

FACTORS INFLUENCING THE PROBABILITY OF AFFILIATION TO THE SOCIAL SECURITY SYSTEM AMONG INFORMAL SECTOR WORKERS IN ECUADOR

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Abstract

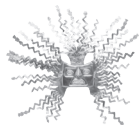
The study aims to identify the factors influencing the probability of affiliation to voluntary social security among workers in the informal sector in Ecuador during the period 2018-2020. The methodology applied a logit model with marginal effects using data from the National Employment, Unemployment and Underemployment Survey for Ecuador. The results suggest that factors such as labor income, urban residence, marital status married, and formal higher education tend to increase the likelihood of affiliation. Conversely, poverty and involvement in agricultural activities decrease the probability of opting for voluntary insurance coverage. We can conclude that, although there is interest in belonging to social security, informal workers prioritize the coverage of immediate needs due to their low labor income.

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FACTORES QUE INCIDEN EN LA PROBABILIDAD DE AFILIACIÓN AL SISTEMA DE SEGURIDAD SOCIAL ENTRE LOS TRABAJADORES DEL SECTOR INFORMAL EN ECUADOR

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Resumen

El estudio tiene como objetivo identificar los factores que influyen en la probabilidad de afiliación voluntaria a la seguridad social entre los trabajadores del sector informal en Ecuador durante el periodo 2018-2020. La metodología empleó un modelo logit con efectos marginales, utilizando datos de la Encuesta Nacional de Empleo, Desempleo y Subempleo del Ecuador. Los resultados sugieren que factores como el ingreso laboral, la residencia urbana, el estado civil casado y la educación superior formal tienden a aumentar la probabilidad de afiliación. Por el contrario, la pobreza y la participación en actividades agrícolas disminuyen la probabilidad de optar por una cobertura de seguro voluntaria. Se concluye que, aunque existe interés en pertenecer al sistema de seguridad social, los trabajadores informales priorizan la satisfacción de necesidades inmediatas debido a sus bajos ingresos laborales.

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1. INTRODUCTION

The concept of social security emerged in Europe during the latter half of the eighteenth century. This era marked the articulation of the social state's responsibility to safeguard workers through principles rooted in solidarity and justice within the labor market, achieved by intervening in its operations (Alba Vega & Krujit, 1995). This conceptualization led to the establishment of state-sponsored social protection systems, exemplified by the Bismarck and Beveridge models. The first model emphasized mandatory insurance for self-employed and salaried workers, while the second expanded security coverage to encompass all individuals without discrimination, guided primarily by the principles of universality and unwavering solidarity (Torres et al., 2014). These systems laid the foundation for the evolution of global social security frameworks.

Modern social security models are characterized by the introduction of elements of both the Bismarck and Beveridge paradigms, resulting in a hybrid system where contributory and non-contributory social insurance coexist. Gough and Wood (2004) in their assessment of African, Asian and Latin American nations, highlight the limited extent of state market regulation in these regions, which excludes a significant portion of the population from formal social protection systems. However, a similar situation is observed in countries with high economic growth, where the informal sector comprises many workers without social security coverage (ILO, 2001). This phenomenon underscores the existence of a bifurcated social security structure, favoring formal sector employees while leaving informal sector workers to navigate occupational risks independently.

In this regard, it is foreseen that the absence of State regulation of the labor market regulation may lead to non-compliance with the law, particularly concerning the lack of social security affiliation for workers, a characteristic that differentiates formal employment (with social security affiliation) from informal employment (without social security coverage) in the Ecuadorian context (Acosta-González & Marcenaro-Gutiérrez, 2023).

In Latin America and the Caribbean, social security initially mandated affiliation to the system for public servants, the military, and labor unions (Maldonado, 2021). Subsequently, a Bismarck-style model was adopted, progressively extending coverage to the entire population regardless of employment status. In Ecuador, the special regimes of Peasant Social Security and Voluntary Insurance were established in 2001 (Porras, 2015). The voluntary affiliation regime is one of the mechanisms that uphold the principle of universality concerning the right to social security, as it extends coverage to both salaried workers and those without labor dependency, offering similar benefits for both groups.

Conversely, informality has emerged as a prominent global social issue. States have struggled to regulate labor markets effectively to prevent precarious

working conditions, including the lack of protection resulting from exclusion from social security systems. In Latin America, as of 2016, 37,4 % of workers were part of the informal sector, and by 2018, this figure had risen to 140 million workers, representing 53 % of the labor force (ILO, 2018). Velásquez (2021) highlights that the lack of protection and limited access to social security systems remain underestimated challenges in the region. In 2020, the COVID-19 pandemic led to a 2,6 % contraction in GDP, which significantly impacted the labor market (Hernández & Quintero, 2021). Informal workers were more affected, as they were three to four times more likely to experience poverty than their formal counterparts (ILO, 2022). In Ecuador, the situation for informal workers remains particularly challenging. According to the National Institute of Statistics and Census (INEC, 2018), 77,06 % of individuals in the informal sector were not affiliated with any form of social security, and by 2020, this percentage had increased by 3,94 percentage points (INEC, 2020).

On the other hand, although the State has implemented reforms to expand health protection coverage—extending benefits to children under 18 years old, spouses, and common-law partners—labor policy has yet to significantly increase social security coverage for workers. Current policies remain largely focused on the formal sector, despite informality in the labor market is higher than 50 % (INEC, 2022). For informal and low-income workers, the financial contribution required for voluntary affiliation to social security remains relatively high compared to their income levels. Additionally, other factors may influence their decision not to join the social security system.

The objective of this research is to identify the factors influencing the voluntary affiliation of informal workers to social security system in Ecuador. The study aims to provide valuable insights for the formulation of public policies that not only improve labor conditions but also promote broader integration into the social security framework. We propose the following hypothesis: Voluntary affiliation to social security depends solely on the worker's income level. To achieve the objective and test the hypothesis, the research is structured into four sections: Literature review; Materials and Methods; Results and Limitations; and Conclusions and Discussion. The Literature Review explores the concept of informality in the labor market and the framework of social security and voluntary participation in Ecuador. The Materials and Methods section outlines the variables included in the econometric model. The Results and Limitations section examines the characteristics of Ecuador's informal labor market and presents the findings of the econometric model, comparing them with key theories which are then compared with leading theories from relevant literature. Finally, the Conclusions and Discussion section summarizes the key insights derived from the research findings.

