

Labor informality in Ecuador: Analyzing its determinants under a quantitative approach

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Abstract: *This research aims to establish the determinants of labor informality in Ecuador in the years 2009 and 2019, using cross-sectional microdata. For this purpose, we used data obtained from the National Survey of Employment, Unemployment and Underemployment (ENEMDU for its acronym in Spanish). We applied probit models to estimate the probability that an individual with specific characteristics belongs or does not belong to the informal sector, and the Oaxaca-Blinder (1973) methodology to corroborate the existence of a wage gap between the formal and informal sectors. With this, we found that migration, family size, age and sex are determinants of labor informality in Ecuador, where, the number of family members and age have a positive influence on the probability of being an informal worker, while being a migrant and being male have a negative influence. In addition, we find that there is a significant wage gap between the formal and informal sectors, which is mainly due to differences in human capital endowments. Finally, we recommend that policymakers implement a social program aimed at reducing vulnerability and mitigating the effects of labor informality.*

Keywords: *Informal economy. Wage gaps. Human capital. Wages.*

I. INTRODUCTION

Labor informality is considered an economic and social problem because it undermines the social welfare of the population; although it is a source of income for those who are unable to find an opportunity in the formal labor market, being an informal worker implies facing a precarious employment situation, accompanied by low wages, long working hours, lack of labor rights and lack of social protection that prevent the aspiration to have a peaceful old age (Tokman, 2007). But this problem goes beyond that, since informality involves inequality, poverty and deprivation of basic services that do not allow covering the vital needs of human beings; and, in turn, it is a concern for the State, since fewer workers in the formal sector implies a reduction in tax collection, limiting the availability of economic resources for the State (Elorza, 2016).

On a global scale, according to the International Labor Organization [ILO] (2020), more than 2 billion workers in the world belong to the informal economy and 93% of the world's informal work is found in emerging and developing countries, with a 90% concentration in rural areas, especially in the agricultural sector. According to Maurizio (2021), in Latin America and the Caribbean more than 70% of jobs are in the informal sector, where only 40% of the regional population has access to social protection. At the national level, INEC (2022) reports that during January 2022, the informal sector represented 53.1% of the Ecuadorian labor market.

In this sense, informality is undoubtedly one of the socioeconomic problems that most afflict Ecuador and the world, given its rationale, which as mentioned by Robles and Martínez (2018) is a symptom of low productivity and little development for an economy. Therefore, in this article we intend to know what are the determinants of labor informality in Ecuador, starting from the dualistic approach initially proposed by Lewis (1954) and studied by Hart (1973), where, the coexistence of two economic sectors is highlighted, the traditional sector that encompasses primary activities such as agriculture, livestock, fishing, among others, and the modern sector that encompasses activities that require higher productivity. Therefore, in order to select the possible determinants of labor informality, the dualistic model analyzes the sociodemographic factors that cause a mismatch between labor demand and supply (Pérez et al., 2014).

Empirical evidence shows that the phenomenon is multicausal, i.e., there are several factors that influence labor informality, among them, are the level of schooling, marital status, gender, household income, age and the geographic

area to which an individual belongs (Loayza, 2008; Ospino and Roldán, 2009; Williams, Shahid, and Martínez, 2016; Robles and Martínez, 2018). Consecutively, authors such as Rodríguez and Calderón (2015); and, Carvajal, Cárdenas, and Estrada (2017), highlight that individuals who are working in the informal sector possess certain characteristics in common: low academic levels, are young or older adults, low income, reside in rural areas, and are mostly women. While, Atesagaoglu and Elgin (2015); Canelas (2019); Perez, (2020); Bargain, Etienne, and Melly (2021) highlight that, on average, informal jobs earn lower incomes than formal jobs. However, the literature linking labor informality with migration and family size is scarcer.

Therefore, this research is based on the hypothesis that there are sociodemographic factors that influence labor informality in Ecuador. Therefore, the objective of the study is to establish the determinants of labor informality in Ecuador, in the years 2009 and 2019, using cross-sectional econometric techniques. In this sense, data obtained from the quarterly ENEMDU conducted by INEC (2009, 2019) were used. Regarding the main findings, it was found that migration, age, sex, family size, ethnicity, marital status, labor income, schooling, natural region and geographic area of residence are determinants of labor informality in the Ecuadorian context. In addition, the existence of a wage gap between the formal and informal sectors in the years 2009 and 2019 was confirmed; where, the wage difference in favor of formal employees increased in 2019 and, in turn, the empirical results show that there is a direct relationship of the level of schooling and inversely proportional of the size of the family with the income of workers, so that, these increase as a function of the number of years of schooling and decrease as the number of household members increases.

Finally, the research is structured as follows, in addition to the introduction: section (2) shows the literature review; section (3) contains the data and econometric strategy; section (4) presents the discussion of the findings of the present study with those of other authors; section (5) includes the conclusions and policy recommendations derived from the research; sections (6) and (7) contain the bibliography and annexes, respectively.

