06
Secondary	0.67	0.27	0.06	0.56	0.38	0.07
High school	0.67	0.26	0.08	0.60	0.31	0.09
College	0.83	0.12	0.05	0.77	0.17	0.06
Postgraduate	0.92	0.05	0.03	0.89	0.07	0.04
Age group						
25_34	0.56	0.33	0.12	0.44	0.44	0.13
35_44	0.73	0.21	0.07	0.63	0.29	0.08
45_54	0.75	0.21	0.04	0.67	0.27	0.06
55_65	0.74	0.22	0.04	0.67	0.28	0.05
25_34	0.73	0.22	0.05	0.65	0.29	0.06
Ethnicity						
Indigenous	0.64	0.32	0.04	0.51	0.44	0.06
Black or Montubio	0.58	0.35	0.07	0.53	0.36	0.12
Mixed or White	0.73	0.21	0.06	0.64	0.29	0.07
Average	0.67	0.28	0.05	0.59	0.35	0.06

Source: Own elaboration whit data from ENEMDU 2019 and 2022

2019, workers with postgraduate studies have a 92% probability of having adequate job and only a 5% probability of being underemployed; while workers with primary education have a 53% and 43% probability of being in adequate job and underemployed, respectively. However, the probability of being unemployed is very similar among workers according to their educational level, with workers with a high school diploma having the highest probability (8%). In a similar way to other socioeconomic groups, the COVID-19 pandemic affected the probability of having an adequate job for workers with low and high education, but much more severely for workers with low education, reducing it by 10% and 13% the probability of having an adequate job for workers without schooling and with primary education, respectively.

On the other hand, youngest workers (18–24 years old) are more prone to underemployment and unemployment and less likely to have adequate job than workers in other age groups. Their probability of being unemployed is double (almost triple) that of other age groups and the probability of being underemployed is on average 10% higher. After the pandemic, workers between 25 and 65 years old still had higher probability than average of having an adequate job (59%) but younger workers only had a 44% probability of obtaining an adequate job, that is, a 15% lower probability than the average worker.

The Ecuadorian labor market also shows different treatment for workers depending on their ethnic group. Indigenous and black or montubio workers are respectively 11% and 13% more likely to be underemployed than mixed or white workers. After COVID-19,

this gap widened to 15% for indigenous people and was reduced to 7% for black or montubio workers. Differences in human capital endowments and labor discrimination would be the main explanations for the bad labor conditions of indigenous, black or montubio workers.

COVID-19 significantly affected the conditions of workers in the Ecuadorian labor market. Before the pandemic, an average worker had a 67% probability of being adequately employed, 28% of being underemployed, and 5% of being underemployed, but after the pandemic these probabilities changed to 59%, 35%, and 6%, respectively. In other words, by 2022, an average worker was 8% less likely to be adequately employed, 7% more likely to be underemployed, and 1% more likely to be unemployed, implying a deterioration in the quality of employment. In 2022, women had the highest probabilities of being underemployed (34%), workers without schooling (66%), those with primary education (54%), those not married (35%), workers aged 18–24 years (44%) and indigenous people (44%). All these probabilities were higher compared to 2019, implying that the pandemic affected more severely to the most vulnerable workers in the Ecuadorian labor market. In relation to unemployment, such broad changes are not observed between groups of workers as with underemployment, which reinforces the idea that in an unfavorable work environment the most defenseless workers take low-quality jobs to avoid unemployment.