2. LITERATURE REVIEW

2.1. Informality in the Labor Market

The ILO (2023) states that informal workers constitute a significant portion of the labor market. However, their working conditions pose considerable risks due to factors such as limited access to labor rights, lack of social protection, precarious employment conditions, and lower income levels compared to the formal sector (Giler-Macías et al., 2024; Paz, 2021). The high prevalence of informal labor became particularly evident in the post-pandemic period since the greatest recovery of employment was primarily driven by self-employed workers. According to the ILO (2022), these workers often experience conditions of informality and labor precariousness, as self-employment frequently emerges as a response to challenges in accessing formal employment. Informality is part of the so-called “subterranean economy” because it operates outside fiscal regulations.

The subterranean economy, defined as economic activities that do not generate added value (Cuero, 2015), has absorbed a significant portion of the workforce from marginalized areas in developing countries, placing them in a labor market that is difficult to regulate. According to Gómez (2007), understanding the nature of informality is complex, as it extends beyond legal considerations to include determinants such as poverty, income levels, economic inequality, and education. Beccaria et al. (2022) emphasize that one of the defining characteristics of the informal sector is the absence of social and legal protection for workers. Arias et al. (2020) suggest that informality can be analyzed from both legal and economic perspective: legally, because these activities operate on the margins of regulatory frameworks, and economically, because the formal sector lacks the capacity to generate sufficient employment opportunities.

Quejada et al. (2014) identify three theoretical approaches to analyzing the determinants of informality: i) the dualistic approach, with attributes informality to market fragmentation, where the modern sector fails to absorb all workers, leading surplus labor to generate its own employment; ii) the structuralist approach, which links the imbalance between labor supply and demand to various sociodemographic factors and structural economic constraints, such as limited industrial development, particularly in developing nations; and, iii) the neoclassical approach, which views informality as the result of a mismatch between labor supply and demand, compounded by wages set below subsistence levels. These perspectives highlight the multidimensional nature of labor informality, encompassing social, demographic, economic, and regulatory determinants (Adame & Tuesta, 2017).

Carvajal Calderón et al. (2017) pointed out that informality is more prevalent among young workers due to their lack of experience and among

older adults due to lower productivity levels. Additionally, a higher proportion of informal workers with primary and secondary education compared to those with higher education. This research findings also indicate that informality is more common among women and that informal workers earn, on average, 1,5 times less than the minimum monthly wage. Berrio-Calle and Bran-Piedrahita (2019) differentiate between cyclical and acyclical determinants of informality. Among the cyclical determinants, they identify factors such as unemployment, trade balance, and interest rate, while among the acyclical determinants, they note that workers with low levels of education, particularly those engaged in agricultural, mining, and construction activities, are more likely to be informal compared to those employed in tertiary sectors (Beccaria et al., 2022). They also emphasize that social inequality remains a pervasive issue in Latin America, exacerbated by the prevalence of unstable jobs, characteristic of the informal sector.

In this region, the rise in informality stems from structural deficiencies in the labor market, exacerbated by a contraction of economic growth which presents limited capacity of the formal sector to generate employment (International Monetary Fund, 2019). According to ILO (2016), economic contraction since 2015 had worsened existing labor market conditions. Between 2007 and 2014, the formal sector exhibited a modest growth rate of 1,02 %; however, from 2015 to 2018, it experienced a negative variation of -0,05 %. In contrast, during the same period, the informal sector maintained a growth rate of 1,03 %.

In Ecuador, although the informal labor market declined between 2010 and 2015, it subsequently increased by 3,7 percentage points between 2015 and 2018. Currently, the informal sector accounts for approximately half of the labor market population (Acevedo et al., 2021). Olmedo (2018) and Fajardo-Ronquillo (2020) argue that informality in the Ecuadorian is not merely a temporary phenomenon; rather, it has become an integral part of the country's economic structure due to the persistently poor working conditions. Informality in Ecuador is highly heterogeneous, encompassing street vendors, domestic workers, employees of small enterprises, and even workers in large companies who lack social security affiliation or formal labor contracts. According to the World Bank (2012), smaller companies, in particular, affiliate only 20,5 % of their employees, likely due to the high costs associated with formalizing the labor relations.

In the labor market, the formal and informal sectors are closely interconnected, as workers frequently transition between them. Self-employed workers often begin in the informal sector and, as they acquire cognitive and physical skills, seek better employment opportunities in the formal sector. The transition between these sectors is largely influenced by improvements in education, real wages, and work experience, reducing the likelihood that workers remain in informal employment (Vega Núñez, 2018). According to Grupo FARO (2020), informal workers in Ecuador work an average of 47 hours per week and earn approximately USD 250 per month. Furthermore,

around 50 % of these workers have remained in the informal sector for more than three years. These statistics underscore the urgent need to implement inclusive policies aimed at improving working conditions and, above all, expanding social security coverage as a crucial factor in enhancing a better quality of life for workers.

2.2. Social Security

Social security emerged as a result of the transition from a feudal to a capitalist mode of production, during which concerns about labor exploitation led to frequent labor demonstrations between the 19th and 20th centuries. Because of these protests, social security was incorporated into the legislation of several countries as a fundamental workers' right. Over time, the concept of social security evolved alongside the development of the Welfare State Theory. What was initially a labor achievement exclusive to workers later became recognized as a universal right for the entire population (García, 2014).

According to Pérez and Domínguez (2012), social security is a state-managed right that guarantees access to essential social services to meet the population's basic needs. The authors emphasize that social security serves as a key public policy instrument for implementing programs that mitigate inequality and social risks.