II. PREVIOUS LITERATURE REVIEW

The conceptualization of informality began in the 1950s, with the research of Lewis (1954), who emphasizes that, within developing economies, two very marked and different economic sectors coexist, the traditional sector and the modern sector, where the former refers to primary activities such as agriculture, livestock, fishing, among others, while the modern sector encompasses activities that require higher productivity. In addition, the author highlights the presence of oversupply caused by the migratory movement from the traditional to the modern sector, which brings with it the presence of a subsistence wage, that is, a salary that only allows us to acquire the necessary goods to keep us alive.

Consequently, Hart (1973) distinguished a dualistic model of the urban labor force, in which he associated salaried employees with the formal sector and the self-employed, engaged in low productivity activities with insufficient income within the informal sector. Given this, the present research starts from the dualistic approach, which analyzes the sociodemographic factors that cause a mismatch in labor demand and supply, considering variables such as age, sex, level of schooling, marital status, among others (Pérez et al., 2014). In this sense, Robles and Martínez (2018) examine the factors that foster informality in Mexico employing a logit-type econometric model and using cross-sectional data, where, the results found confirm that the phenomenon is multicausal, i.e., there are several factors that influence informality; among them are: level of schooling, work experience, social stratum, marital status, head of household, gender and branch of activity to which an individual belongs (Loayza, 2008; Ospino and Roldán, 2009). Under this idea of multicausality, Rodríguez and Calderón (2015); Carvajal, Cárdenas, and Estrada (2017) and, Ruiz et al. (2017) highlight that individuals who are working in the informal sector have certain characteristics in common: low academic levels, short work experience, are young or older adults, low income and are mostly women; therefore, they face economic instability because they do not receive a fair wage and are outside legal protection.

Complementing the above, Williams, Shahid and Martinez (2016) show that, the highest levels of entrepreneurial formality are related to people who possess the following characteristics: women, advanced age, high levels of schooling, and, therefore, entrepreneurship should be promoted in women, improve the educational level and take as role models those entrepreneurs of advanced age (Korku, Nana, and Zinyembad, 2021). While, Bernal (2009), highlights that men and adults are less likely to be informal, given that, workers aged 25 and 44 are 2.3% more likely to be informal than individuals older than 45 years; such results are consistent with the findings of Gomes, Iachan, and Santos (2020), where, they found that, young workers who initially work in the informal sector are more likely to find formal jobs than those workers with older age.

On the other hand, Ariza (2006) and Lehmann and Pignatti (2018) specified that women are more involved in the informal sector and, in turn, Torns and Recio (2012) and Wegren et al. (2017) evidenced the persistence of gender inequality in the labor market, which can be found in the type of working day and the duration of the employment contract; while Berniell, et al. (2021) found that the probability of women working in the informal sector increases after having their first child and this increases even more if the mother has a low level of education. Under this gender perspective, Yahmed (2018) highlights that, the informal sector has the highest average gender wage gap; however, in the formal sector, as the level of education increases, a change in the gender wage gap is reflected, given that, formal jobs offer higher wages for women. However, due to persistent gender discrimination in employment causes that in poor countries an increase in women's participation in the labor market negatively affects women's average wages (Elgin and Elveren, 2021).

Canelas (2019) in her research shows that, on average, informal jobs earn lower incomes than formal workers; in addition, poverty increases the probability of belonging to the informal sector by 10%, as long as individuals are low-skilled, therefore, the author suggests the creation of sources of employment, accompanied by investment in quality education; likewise, another study proposes making the labor market more flexible, given that, it has a positive impact on the increase of formal workers (Wahba and Assaad, 2017). In turn, Webster et al. (2016) in their study used cross-sectional data to identify the presence of statistically significant relationships of poverty indicators with informality, where, it can be highlighted that a higher level of education is associated with a higher per capita income, i.e., those who have greater human capital are more likely to find a job that gives them a better remuneration, although, in general, informal workers receive low incomes (Malagón, 2018; Gasparini and Tornarolli, 2009).

Regarding human capital, Maloney (1999) highlights that informal agents have a lower level of education than people belonging to the formal sector. Similarly, Madrigal (2008) points out that low-skilled workers have a relatively higher value for self-employment and, conversely, for formal jobs that receive social security. In addition, Méndez (2002) highlights the importance of consolidating efforts to strengthen the education system, given that individuals with low levels of schooling are less likely to work in the formal sector, since changes in the productive structure mean that the demand for skilled workers is increasing. Bargain and Kwenda (2010) mention that the probability of belonging to the formal sector increases as the level of education increases, due to the positive returns it generates. Together, Galiani and Weinschelbaum (2012) conclude that human capital is a determinant of whether people work in the formal or informal sector, highlighting that, as the head of household and his/her partner increase their years of schooling, the greater the probability that they will be formally employed. Likewise, Williams, Shahid, and Martinez (2016) elucidate that informal workers possess a lower level of education than formal workers, associating that, higher levels of formality are related to more years of education.

Regarding the area, Lewis (1954) emphasizes that informality is more prevalent in rural areas with agricultural activity, with the traditional sector being the most prevalent in the labor market. Likewise, Loayza (2008) alludes that in an area with a high proportion of young and rural population, it is more likely that levels of informality will increase. In addition, Luebker (2008) considers that, in rural areas, the number of informal workers is higher because in most developing countries there are few developed geographic areas, causing these areas to lack many basic aspects that lead to a good quality of life. Similarly, Gasparini and Tornarolli (2009) indicate that labor informality is positively related to the rural area, thus, Jiménez (2012) mentions that those people who come from rural areas have a greater possibility of belonging to the informal sector, however, the above does not imply that informality does not happen in urban areas, since, there are workers who, because they are not formally educated to perform a profession, develop skills through a trade, giving preference to informality; Since it is in economic activities such as industry, commerce and construction where informality is most concentrated (Loayza, 2008).