Inequality between workers in the best and worst positions in the labor market widened in 2022 compared to 2019 (Table 6). In 2019,

workers with the highest probability of having an adequate job (Group A) have the following characteristics: men, 35–44 years old, mixed or white, married and heads of household; while the workers with the lowest probability of having an adequate job (Group B) have the following characteristics: women, no education, black or montubio, not married and not heads of household. For workers in Group A, the probability of having an adequate job was 96% and for those in Group B it was only 7%. In contrast, workers in Group A have only a 3% and 1% probability of being underemployed and unemployed, respectively, while those in Group B have probabilities of 80% and 13%. By 2022, Group B workers were 2% less likely to be adequately employed, 4% more likely to be underemployed, and 2% less likely to be unemployed, while Group A workers were 1% less likely to be employed. adequate, 1% more likely to be underemployed, and the probability of being unemployed remained at 1%. Briefly, in Ecuador's labor market, youngest workers, women, and those with low education are highly disadvantaged and their employment conditions deteriorated after the pandemic.

5.1. Diagnostic Tests

Wald diagnostic tests and likelihood ratio tests were performed on the model to evaluate whether it is possible to merge two categories into one for the dependent variable. If none of the variables in the model influence the probability ratio of two categories, it is said that the categories are "not distinguishable" based on the explanatory variables of the model (Beltrán and Castro, 2010).

Both the Wald test and the likelihood ratio test raise the null hypothesis that all coefficients except the intercept associated with a given parameter of results of the dependent variable are zero. The hypothesis of no distinction between two categories is verified if all the coefficients (except the intercept) are statistically equal and this occurs if they are not significant.

The results for the different pairwise combinations of the categories of the dependent variable are presented in Table 7. As can be seen, the coefficients are all statistically significant at 1% significance level, so the null hypothesis is rejected for each pair of categories and, it is concluded that it is not possible to merge the alternatives of the dependent variable.

5.2. Marginal Effects

On the other hand, Figures 1 and 2 show the effects of the explanatory variables on the probability of the worker's activity status (marginal effects). Education has a positive (negative) and increasing impact on the probability of been adequate employment (underemployed), especially after higher education. For example, higher education increases the probability of having an adequate job by approximately 18.8% and reduces the probability of being underemployed by approximately 17.0%, in relation to workers with a high school diploma. Likewise, postgraduate education increases the probability of the worker having an adequate job by 18.5% and decreases the probability

Table 6: Estimated probabilities by labor condition. Groups with highest and lowest probability of been adequately employed

Personal attributes	2019		2022	
	Groups		Groups	
	A	B	A	B
Gender	Male	Female	Male	Female
Age group	35–44	18–24	35–44	18–24
Education	Postgraduate	Illiteracy	Postgraduate	Illiteracy
Ethnicity	Mixed or White	Black or Montubio	Mixed or White	Indigenous
Marital Status	Married	Not married	Married	Not married
Role in household	Head	Another role	Head	Another role
Labor condition	Probabilities			
Adequately employed	0.96	0.07	0.95	0.05
Underemployed	0.03	0.8	0.04	0.84
Unemployed	0.01	0.13	0.01	0.11