Social security systems are typically structured into two levels of protection: i) the contributory model, which is based on mandatory contributions and designed to accommodate dependent workers, with benefits calculated according to real ages or incomes; and, ii) the non-contributory model, which is universal in nature and does not require minimum contributions, as it is financed through the state budget and aimed at individuals in vulnerable conditions, regardless of their labor participation. These systems, in turn, operate under either a pay-as-you-go or an individual capitalization approach. The pay-as-you-go system functions as an intergenerational agreement in which active contributors finance pensions to support vulnerable individuals. Meanwhile, the individual capitalization system involves the accumulation of personal contributions that workers will later collect as benefits (Herrera & Velázquez, 2021).

Several Latin American countries have implemented social protection floors as a strategy to address poverty and social inequality. This framework is structured around two key dimensions: a) the horizontal dimension, which aims to extend coverage to the entire population, including informal sector workers, self-employed individuals, domestic workers, and unpaid workers; and b) the vertical dimension, which focuses on strengthening traditional social security schemes and progressively expanding access to additional protection mechanisms, such as voluntary affiliation programs. These social protection floors were formally adopted by ILO in 2012 by ILO through Convention

Number 202 as a strategy to guarantee access to healthcare, income protection in cases of unemployment or illness, food security, education, childcare, and retirement income for the elderly (Schwarzer et al., 2014). According to ILO (2021), the average contributory coverage rate increased from 36,6 % to 42,2 % between 2005 and 2010, reaching 47,5 % by 2016. However, from that point onward, coverage declined, decreasing by 0,06 percentage points to 46,9 % in 2017 and by an additional 0,03 percentage points in both 2018 and 2019.

Currently, social security systems operate under a mixed model, meaning they are not confined to a single level of protection but instead complement each other to extend their coverage to most of the population. In several Latin American countries, social security systems are structured around three levels of protection: contributory, non-contributory, and complementary. Particular emphasis has been placed on the non-contributory model to expand coverage and reduce poverty and social inequality (Abramo et al., 2019).

Ecuador's social security system follows a mixed model comprising both contributory and non-contributory components. It includes general compulsory insurance, which is further divided into pension insurance, health insurance and occupational risk insurance. Additionally, it encompasses a special regime—peasant social security—and a complementary scheme—voluntary social security. These programs are administered by the Ecuadorian Social Security Institute (IESS), the Armed Forces Social Security Institute (ISSFA), and the National Police Social Security Institute (ISPOL) (Galiano & Bravo, 2019).

These insurances schemes differ in their financing mechanisms, as they are funded through varying contributions percentage from workers, employers and the state, depending on their specific nature. Notably, pension insurance operates on an intergenerational pay-as-you-go system, in which members contribute to ensure dignified retirement for the elderly. However, actuarial deficits within the system led to the introduction of an individual savings mechanism in 2001, resulting in the establishment of a mixed system. The subsequent reforms sought to regulate fund allocation by prohibiting the cross-financing of different programs. Nevertheless, these changes failed to address the structural challenges faced by the IESS (Barona & Cisneros, 2014; Sasso, 2011).

To uphold the principle of universality, Ecuador introduced several reforms to its social security system starting in 2008. These reforms included extending access to social benefits for spouses and children up to 18 years old, allowing voluntary affiliation for people with disabilities since 2012, and incorporating unpaid household workers into the system in 2015. Today, a key challenge for the social security system is expanding coverage to workers across various employment categories—including self-employed, agricultural, dependent, and independent workers—many of whom remain within the informal sector (Barona & Cisneros, 2014). According to Robalino and Pazmiño (2016), one strategy for gradually reducing coverage gaps among informal workers is voluntary social security, which would include self-employed

individuals and unpaid workers. This approach could also contribute to the system's financial sustainability, as the contributions from these new affiliates would help strengthen its long-term viability.

2.3. Voluntary Social Security in Ecuador

In Ecuador, voluntary social security was created in 2001 as one of the special regimes managed by the IESS. It is designed for individuals who choose to contribute voluntarily, regardless of their employment status. Eligible participants include self-employed workers, business owners, sole proprietors, and independent professionals (Núñez & Rivadeneira, 2021). Members under this regime are entitled to the same social benefits as those covered by the general mandatory insurance, including maternity support, old age pensions, health-care, and occupational accident coverage, except for unemployment benefits. The contribution rate is set at 20,60 % of the monthly income declared to the IESS, provided that this amount is not lower than the unified basic wage (Robalino & Pazmiño, 2016).

Although voluntary affiliation serves as an alternative for independent workers, coverage gaps persist, particularly among informal sector workers (Fernández, 2004). According to the IESS (2020), there was a decline of approximately 240.638 affiliates in 2020. As of November 2021, only 5,7 % of the total affiliated population belonged to the informal sector (INEC, 2021). This indicates that informal workers, often characterized by low and unstable incomes, struggle to maintain their contributions to the IESS, which in turn limits their continuous access to social security services.

Uribe et al. (2006) describe informality as a phenomenon influenced by economic and legal factors such as precarious employment, subcontracting, lack of social protection, market fragmentation, tax evasion, and labor market imbalances. Institutional theory suggests that individuals excluded from the formal sector or those who fail to comply with legal regulations are unable to access social security, thereby losing entitlement to labor and social benefits. To determine whether formalization is advantageous, individuals often conduct a cost-benefit analysis of social security contributions, and the administrative requirements associated with formal employment. This assessment may lead them to remain in the informal sector, even if that was not their initial intention (Maloney, 1997).

Therefore, in a country as Ecuador where the economic structure tends toward informality for various reasons, it is essential to analyze the feasibility of integrating informal workers into the social security system. When access is voluntary rather than mandatory—as it is for salaried employees in dependent employment—ensuring sustained participation in the system presents a significant challenge.

3. MATERIALS AND METHODS

This research aims to identify the factors influencing the likelihood that a worker in the informal sector will join the social security system using a logit model. This model was chosen because other econometric models could require a quantitative or logarithmic dependent variable, which would not appropriately measure the probability of affiliation, where the most suitable response is binary (yes or no). Using a different model could result in predictions outside the probability range of the response.