Regarding age in the informal sector, it is noted that there are more individuals in the informal sector than in the formal market, in the age group 15 to 29 years old and over 65 years old (Castells, 1989). Similarly, Méndez (2002) highlights that age is another factor that influences the decision to work, where participation in informal work is common among younger and older individuals. In addition, Perry et al. (2007) mention that most individuals working in the informal sector are young, while middle-aged and older workers tend to work in the formal sector or on their own account, although most of them end up in the informal sector. In turn, García, Ortiz, and Uribe (2008) allude that people are more likely to become formal workers in their productive age, as long as they have accumulated sufficient human capital and work experience. Guataquí, García, and Rodríguez (2010) point out that there is no linear behavior between informality and age; rather, the probability of a person belonging to the informal sector decreases until reaching the age corresponding to a range of 25-35 years of age and increases thereafter.

Regarding migration, Harris and Todaro (1970) point out that migrants expect to work in the formal sector in the future. Similarly, Joshi and Joshi (1976) state that people migrate with the purpose of finding a job in the formal sector in the future and in the meantime they settle for an informal job (Banerjee, 1983); although, according to Cole and Sanders (1985) finding a formal job as a migrant can take a long time. Therefore, Elgin and Oyvat (2013) mention that the fact that people migrate from the countryside to the city in search of better opportunities stimulates the growth of the informal economy, i.e., there is a possibility that people who have migrated may never be able to move to the formal sector causing congestion in the informal sector. It should be noted that there are no theories that support the idea that the number of members in a family has an influence on the probability of belonging to the informal sector; however, this research aims to provide empirical evidence regarding the possible relationship between the two variables.

Within this framework, Martínez, Short, and Estrada (2017) in their research show the reality of informal people in Cali, where, a street vendor on average works 10.8 hours a day for 6.5 days a week, reflecting the labor precariousness of this group. In this sense, Boonjubun (2017); Rodríguez and Calderón (2015) treat street vending as an informal activity and highlight that applying programs focused on evicting street vendors in order to make cities safer is a misconception because their execution makes cities more insecure. However, Huynh and Nguyen (2020) mention that the best measure to reduce informality is through investment in public spending because on average, a 1% increase in public spending causes a 0.26% reduction in the informal economy, i.e., expansionary fiscal policies improve the quality of public services and discourage people from working in informality. Meanwhile, Boonjubun (2017) propose the promotion of entrepreneurial talent, through incentives for the creation of formal companies and, in turn, the application of strategies for their growth.

Authors such as Leyva and Urrutia (2020) find in informality positive aspects for a country's economy, since its presence in economic crises can help mitigate the impact of strict labor regulations on fluctuations in employment and consumption, providing more flexibility for the economy to respond to crises. Likewise, Colombo, Menna and Tirelli (2019) determine that, in times of crisis, the informal sector serves as a buffer because it picks up those workers who are unemployed. While, Alberola and Urrutia (2020) mention that, informality reduces inflation volatility, although with the presence of informality, monetary policies are less effective.

In addition, Garganta and Gasparini (2015); Chatterjee and Turnovsky (2018) recommend not to apply conditional cash transfer programs, nor remittances because they may cause undesirable results in the labor market; rather, severance payments encourage individuals to leave the informal sector (Flórez, 2017). Meanwhile, Albertini, Fairise, and Terriau (2021) propose increasing sanctions and controls within the informal sector, since, that causes this proportion to decrease, although so does total employment. Finally, the role of governments in reducing informality rates can be highlighted and, to this end, it is essential to reduce political polarization (Orviska et al., 2006; Elbahnasawy, Ellis, and Adom, 2016).

III. DATA AND METHODOLOGY

DATA

The first paragraph under each heading or subheading should be flush left, and subsequent paragraphs should have a five-space indentation. A colon is inserted before an equation is presented, but there is no punctuation following the equation. All equations are numbered and referred to in the text solely by a number enclosed in a round bracket (i.e., (3) reads as "equation 3"). Ensure that any miscellaneous numbering system you use in your paper cannot be confused with a reference [4] or an equation (3) designation.

In this study we used data obtained from the quarterly ENEMDU conducted by INEC (2009, 2019). In order to make the sample more robust, the bases corresponding to the third and fourth quarters were joined. In this sense, according to Alborno, Ricaurte, and Oleas (2011) there are three ways to measure informality through employment surveys, of which the one that corresponds to the activity status of workers was used. Therefore, a dummy variable was used as a dependent variable, which takes the value of 1 if the individual works in the informal sector and 0, in the case of being a formal worker; it should be noted that data referring to domestic employment and not classified by sector were eliminated.