(1) A corresponds to workers with the highest probability of been adequately employed.
(2) B corresponds to workers with the lowest probability of been adequately employed
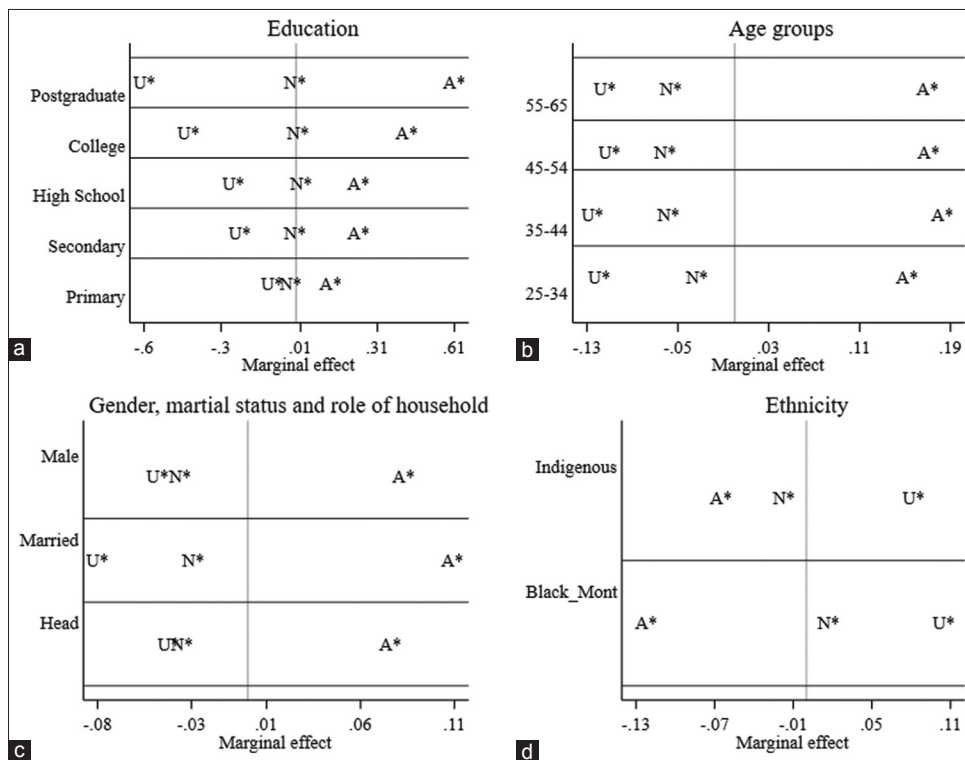Source: Own elaboration with data from ENEMDU 2019 and 2022

Table 7: Diagnostic tests on coefficients of the multinomial logit

| Categories	2019					
	Wald test			Likelihood ratio test		
	Ho: All coefficients except the intercepts for a given pair of alternatives are zero					
	χ^2	df	$P>\chi^2$	χ^2	df	$P>\chi^2$
Adequately employed and underemployed	14.316.932	14	0.0000	17.349.315	14	0.0000
Adequately employed and unemployed	8.369.216	14	0.0000	9.058.492	14	0.0000
Underemployed and unemployed	4.333.163	14	0.0000	5.136.314	14	0.0000
Categories	2022					
	χ^2	df	$P>\chi^2$	χ^2	df	$P>\chi^2$
Adequately employed and underemployed	11877.747	14	0.0000	14580.797	14	0.0000
Adequately employed and unemployed	6893.667	14	0.0000	7649.379	14	0.0000
Underemployed and unemployed	3330.378	14	0.0000	3813.26	14	0.0000

Source: Own elaboration

Figure 1: (a-d) Marginal effects of the determinants of labor condition. Ecuador, 2019

Source: Own elaboration with data from ENEMDU-2019
A: Adequately employed, U: Underemployed; N: Unemployed
*Indicates statistical significance at 5%1