The database for this analysis was obtained from the National Survey of Employment, Unemployment, and Underemployment (ENEMDU) conducted by INEC for December 2018, 2019, and 2020. This dataset provides insights into the labor and socio-economic conditions of informal sector workers aged 15 and older. The survey includes data on employed households at the national level, covering both urban and rural areas.

For this study, questions p05a from the ENEMDU survey were considered, which asks about the type of social security to which the worker is affiliated. The analysis focused on the category “IESS, voluntary insurance” to estimate the probability of affiliation. The formal sector was excluded from the analysis, as affiliation to the general social security system is a legal right that must be ensured by employers under Ecuadorian labor regulations.

The methodological approach follows the study by Li and Olivera (2009), who applied a logit model to estimate the probability of contributing to voluntary insurance in Peru, incorporating sociodemographic variables such as age, gender, marital status, income, and household poverty status. This research similarly considers voluntary affiliation to social security among informal sector workers as the dependent variable, recognizing that affiliation in the formal sector is mandatory. The logit model is estimated by means of the maximum likelihood method, given the binary nature of the dependent variable (1 = voluntary affiliation to social security; 0 = not voluntary affiliation to social security). Model fit was assessed using goodness-of-fit tests, while model validation was conducted through the percentage correctly predicted metric and the ROC curve analysis.

3.1. Econometric Model Specification

The independent variables were selected based on the previously mentioned research (Li & Olivera, 2009), determining the following: age, gender, marital status, urban residence, level of education, labor income, and poverty status. Additionally, based on the recommendations of Lara (2009), the variables “primary economic activity” and “head of household” were incorporated. The model to be estimated with its respective variables is detailed below:

$$Y_i = \beta_0 + \beta_1 \text{laborin} + \beta_2 \text{headhouse} + \beta_3 \text{married} + \beta_4 \text{place} + \beta_5 \text{gender} + \beta_6 \text{age40} + \beta_7 \text{eduatt} + \beta_8 \text{poverty} + \beta_9 \text{branchactiv} + \varepsilon_i \quad (1)$$

Where

Y_i = 1 (voluntary affiliation); 0 (Not voluntary affiliation)

β_0 = constant term

$\beta_1 \dots \beta_n$ = estimated parameters

ε_i = error term

laborin = labor income

headhouse = head of household

married = married

place = urban residence

gender = female gender

age40 = age over 40 years

eduatt = high educational attainment

poverty = poverty status

branchactiv = primary economic status

Table 1 below provides a description of the variables with their expected signs, taken from similar studies

Table 1. Variables Description

Variable	Abbreviation	Description	Expected sign
Affiliation	affiliation	The variable is dichotomous, indicating whether an individual from the informal sector is affiliated with voluntary insurance or not.	
Labor Income	laborin	Quantitative variable, expressed in dollars, signifying the economic compensation received by individuals for their productive activity.	Positive
Head of Household	headhouse	Dummy variable that signals whether the individual serves as the head of the household (1) or not (0)	Positive
Marital Status	married	Dummy variable that signals whether the individual is married (1) or not (0)	Positive
Urban Residence	place	Dummy variable that denotes whether the individual resides in an urban area (1) or rural (0).	Positive
Gender	gender	Dummy variable that signifies the individual's gender, distinguishing between women (1) or men (0)	Negative
Age	age_40	Qualitative variable that distinguishes whether the worker is aged 40 years or older (1) or younger (0)	Positive
Level of Education	eduatt	Dummy variable that signals whether the individual possesses a higher level of education (1) or not (0)	Positive
Poverty	poverty	Dummy variable that signifies whether the worker falls into the category of poor (1) or not poor (0)	Negative
Primary Economic Activity	branchactiv	Dummy variable that denotes whether the worker belongs to the sector of agriculture, livestock, and forestry (primary economic activity) (1) or not (0).	Negative

Source: ENEMDU questionnaire (INEC, 2020)
Elaborated by the author

The model is analyzed using marginal effects to provide an interpretation that more accurately reflects reality. For the quantitative variable (labor

income), the value was obtained by calculating the elasticity (margins, *eyex* command). In the case of qualitative variables, the values are determined by applying derivatives (marginal effects).

Initially, the research aimed to use the cumulative ENEMDU database. However, INEC statistics only provided data for 2018, preventing full coverage of the intended 2018-2020 study period. To address this limitation, the analysis focused on data specifically from December of each year. Furthermore, due to the pandemic, INEC implemented a new telephone survey methodology, which introduced discrepancies in the significance of certain variables between 2019 and 2020.

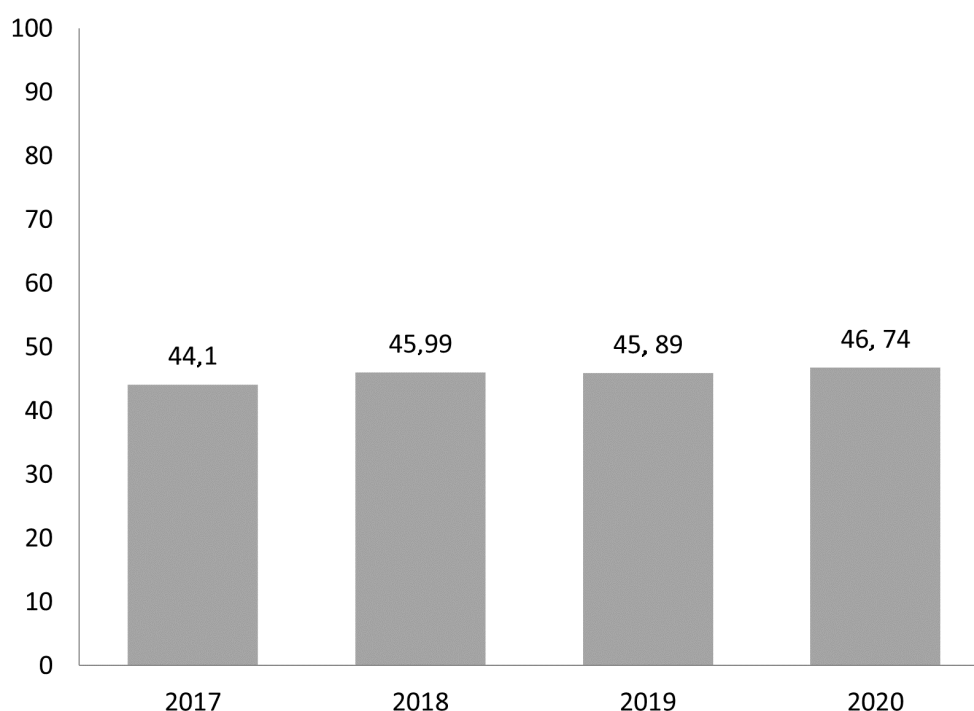
4. RESULTS AND LIMITATIONS

4.1. Attributes of the Informal Sector in Ecuador

This section examines the current state of the informal labor market in the Ecuadorian economy, considering socioeconomic variables such as gender, labor income, occupation category, social security affiliation, educational level and poverty status.