In addition, as independent variables, the sex variable was used, which reveals the participation of each of the sexes with respect to the total population, being male and female; another variable is age, which is the time interval from birth to the time of reference, where only individuals between the ages of 15 and 65, who make up the Economically Active Population (EAP), were taken into account; also the migration variable, which is the movement of a person from one place of residence

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to another, which takes the value of 1 if the individual is a migrant and 0 if not; and family size, which measures the number of members that make up a family, which for the samples analyzed takes values ranging from 1 to 21.

Additionally, as control variables, the variable ethnicity was considered, which refers to the participation of each of the ethnicities analyzed, taking into account four categories: indigenous, white, black and mestizo; also, the variable natural region that refers to the natural zone to which it belongs, being the categorical variables: Costa, Sierra and Oriente; followed by the variable marital status, which is the particular situation that characterizes a person in relation to their personal relationships, where, individuals who are in free union were grouped within the married and those who are divorced and widowed as single; additionally, schooling was used which indicates the number of years approved in relation to the level of instruction, which takes into account primary, secondary, high school, third and fourth level university education.

In addition to the above, we used the geographic area that corresponds to a territorial zone, which can be urban or rural; and the labor income variable that represents the income received by a worker in his/her main occupation, expressed in U.S. dollars, where, to obtain the minimum and maximum values, a box and whiskers diagram was used for each year of study that shows the quartiles of the distribution of labor income (see Annexes 1 and 2), taking as a minimum value \$0 for both years and a maximum value of \$780 for 2009 and \$800 for 2019. Table 1 summarizes the description of the variables.

Table 1. Description of variables.

Variable	Symbol	Category	Measure	Definition
Dependent				
Labor informality	Sector	1: informal sector. 0: formal sector.	Dicotoma	People located in the informal and informal sector.
Independent				
Migration	migration	1: Migrant 0: Non-migrant	Dicotoma	Displacement of a person from one place of residence to another.
Age	Age		Years	Time interval from birth to reference time.
Sex	Sex	1: Male 0: Female	Dicotoma	Indicates the participation of each gender with respect to the total population.
Family size	Size		Number	Number of members that make up a family.
Control variables				
Natural region	Region	1: Sierra 2: Coast 3: Amazon	Polytomics	Refers to the natural region to which it belongs: Coast, Highlands and East. Excluding the Insular region.
Ethnicity	Ethnicity	1: Indigenous 2: White 3: Black 4: Mongrel	Polytomics	Indicates the participation of each of the ethnic groups analyzed, with respect to the total population.
Marital status	Estcivil	1: Married 0: Single	Dicotoma	A particular situation that characterizes a person in relation to his or her personal relationships.
Labor income ¹	Ingrl Iningrl ²		Dollars	Remuneration for productive activities in the form of payments.

¹ Labor income is used as the dependent variable for the development of the second objective.

² In order to reduce the range of dispersion, natural logarithm was applied to labor income.

Human capital	Esc	Years	Number of years passed in relation to level of education.
Area	Area	1: Urban 0: Rural	Dicotoma Indicates the place of residence.

Note: Adapted with information from INEC (2009, 2019).

Table 2 shows the descriptive statistics of the variables, as well as the mean, standard deviation, minimum and maximum values, of which it is essential to highlight that, on average, the educational level increased from 10.37 years in 2009 to 11.12 years for 2019, which indicates that, on average, the study sample has completed their secondary education. In addition, for research purposes, only individuals aged between 15 and 65 were taken into account, where, the average age from 2009 to 2019 increased from 37 to 38 years old. Meanwhile, the average labor income also increased from \$283.99 to \$334.87, although both values are close, it is evident that in 2009 the average income was above the Unified Basic Wage (UBS), but in 2019 the average income was below the UBS. In addition, both the families surveyed in 2009 and in 2019 had an average of 3 or 4 members in their family, i.e., Ecuadorian households have small families, which shows smaller financial costs for the head of household.

Table 2. *Descriptive statistics.*

Year	Variable	Obs	Mean	Std. Dev.	Min	Max
2009	Sector	22766	0.40	0.49	0	1
	Ingrl	23028	283.99	145.14	0	780
	Lningrl	23028	5.52	0.50	4.61	6.55
	Esc	23028	10.37	4.99	0	
	Age	23028	37.90	12.75		
	Sex	23028	0.67	0.47	0	1
	Ethnicity	23028	3.75	0.75	1	
	Area	23028	0.74	0.44	0	1
	Region	23028	1.55	0.58	1	
	Estcivil	23028	0.59	0.49	0	1
	Migration	23028	0.22	0.41	0	1
	Family	23028	3.60	1.83	1	
2019	Sector	33553	0.40	0.49	0	1
	Ingrl	42225	334.87	196.88	0	800
	Lningrl	42225	5.64	0.59	4.51	6.80
	Esc	42225	11.12	4.70	0	
	Age	42225	38.10	14.02		
	Sex	42225	0.54	0.50	0	1
	Ethnicity	42225	3.75	0.74	1	
	Area	42225	0.69	0.46	0	1
	Region	42225	1.58	0.62	1	
	Estcivil	42225	0.55	0.50	0	1
	Migration	41193	0.32	0.46	0	1
	Family	42225	3.40	1.62	1	

To have a clear idea about the behavior of the variable of interest, in Figure 1 it can be identified that, since 2013 there is an increasing trend in the percentage of informal workers reaching the highest point in 2017 with 47.41%, where, this value may be due to the fact that during 2016 and 2017 the Ecuadorian labor panorama in terms of quality suffered a deterioration, given that, urban unemployment increased significantly with a value of 6.5% in 2016, showing a problem of absorption of labor supply, and also increased the rate of voluntary affiliates by 19%, that is, people who do not have a job that offers them affiliation to the social security system, but have the possibility of continuing to contribute and remain protected; being events that influence the decision of workers to belong to the informal sector of the economy (García, et

al., 2017). In general, the growing presence of informality during this period of time is evident, which indicates that a large part of the Ecuadorian population lacks decent working conditions, since the informal sector is characterized by low wages, job instability and little social protection.