Figure 2: (a-d) Marginal effects of the determinants of labor condition. Ecuador, 2022
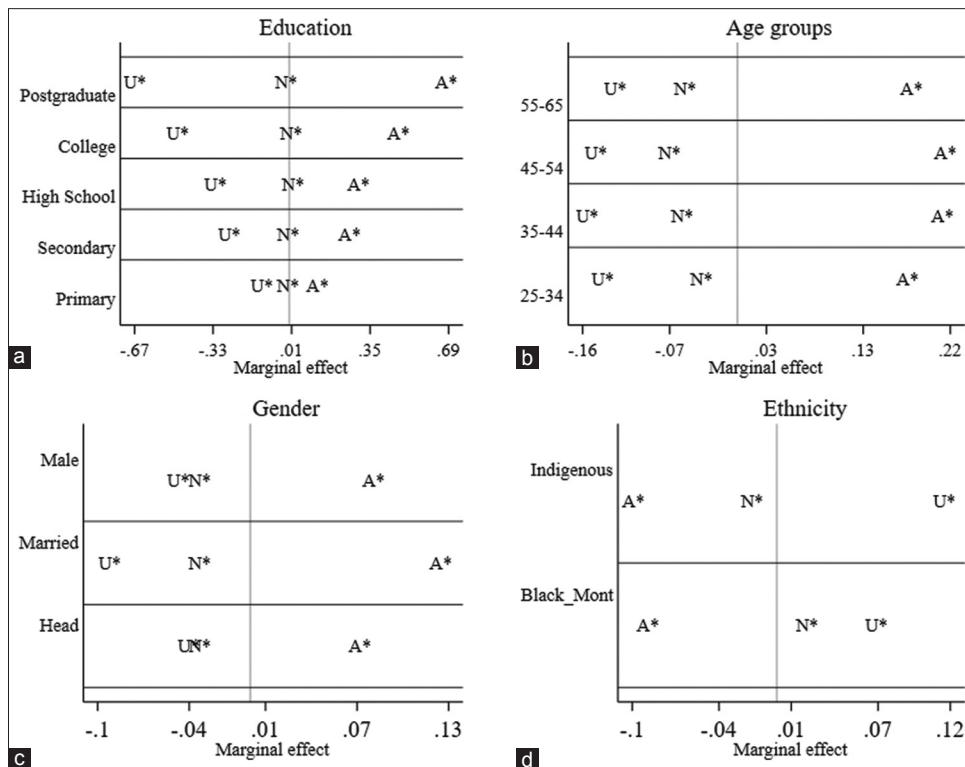
Source: Own Elaboration with data from ENEMDU-2022
A: Adequately employed, U: Underemployed; N: Unemployed
*Indicates statistical significance at 5%

of being underemployed by 17.0%, compared to workers with higher education.

The results also show that education does not have a significant impact (around plus or minus 1%) on the probability of being unemployed, suggesting that unemployment would affect workers in a similar way regardless of their level of education, although the causes are different. Workers with low education have lower unemployment rate than workers with high education because their job search time is shorter. After the pandemic, the marginal effect of education on the probability of having an adequate job increased, implying that workers with low education worsened their labor situation in 2022 compared to 2019. These results suggest an increase in inequality in terms of working condition among workers according to their educational level and that higher education significantly improves the probability of having an adequate employment.

Regarding age groups, Figures 1 and 2 show that the youngest workers (18–24 years old) are the least likely to be adequately employed and most likely to be underemployed. In 2019, workers between the ages of 25 and 34 had a 15% greater probability of being in adequate jobs and an 11% lower probability of being underemployed, compared to workers between the ages of 18 and 24. In the same sense, workers aged 35–44 have a 3% greater probability of having an adequate job and 1% a lower probability of being underemployed compared to workers aged 25–34. In relation to unemployment, workers aged 18–24 have an average 4.8% greater probability of being unemployed compared to the rest of the workers. In general, workers aged 18–24 face severe inequality in the labor market in terms of working conditions compared to workers in other age groups. On the contrary, workers between the ages of 35 and 44 are those who have the best working conditions, due in part to the fact that they have, on average, a better combination of education and experience than the rest of the workers.

The pandemic also widened the inequality between age groups; by 2022, workers aged 25 to 43 were 17% more likely to be adequately employed (2% more than in 2019) and 13% less likely to be underemployed (2 % more than in 2019) compared to workers aged 18–24. The marginal effects on unemployment are like those of 2019, suggesting that the pandemic generated a deterioration in the quality of employment and not so much an increase in unemployment.

Other characteristics evaluated through marginal effects are gender, marital status, and head of household. In 2019, the results reveal gender inequality, because men are 8% more likely to be adequately employed, 4% less likely to be underemployed, and 3% less likely to be unemployed than women. Married workers and heads of household are also 11% and 7% more likely to be adequately employed, respectively, than the unmarried workers or workers with another role in the household. In 2022, gender inequality remained; that is, women were in the same unfavorable condition in the labor market.