Figure 1 illustrates the percentage of the employed population classified within the informal sector during the study period. These findings support Olmedo's (2018) assertion that informality is not merely a temporary issue within the labor market, but has evolved into a structural problem within the economy. This is particularly evident in Ecuador, where the informal sector currently accounts for nearly half (46,74 %) of total employment. Moreover, these results align with Gërzhani (2004), who reports similar percentages for developing countries, in contrast to significantly lower levels of informality (12 %) observed in developed nations.

Figure 1. Informal Sector Evolution (%)



Source: ENEMDU (INEC, 2021)

Elaborated by the author

In 2018, informality increased by 1,89 percentage points, followed by a slight decrease of 0,10 points in 2019. However, these fluctuations do not indicate an improvement in the labor market, as informality rose again in 2020 by 0,85 percentage points. This increase meant that approximately 3,6 million employed individuals were working in the informal sector, driven by a combination of economic challenges and labor market vulnerabilities stemming from the decline the quality of employment. Moreover, between December 2019 and December 2020, adequate employment decreased by 8,4 percentage points, dropping from 38,8 % to 30,4 %, which equates to a decline from 3,1 to 2,4 million people. These results highlight the persistent challenge of increasing employment under adequate conditions. The lack of formal sector opportunities forces much of the labor force to turn to entrepreneurship, often with minimal capital investment.

In Ecuador, as of 2018, the informal sector was predominantly composed (56,89 %) of self-employed workers, of whom more than half (59,57 %) were women. In contrast, men exhibited higher participation rates in the categories of private employees (5,90 %), day laborers (25,26 %), and employers (2,15 %) (Table 2).

Table 2. Comparative table of occupational categories by gender in the informal sector for 2018, 2019 and 2020

Occupational Category	2018		2019		2020	
	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)
Unpaid Household Helper	0,21	0,29	0,22	0,41	0,16	0,27
Self-employed	54,92	59,57	54,87	57,02	56,08	57,45
Private Employee	5,90	3,91	5,12	3,80	4,09	2,36
Day Laborer	25,26	3,29	23,26	2,47	22,08	2,50
Employer	2,15	0,84	2,63	0,74	1,23	0,65
Paid Domestic Worker	1,45	31,85	13,69	35,26	16,12	36,46
Unpaid Domestic Worker	0,09	0,24	0,20	0,30	0,24	0,31

Source: ENEMDU (INEC, 2021)

Elaborated by the author

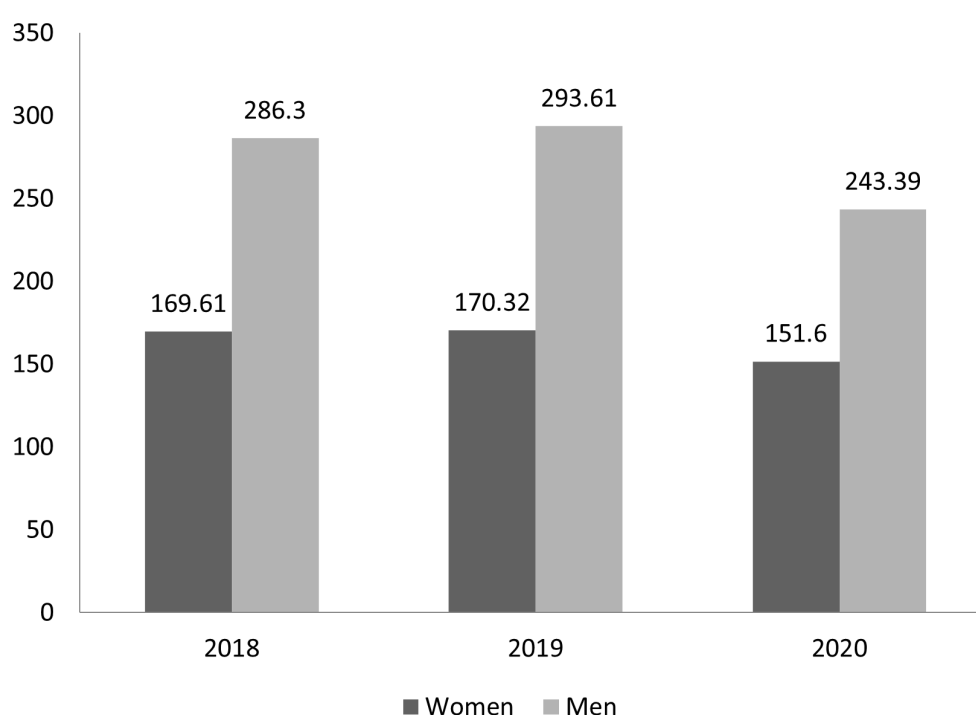
These findings differ slightly from those mentioned by Bonnet et al. (2019), who report a higher percentage of male informal workers (63 %) compared to female informal workers (58 %) in global figures.

In Ecuador, self-employed workers are concentrated in four key economic activities out of the twenty officially recognized sectors. Specifically, 43,05 % engage in livestock, forestry, agriculture, and fishing; 20,35 % work in vehicle sales and restoration activities; 7,84 % participate in the transportation sector; and 6,21 % are employed in food services and lodging. Other sectors, such as manufacturing, construction, arts, and real estate, each less than 5 % of self-employed workers. These figures align with the dualistic approach proposed by Quejada et al. (2014), who point out that individuals not absorbed by the formal market opt for self-employment out of necessity. This perspective suggests that participation in the informal sector is largely involuntary, driven by the formal sector's inability to provide adequate employment opportunities.