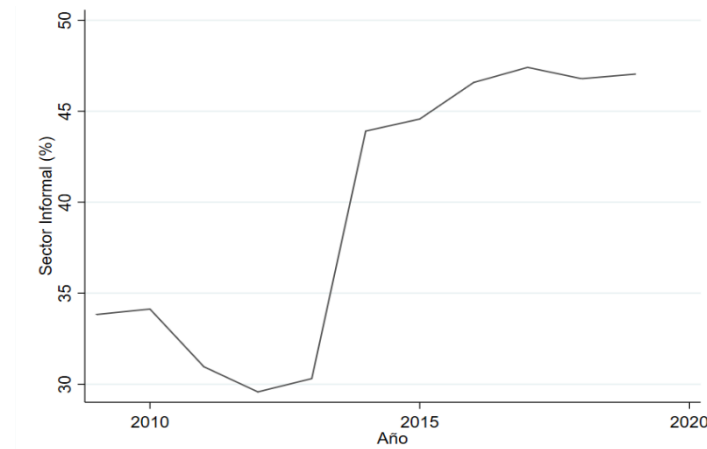
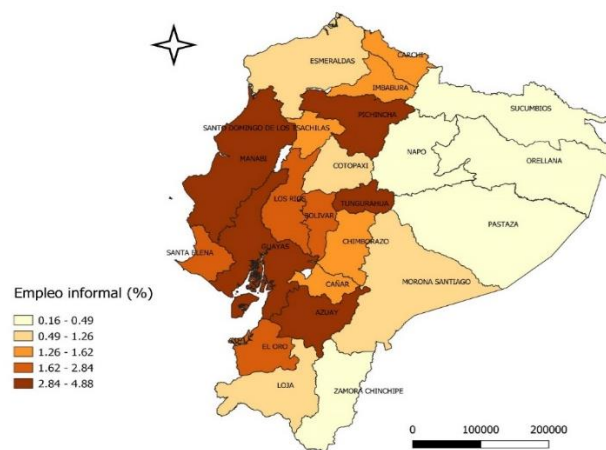


Figure 1. Evolution of the informal sector in Ecuador during the period 2009-2019.

To complement the previous analysis, Figure 2 shows the percentage of informal employment in Ecuador during 2009, which is represented by five shades of orange, where the strongest tone indicates a high percentage of informal employment and the softest tone indicates a low percentage of informality. Therefore, the provinces with the highest informal sector participation are located in the Coast and Highlands regions, specifically in Pichincha, Guayas, Tungurahua, Azuay and Manabí, with a representation of 2.84% to 4.88%, with respect to the total number of people with informal employment. Followed by the provinces: El Oro, Los Rios, Bolivar and Santa Elena with a concentration of between 1.62% and 2.84%; the rest of the provinces have percentages below 1.62%, with Orellana and Zamora Chinchipe being the provinces with the least informal employment.



Population employed in the informal sector in 2009 at the provincial level (%).

Additionally, Figure 3 shows the percentage of informal employment in Ecuador during 2019. In this year, the maximum percentage of informal sector participation was 9.53%, i.e., the concentration of informal workers increased close to 100% compared to 2009. The provinces of Guayas, Manabí, Pichincha, Azuay and Tungurahua have between 3.04% and 9.53% of workers in the informal sector, maintaining the same position as in 2009, while the rest of the provinces, with the exception of Cañar, have increased their concentration in the informal sector for 2019. In summary, it can be noted that the informal sector is more representative in the Coast and Highlands regions, being the provinces of Guayas and Pichincha the most affected, this may be due to the fact that at the national level these are the provinces with the largest number of inhabitants and, therefore, the absorption capacity of the formal sector may be reduced.

the difference between the observable explanatory variables of the two groups and the second component reflects the difference between the unobservable characteristics, measured by the discrepancies between the parameters of the two groups. In addition, equation (3) shows the Blinder-Oaxaca econometric model.

$$\ln(w_{for}) - \ln(w_{inf}) = X'_{for}b_{for} + X'_{inf}b_{inf} \quad (3)$$

It includes the natural logarithm of the formal and informal sector wages. $\ln(w_{for})$ and informal $\ln(w_{inf})$ vectors of the averages of both sectors X'_{for} , X'_{inf} and estimated coefficients of formal and informal sectors. b_{for} , b_{inf} . In this sense, equation (3) is decomposed in two ways, as shown in equation (4).

$$\ln(w_{for}) - \ln(w_{inf}) = \Delta X'^{b}_{for} + X'_{inf}\Delta b \quad (4)$$

The first member shows the difference in the logarithm of income between the formal and informal sectors and the second member represents the difference in the coefficients, due to discrimination effects. Next, equation (5) shows the wage equation for the formal and informal sector.

$$\ln W_i = X'_i\beta + \mu_i \quad (5)$$

Where, $\ln W_i$ represents the natural logarithm of the wage, X'_i symbolizes the vectors of the explanatory variables, β corresponds to the vectors of the parameters and μ_i are the residuals of the model (Otero, 2012).