On the other hand, ethnic groups are treated differently in the labor market. Mixed or white workers are 6% and 12% more likely to

be adequately employed than indigenous and black or montubio workers, respectively. Similarly, mixed or white workers are less likely than other ethnic groups to be underemployed (on average 9%). Unemployment differences are smaller (about 1%) between ethnic groups. The pandemic mainly affected indigenous workers, who were, by 2022, 9% less likely to be adequately employed (3% more than in 2019) and 11% more likely to be underemployed (3% more than in 2019) than mixed or white workers. On the contrary, inequality in the working condition of black or montubio workers was reduced compared to mixed or white workers; the probabilities of being adequately employed and of being underemployed decreased by 4% in 2022 compared to 2019. In short, the pandemic mainly affected the quality of employment of indigenous people.

6. CONCLUSIONS

The main objective of this research was to identify the microeconomic determinants of the working condition of workers in Ecuador before and after COVID-19. To do this, an unordered multinomial logit model was estimated using the data from the annual ENEMDU 2019 and 2022, which allowed us to calculate the probability of workers of being adequately employed, underemployed or unemployed and how their personal attributes (education, age, gender, ethnicity, marital status, role in the home) affect that probability.

The pandemic considerably affected the creation of quality jobs in Ecuador. As a result, between 2019 and 2022, the probability of being adequately employed decreased from 67% to 59% (-8%), of being underemployed increased from 28% to 35% (+7%), and of being unemployed it increased from 5% to 6% (+1%). This means that, by 2022, the probability of having a low-quality job (underemployment) or of not getting a job was 41%, which implies a significant deterioration in working conditions for workers in Ecuador.

This research revealed that the working condition of workers in Ecuador depends directly on the human capital (education and experience) and the characteristics (gender, ethnicity, marital status) of the worker. That is, access to the increasingly scarce suitable jobs is highly related to the worker's accumulation of human capital. Workers with high education and work experience are overrepresented in these jobs and their probability of obtaining them is relatively high. For this reason, the youngest workers, who are in the process of educational training and beginning their working life, are the most affected by the deterioration in working conditions in Ecuador. Furthermore, gender and ethnic discrimination seems to influence the working condition of workers. Women and minority ethnic groups (indigenous, black and montubio) are more affected by underemployment than their counterparts. Women are, before and after the pandemic, more prone (on average 5%) to underemployment than men, while indigenous and black people or montubio are 15% and 7% more likely to be underemployed than mixed or white workers.

Underemployment affects certain groups of workers heterogeneously and consistently. This allows us to analyze the inequality between workers in better and worse conditions.

Thus, after the pandemic, labor inequality between these two groups increased; that is, it is now even more difficult for the most vulnerable workers to obtain an adequate job. Regarding unemployment, the results are not as conclusive as those of underemployment. In general, unemployment affects workers more homogeneously, suggesting that workers prefer to work in low-quality jobs (underemployment) than to be unemployed.

Thus, the pandemic significantly reduced adequate employment, which led the most vulnerable workers (young people, women, indigenous, blacks or montubio) to take refuge in underemployment to avoid unemployment, which accentuated inequalities between workers, not only in salary terms (Linthon-Delgado and Méndez-Heras, 2022), but also in their working condition.

Based on the evidence, it is suggested that public policy, to address the unfavorable situation of young workers, must design and apply job placement programs that guarantee the entry and permanence of an increasing proportion of young workers in adequate jobs. Likewise, increasing access to quality higher education is essential so that young people have the human capital required by the labor market. On the other hand, it is necessary to apply policies to combat discrimination and, consequently, reduce gender and ethnic gaps. In general, strengthening quality of education and promoting equal opportunities in society will significantly contribute to reducing inequalities among workers in Ecuador. Finally, it is suggested that future research incorporate an analysis by sectors of economic activity, which allows analyzing the importance of the economic structure in the determinants of adequate employment, underemployment, and unemployment in Ecuador.

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