On the other hand, according to the neoclassical approach, worker dissatisfaction with low wages is one of the causes of informality. In Ecuador, self-employment is generally associated with earnings below the unified basic wage (*salario básico unificado*, SBU). This finding is similar to the results of Grupo FARO (2020), which mentions that informal workers earn approximately USD 250 per month, and Rubio (2014), who characterizes informal employment in Colombia as marked by precarious wages and job instability.

As illustrated in Figure 2, average labor income for informal workers remained below the SBU over the three years analyzed. In 2018, informal workers earned only 63 % of the SBU, which stood at USD 386 that year. By 2020, their income had further declined to just 52 % of the SBU, which had increased to USD 400, reflecting the precariousness of employment due to the health crisis. Moreover, a persistent wage gap exists between men and women in the informal sector, with women earning, on average, USD 110,59 less than men over the three-year period.

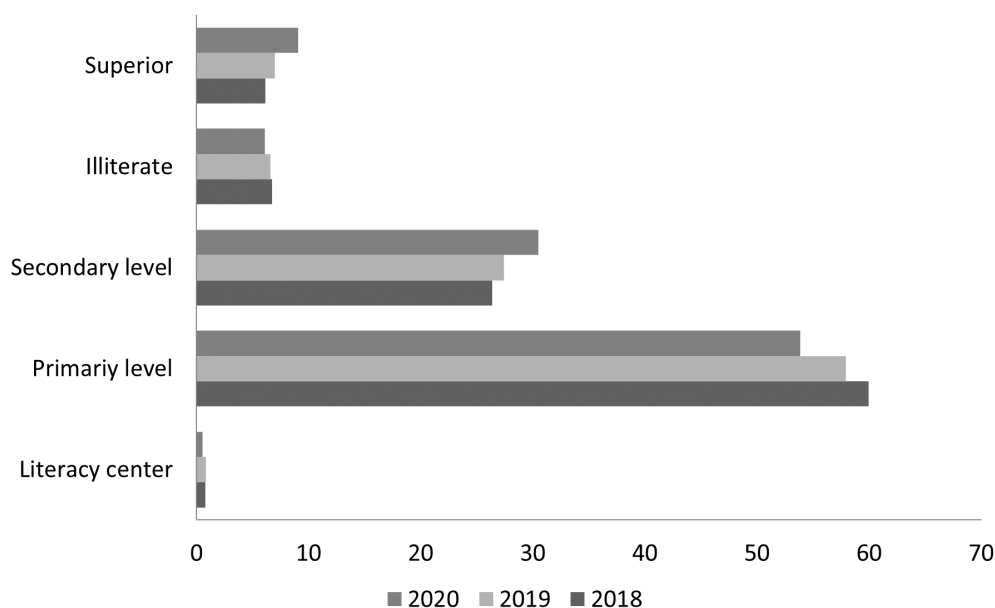
Figure 2. Labor Income by Gender (USD)



Source: ENEMDU (INEC, 2021)

Elaborated by the author

One defining characteristic of the informal sector is the low level of education among its workers. As shown in Figure 3, in 2018, 59,95 % of workers in this sector had only completed basic education, while only 6,15 % had attained higher education. By 2020, these figures showed minimal variation. This finding supports the conclusions of Ela (2013), who analyzed the labor market in Turkey and confirmed that individuals with lower levels of education are more likely to be employed in the informal sector.

Figure 3. Educational Attainment (%)

Source: ENEMDU (INEC, 2021)

Elaborated by the author

Regarding place of residence, workers with only basic education are predominantly concentrated in rural areas and experience higher levels of poverty compared to their urban counterparts. In 2018, 66,88 % of rural workers had only a basic level of education, while a mere 2,50 % had access to higher education. Similarly, 66,05 % of workers with basic education were classified as poor, whereas only 1,97 % of those with higher education fell into this category.

As a general context, in 2019 the percentage of rural workers engaged in the informal sector declined by 4,6 percentage points compared to 2018, decreasing from 1,5 to 1,4 million people. However, in 2020, the poverty rate among this group of rural workers increased by 6,09 percentage points, affecting approximately 1,6 million individuals (Table 3).

Table 3. Poverty and Regional Distribution Among Informal Sector Workers

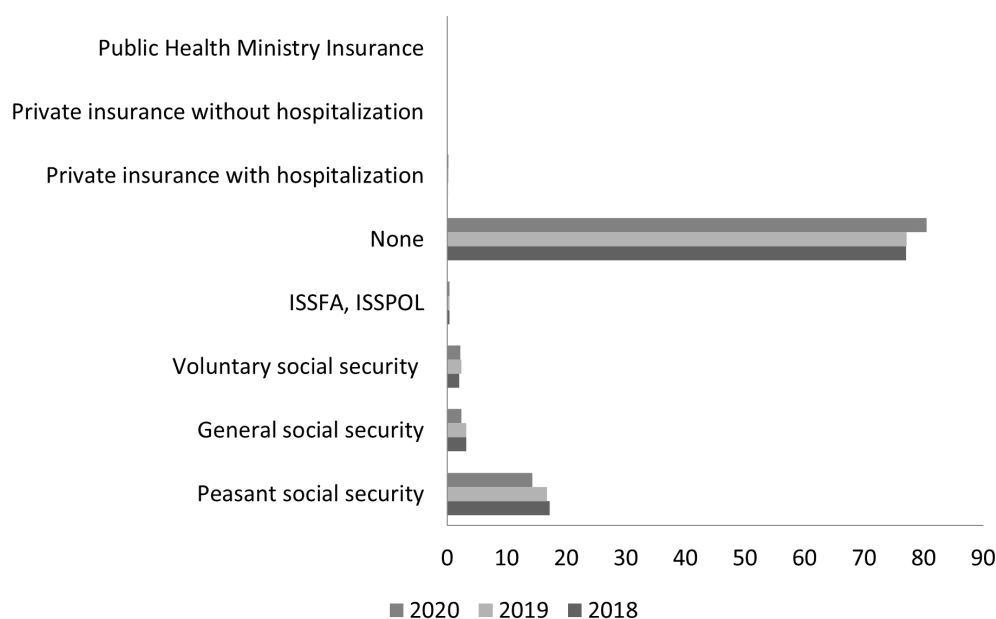
Place of Residence	2018		2019		2020	
	Not poor	Poor	Not poor	Poor	Not poor	Poor
Rural	51,06 %	74,91 %	50,13 %	70,31 %	52,94 %	76,40 %
Urban	48,94 %	25,09 %	49,87 %	29,69 %	47,06 %	23,60 %