IV. DISCUSSION OF RESULTS

Table 3 shows the results of the probit model estimates for 2009. In this sense, in order to have a better picture of the determinants of labor informality, the results of model 6 should be analyzed, since it shows the best fit. Therefore, we can highlight the following: if an individual increases his labor income, his probability of participating in the informal sector will decrease by 22.2%, which would imply that an increase in wages encourages the population to join the formal sector; while, when taking into account the size of the family, as the number of members increases, their probability of being informal is lower by 0.2%, it should be noted that this result is not statistically significant. In addition, those who are outsiders to the territory where they migrate are 2% less likely to be informal than those who have always resided in a city; these results are contradictory to the empirical evidence that shows that those who are migrants are more likely to engage in informal activities.

With respect to the schooling variable, it is observed that as the level of education of an individual increases, he/she is 2% less likely to belong to the informal sector; therefore, investing in our academic training allows us to perform more easily in formal jobs. The opposite happens as the age of workers increases, given that their probability of being informal increases by 0.3%, which can be explained by the fact that many jobs now require young personnel. Additionally, men are 6.2% more likely to belong to the informal sector than women, contradicting the empirical evidence that women are more likely to be informal. And people who are married or in common-law unions are 1.1% more likely to be informal than those who are single, therefore, individuals should take advantage before forming a household to find a formal job that will allow them to guarantee job stability.

Table 4 shows the results of the probit model estimations for 2019, where, as in 2009, the variables used are statistically significant except for sex (male) and the Amazon region in model 6, which includes the dependent and control variables. In addition, both the AIC and BIC criteria and the pseudo R² show that model 6, which includes all the variables of interest, is the model that offers the best fit with respect to the rest. As for the results, the variables labor income, family size, schooling, ethnicity, area, age and natural region maintain the same relationship obtained for 2009. Meanwhile, the marital status and sex variables have the opposite effect to that found in 2009, given that in 2019 those who are married or in union are 5% less likely to belong to the informal sector than those who are single or divorced, and men show a negative relationship in models 1, 3 and 4.

In general, the results obtained were as expected based on the empirical evidence, since most of the sociodemographic variables used in the model are determinants of labor informality. In the first place, labor income has a negative influence on labor informality, given that, if there is an increase in wages the population will have more incentives to belong to the formal sector (Canelas, 2019). Schooling maintains the aforementioned relationship, since, the results show that as the level of qualification improves, the probability of belonging to the informal sector decreases by 2%, therefore, if one wishes to work in the formal sector it is essential that the individual is constantly prepared and thus can perform in the best way

within it; it should be noted that the results of the authors mentioned in the literature review are related to what was found (Loayza, 2008; Galiani and Weinschelbaum, 2012; Boedo and Senkal 2014; Rubio, 2017).

In addition, it was observed that those people who are not from the territory where they migrate are between 5% and 7% less likely to be informal than those who have always lived in a city, a result contrary to what was expected, given that, because they are migrants, it was assumed that they have less interest in formal jobs and prefer to go to informal jobs in order to obtain income in the shortest time possible, occupying jobs with lower educational levels than they have; however, their influence on the labor market is not usually significant with respect to the rest of the population (Recio, et al., 2006; Contreras, Ruíz, and Sepúlveda, 2013). In addition, people who are married or in common-law unions are up to 11% more likely than those who are single to be informal workers, a result similar to the findings of Loayza (2008); Ospino and Roldán, (2009); Robles and Martínez (2018).

Referring to the sex of workers, it was found that men are more likely than women to get informal jobs, being a result contrary to what was found in the empirical evidence, which highlights that women are more involved in the informal sector, where, the informal sector has the highest average wage gap by sex causing that in poor countries an increase in women's participation in the labor market negatively affects women's average wages (Wegren et al., 2017; Lehmann and Pignatti, 2018; Yahmed, 2018; Elgin and Elveren, 2021). Additionally, it was shown that indigenous people are more likely to be informal workers than the rest of the ethnicities analyzed, which implies in a certain way the existence of racial discrimination in the labor market, therefore, this group being more vulnerable should have greater consideration in the design of public policies.

With regard to the family size variable, a positive probability was obtained with labor informality; to get a better idea, it was divided by ranges, where it was observed that families with more than 5 members in the household have a 0.6% greater chance of working informally than families with 4 or less family members; although there is no empirical evidence to support this relationship with informality, it is evident that a greater family burden is directly related to informality. Finally, a positive relationship between age and the informal sector was found, and the sample analyzed was also divided by age group, where the findings show different relationships according to age group; on the one hand, people between 25 and 34 years of age are less likely to be informal than the young population (15-24 years) and those over 35 are more likely to be informal than young people, results that are similar to those concluded by Gomes, Iachan, and Santos (2020), since they found that young workers who initially work in the informal sector are more likely to find formal jobs than older workers.

Labor informality in Ecuador: Analyzing its determinants under a quantitative approach

Table 3. Estimation of probit models for 2009.

	(1)	(2)	(3)	(4)	(5)	(6)
INFORMAL SECTOR						
Migration	-0.058*** (0.007)		-0.010 (0.007)	-0.062*** (0.007)	-0.031*** (0.006)	-0.020*** (0.006)
Age	0.510*** (0.017)	0.272*** (0.024)		0.007*** (0.000)	0.006*** (0.000)	0.003*** (0.000)
Sex: male	0.045*** (0.006)		-0.004 (0.006)	0.036*** (0.006)	0.116*** (0.005)	0.062*** (0.005)
Family size	0.192*** (0.013)	0.087*** (0.017)		0.015*** (0.001)	0.008*** (0.001)	0.002* (0.001)
Coastal Region			0.100*** (0.006)	0.088*** (0.006)	0.063*** (0.005)	0.059*** (0.005)
Amazon Region			-0.023+ (0.014)	-0.030* (0.014)	-0.012 (0.013)	0.001 (0.012)
Ethnicity: white			-0.234*** (0.017)	-0.335*** (0.016)	-0.198*** (0.016)	-0.091*** (0.016)
Ethnicity: black			-0.131*** (0.022)	-0.194*** (0.021)	-0.126*** (0.020)	-0.065*** (0.019)
Ethnicity: mixed race			-0.211*** (0.012)	-0.308*** (0.011)	-0.181*** (0.012)	-0.085*** (0.012)
Marital status: married			0.038*** (0.006)	-0.020** (0.006)	0.019*** (0.006)	0.011* (0.005)
Log of labor income		-4.130*** (0.078)			-0.288*** (0.003)	-0.222*** (0.003)
Schooling		-1.031*** (0.027)				-0.020*** (0.001)
Urban area			-0.312*** (0.006)			-0.119*** (0.006)
Observations	28954	28180	28954	28954	28180	28180
AIC	39559.51	28635.58	36819.02	38219.55	29967.85	27792.22
BIC	39572.92	28676.82	36901.75	38310.56	30066.81	27907.67
r2_p	0.013	0.266	0.082	0.047	0.232	0.288

Table 4. Estimation of probit models for 2019.
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Labor informality in Ecuador: Analyzing its determinants under a quantitative approach

	(1)	(2)	(3)	(4)	(5)	(6)
INFORMAL SECTOR						
Migration	-0.067*** (0.005)		-0.019*** (0.005)	-0.066*** (0.005)	-0.051*** (0.005)	-0.031*** (0.005)
Age	0.328*** (0.015)	0.050* (0.019)		0.005*** (0.000)	0.004*** (0.000)	0.003*** (0.000)
Sex: male	-0.028*** (0.005)		-0.044*** (0.005)	-0.027*** (0.005)	0.013** (0.005)	0.005 (0.005)
Family size	0.089*** (0.009)	-0.198*** (0.012)		0.009*** (0.001)	-0.022*** (0.001)	-0.006*** (0.001)
Coastal Region			0.157*** (0.005)	0.139*** (0.005)	0.101*** (0.005)	0.094*** (0.005)
Amazon Region			0.025** (0.009)	0.072*** (0.010)	0.032*** (0.009)	0.012 (0.009)
Ethnicity: white			-0.218*** (0.024)	-0.311*** (0.024)	-0.200*** (0.022)	-0.074** (0.025)
Ethnicity: black			-0.210*** (0.019)	-0.318*** (0.019)	-0.223*** (0.018)	-0.124*** (0.020)
Ethnicity: mixed race			-0.249*** (0.008)	-0.341*** (0.007)	-0.216*** (0.008)	-0.132*** (0.011)
Marital status: married			-0.016** (0.005)	-0.050*** (0.005)	-0.042*** (0.005)	-0.050*** (0.005)
Log of labor income		-3.807*** (0.059)			-0.263*** (0.002)	-0.233*** (0.004)
Schooling		-0.848*** (0.021)				-0.020*** (0.001)
Urban area			-0.300*** (0.005)			-0.123*** (0.006)
Observations	39335	39661	38782	38782	38569	38569
AIC	54198.72	42447.75	48348.25	51017.39	42380.00	40075.80
BIC	54224.46	42490.69	48433.91	51111.62	42482.73	40195.64
r ² _p	0.006	0.228	0.101	0.051	0.208	0.251

To verify the second hypothesis, the Oaxaca-Blinder (1973) methodology was used to perform three decompositions: the first includes a control for individuals considering their level of schooling, the second their age and the third their family size, which were used in both years of the study. In general, the results for both years of study are statistically significant. Next, Table 5 shows that the geometric mean of the logarithm of labor income is equal to 5.68 in the formal sector and 5.30 in the informal sector, yielding a wage differential of 0.39.

Table 5. Oaxaca-Blinder decomposition for 2009.