Source: ENEMDU (INEC, 2021)

Elaborated by the author

The findings of the study regarding socioeconomic variables closely align with those of Berrio-Calle and Bran-Piedrahita (2019) and Carvajal Calderón et al. (2017), who conclude that informality is predominantly observed among workers with primary and secondary education, low labor income, and employment in primary economic activity. Similarly, these characteristics of informality in Ecuador correspond to the World Bank's (2012) observations on this sector's non-compliance with legal regulations, including tax evasion, low or nonexistent social security affiliation, and the absence of formalized labor contracts.

Informal workers residing in rural areas are primarily affiliated with the peasant social security regime, while a smaller proportion is covered by mandatory general insurance or voluntary insurance. In contrast, voluntary social security is more common among residents of urban areas. However, in 2018 and 2019, 77,07 % of informal workers were not affiliated with any type of social insurance, and this figure increased to 80,53% in 2020. During the same year, affiliation with mandatory general social security declined by 2,3 %, while voluntary insurance decreased by 9,20%, possibly because of the pandemic that reduced the labor income of workers in this sector (Figure 4). This high percentage of uninsured workers reflects a significant lack of labor rights protection and limits access to essential benefits such as maternity healthcare, pensions, coverage of work-related accident.

Figure 4. Social Security Types (%)

Source: ENEMDU (INEC, 2021)

Elaborated by the author

To improve economic conditions, the labor market has been subject to public policies primarily focused on enforcing labor obligations, such as formal hiring and the elimination of outsourcing. Additionally, policies have aimed to expand social security coverage through a combination of incentives and penalties for non-compliance. Regarding public policies, CEPAL (Abramo, 2021) highlights the importance of promoting the transition to a formal economy to achieve inclusive development and guarantee decent working conditions for everyone. Table 4 shows the key labor public policies implemented in Ecuador over the past 15 years.

Table 4. Main Public Policies in Ecuador's Labor Market

Year	Policy	Attributes
2008	Eradication of outsourcing	Constituent Norm N°8: Hourly contracts were replaced by permanent part-time contracts (workers who do not comply with the full 40-hour workweek).
2008	Wage reform	The annual wage increase was calculated based on both the inflation rate and labor productivity (previously, the reference was only inflation). The “living wage” was also defined as quotient between the cost of the basic food basket and the number of recipients in a household.
2009	Labor inspectorates	The inspectorates were established to increase compliance with labor obligations by employers towards their workers. The inspectorates are managed by the Ministry of Labor; an inspector acts as a mediator in labor disputes between employer and worker.
2010	Decent domestic work	The “Decent Domestic Work” campaign was promoted by the Ministry of Labor with the objective of guaranteeing adequate work for domestic workers. The policy sought to equalize the labor benefits of domestic workers with those received by general workers (unified basic wage, working hours, overtime, supplementary hours, reserve funds, vacations, among others).
2013	Penalty for non-affiliation to social security	The Integral Organic Penal Code established as a contravention of the employer the non-affiliation to the mandatory social security of its workers during the first thirty days of work. Otherwise, it will be punished with a penalty of three to seven days imprisonment.

Source: León (2019) and Cadena (2015)
Elaborated by the author

Since 2008, labor obligations, including social security affiliation, have been included into the Ecuador's National Development Plans. In the 2013-2017 National Plan, public policy was structured around promoting decent work and ensuring compliance with social security affiliation. The 2017-2021 National Plan expanded its scope to include goals related to poverty reduction,

gender wage gaps, and other socioeconomic disparities (Cadena, 2015). One of its objectives was to reduce extreme poverty by 2,7 % and multidimensional poverty by 27,4 % by 2021. However, between 2017 to 2020, poverty increased by 6 %, and the multidimensional poverty rate stood at 40,20 %.

Regarding unemployment, the plan aimed to lower the unemployment rate to 7,6 %, reduce the adequate employment gap between men and women to 2 %, and decrease the gender wage gap to 18,4 % by 2021. By 2020, however, the unemployment rate had risen to 10,1 %, the employment gap had only marginally declined by 0,02 %, and the gender wage gap stood at 15,3 % (López, 2016).

By 2020, the urban adequate employment rate was 30,8 %, while the rural adequate employment rate was 17,7 %, meaning that less than 25 % of the expected employment target has been achieved. Similarly, in rural areas, the income poverty rate reached 47,9 %, and the multidimensional poverty rate was 68,7 %. The expected goal of reducing poverty to 31,9 % and multidimensional poverty to 49,2 % was also unattainable (López, 2016).

4.2. Factors Influencing Voluntary Social Security Affiliation

This section examines the determinants influencing an informal workers decision to join voluntary social security between 2018 and 2020 using a logit model.

According to the results obtained (Table 5), it can be determined that the econometric models for 2018, 2019 and 2020 are significant at the 0,05 level. Based on this model evaluation, we reject the null hypothesis—which states that social security affiliation depends solely on the worker’s income level—and accept the alternative hypothesis, recognizing that multiple variables can explain the probability of an informal worker affiliating with social security.