	Schooling (1)	Age (2)	Family size (3)
Differential:			
Formal sector	5.682*** (1414.08)	5.682*** (1414.07)	5.682*** (1414.07)
Informal sector	5.295*** (1102.86)	5.295*** (1102.86)	5.295*** (1102.86)
Difference	0.387*** (61.86)	0.387*** (61.86)	0.387*** (61.86)
Decomposition:			
Endowments	0.0386*** (8.53)	-0.00926*** (-6.73)	0.0000284 (0.35)
Coefficients	0.279*** (39.41)	0.416*** (65.55)	0.387*** (61.83)
Interaction	0.0700*** (12.23)	-0.0193*** (-9.80)	0.000127 (0.36)
Remarks	22766	22766	22766

Note: t-statistics in parentheses, * p < 0.05, ** p < 0.01, *** p < 0.001

Continuing with the analysis, Table 6 shows the Oaxaca-Blinder decomposition during 2019. Highlighting that for this year the wage gap between the formal and informal sectors has increased by 0.49 in favor of formal workers. In this sense, the first decomposition highlights that, on average, if informal workers had the same human capital endowment as formal workers, their labor income would increase by 11.08%, compared to 2009, the level of schooling has greater importance over time, since it implies an increase in labor wages, therefore, it is essential that people invest in their academic training to have a better job stability. The second decomposition shows that if both sectors had workers of similar age on average, the informal sector would have to earn 1.12% less than formal workers. On the other hand, having the same family burden in both sectors would imply that formal workers would have to increase their labor income by 0.11%. These results imply that by 2019, age is no longer a characteristic that influences so representatively the increase in wages for the informal sector, however, family size has increased its influence on the difference in wages between the formal and informal sectors.

Table 6. Oaxaca-Blinder decomposition for 2019.

	Schooling (1)	Age (2)	Family size (3)
Differential:			
Formal sector	5.895*** (1516.97)	5.895*** (1516.97)	5.895*** (1516.97)
Informal sector	5.406*** (1215.98)	5.406*** (1215.98)	5.406*** (1215.98)
Difference	0.489***	0.489***	0.489***

	(82.82)	(82.82)	(82.82)
Decomposition:			
Endowments	0.0542*** (14.77)	-0.00548*** (-5.52)	0.000516 (1.79)
Coefficients	0.362*** (55.00)	0.499*** (83.51)	0.488*** (82.71)
Interaction	0.0728*** (15.08)	-0.00412** (-3.04)	0.000900 (1.83)
Remarks	33553	33553	33553

Note: t-statistics in parentheses, * p < 0.05, ** p < 0.01, *** p < 0.001

The results obtained showed that there is a wage gap between the formal and informal sectors for both 2009 and 2019, with 0.39 and 0.49 in favor of the formal sector, highlighting an increase in this differential. This is similar to the findings of Loayza, Oviedo, and Servén (2005), who mention that informal workers receive lower wages than formal workers, where, on average, wages in informal companies are half of those in small companies, indicating low productivity (Porta and Shleifer, 2014). However, Maloney (2004) found a statistically significant increase in income when an individual moves from informal to formal employment; he also states that, within the informal sector, on average, those who are self-employed earn more than those who work in the formal sector.

V. CONCLUSIONS AND POLICY IMPLICATIONS

In general, the results obtained in this research support the fact that informality is one of the socioeconomic problems that most afflict Ecuador, given that, over the years, this sector has increased its participation in the labor market, causing an increase in the vulnerable population characterized by the lack of a decent salary and working hours, which prevents them from improving their social welfare. Among the most relevant findings, it was found that in Ecuador human mobility, age, sex and family burden are attributes that condition the prevalence or not of workers in the informal sector, thus proving the existence of sociodemographic characteristics that influence labor informality.

Also, through the Oaxaca-Blinder decomposition (1973) it is confirmed that there is a wage gap between the formal and informal sectors in the years 2009 and 2019; where, the wage difference in favor of formal employees increased in 2019 and, in turn, the empirical findings show that there is a direct relationship between the level of schooling and inversely proportional to the size of the family with the income of workers, so that these increase as a function of the number of years of study and decrease as the number of household members increases. In this way, it is confirmed that those workers who have greater human capital endowments have a comparative advantage over other workers, which allows them to participate more easily in the formal sector; while those who have more family burden are forced to resort to informal jobs, given that they have the responsibility of maintaining a household and consider work as a necessity.

By knowing the socio-demographic characteristics of the most vulnerable workers in the country, it is possible to implement a social program aimed at reducing vulnerability and mitigating the effects of labor informality, guaranteeing new and better opportunities for this group of people, through agreements between the Ministry of Labor and Ecuadorian companies and Non-Governmental Organizations (NGOs) that are willing to offer decent jobs to these people, taking into account the skills and qualities of this group of workers.

In turn, it is necessary that local and national authorities implement programs and policies to ensure access and quality of education for its inhabitants, since schooling has a direct influence on increasing labor income and, in turn, in reducing the wage gap between the formal and informal sectors. This can be achieved by providing free courses and training endorsed by the Secretariat of Higher Education, Science, Technology and Innovation (Senescyt), promoting free workshops for the teaching of different trades that will allow the individual to start a business, for example, free craft workshops that offer a craft qualification to the beneficiaries, all in order to increase human capital endowments and thus facilitate the search for formal employment of informal workers. In addition, given that households with a small family burden were found to be less likely to be informal, greater emphasis can be placed on sex education in educational institutions at the national level.

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