Table 5. Model Estimation for 2018, 2019 and 2020

Variables	model2018 affiliation	model2019 affiliation	model2020 affiliation
laborin	0,000461** (0,000193)	0,000223** (0,000113)	0,000748*** (0,0002)
headhouse	0,512*** (0,152)	0,304** (0,138)	0,376** (0,165)
married	0,579*** (0,135)	0,642*** (0,123)	0,687*** (0,113)
place	0,566*** (0,163)	0,609*** (0,157)	1,156*** (0,132)
gender	0,500*** (0,143)	0,660*** (0,133)	0,494*** (0,106)
age40	1,016*** (0,177)	0,855*** (0,167)	0,960*** (0,149)
eduatt	1,003*** (0,169)	0,769*** (0,168)	0,861** (0,37)
poverty	-0,654*** (0,193)	-0,089 (0,138)	-0,473*** (0,134)
branchactiv	-0,743*** (0,174)	-0,516*** (0,161)	-0,17 (0,121)
Constant	-5,526*** (0,258)	-5,310*** (0,234)	-5,710*** (0,236)
Observations	12.968	13.039	15.767
Standard errors in parentheses *** p<0,01, ** p<0,05, * p<0,1			

Source: Consolidate results derived from the three models. Data from ENEMDU (INEC 2018, 2019, and 2020)
Elaborated by the author

The results indicate that, over the analyzed years, the variables labor income (laborin), head of the household (headhouse), marital status married (married), urban area (place), female gender (gender), age over 40 (age40) and higher education (eduatt) exhibit a positive relationship with the likelihood of an informal worker voluntarily enrolling in social security. On the other hand, poverty status and engagement in primary economic activities (branchactiv) exhibit a negative impact on the probability of voluntary social security affiliation.

Table 6 presents the validation of each model. The findings reveal that, across all three years analyzed, the Logit model for voluntary affiliation achieves an accuracy rate of approximately 97 %. Furthermore, validation using the ROC curve confirms the model's predictive strength, with values close to 1 indicating a good prediction of the model. Specifically, in 2018, the area under the ROC curve demonstrates a discrimination rate of approximately 75 %, while in 2019 and 2020, the percentages exceed 70 %, confirming a good prediction of the model.

Table 6. Model validation for 2018, 2019 and 2020

Validation Assumptions	2018	2019	2020
Percentage Correctly Predicted	97,66 %	97,46 %	97,68 %
ROC Curve Area	75,78 %	73,67 %	72,33 %

Source: Model validation in econometric software. ROC curve in the appendix

Elaborated by the author

4.2.1. Interpreting the Coefficients

Given that the estimated results in Logit models are not directly interpretable, we computed the average marginal effects of the coefficients to facilitate the interpretation of each model as showed in Table 7.

Table 7. Average Marginal Effects of 2018, 2019 and 2020 Models

Variables	2018	2019	2020
	affiliation	affiliation	affiliation
laborin	0,134** (0,0558)	0,0665** (0,0333)	0,263*** (0,0701)
headhouse	0,00996*** (0,00299)	0,00691** (0,00315)	0,00984** (0,00433)
married	0,0113*** (0,00268)	0,0146*** (0,00289)	0,0180*** (0,00304)
place	0,0110*** (0,00322)	0,0138*** (0,00362)	0,0302*** (0,00366)
gender	0,00973*** (0,00283)	0,0150*** (0,00314)	0,0129*** (0,00282)
age40	0,0198*** (0,00361)	0,0195*** (0,00391)	0,0251*** (0,00403)
eduatt	0,0195*** (0,00342)	0,0175*** (0,00391)	0,0225** (0,00972)
poverty	-0,0127*** (0,0038)	-0,00202 (0,00313)	-0,0124*** (0,00355)
branchactiv	-0,0144*** (0,00347)	-0,0117*** (0,00371)	-0,00444 (0,00318)
Observations	12.968	13.039	15.767
Robust Standard errors in parentheses *** p<0,01, ** p<0,05, * p<0,1			

Source: Average marginal effects were calculated in econometric software
Elaborated by the author

Over the three years analyzed, the signs of the estimated parameters align with the theoretical framework. It can be affirmed that, considering the *ceteris paribus* principle, an increase of one dollar in labor income raises the probability of an informal worker voluntarily enrolling in social security by 13,4 percentage points. In 2019, this probability declined by 6,6 percentage points, whereas in 2020, it significantly increased by 26,3 percentage points. The decline in 2019 can be explained by the country's near- zero GDP growth, while the sharp rise 2020 resulted from the health emergency, which

led workers to lose their jobs but seek to maintain their social security affiliation to retain access to social benefits.

The status of head of household has relatively minor influence on affiliation probability, contributing less than 1 percentage point across all three years. Workers whose household head is married—compared to single, divorced, or other statuses—show an approximately 2 percentage points increase in affiliation probability. Urban residence also has a positive effect, increasing the probability by 1 to 3 percentage points, whereas rural residency reduces the likelihood of enrollment. Regarding gender, female informal workers exhibit a slightly higher probability of affiliation, albeit marginal (around one percentage point) in 2018, 2019 and 2020. This suggests that gender is not a decisive factor in determining voluntary enrollment, aligning with findings by Hazra (2021), who observed minimal gender-based differences in the probability of informal sector affiliation in India.

For workers over 40 years old and those with higher education, the probability of affiliation remains positive yet modest, at under 2 percentage points in both categories across all three years. Conversely, poverty negatively affects affiliation likelihood, with an approximate 1 percentage point reduction as precariousness level rise. Finally, informal workers engaged in agricultural, or livestock activities (primary sector) have a 1 percentage point lower probability of affiliation compared to those in industrial activity.

The results obtained for 2018, 2019 and 2020 indicate that the estimated probabilities remained relatively stable across the three years. Similarly, labor income emerges as the primary determinant of voluntary social security affiliation. Since this type of insurance follows a contributory model, affiliation rates are directly proportional to the income received. This presents a challenge for informal sector workers, who typically earn low wages (Figure 2). These findings are consistent with the argument of Fernández (2004), who states that an informal workers may struggle to access or remain social security coverage due to their income levels.

The results also corroborate the findings obtained by Lara (2009) and Li and Olivera (2009), both of whom highlight labor income as a statistically significant variable influencing the likelihood of affiliation to social security. Their research suggests that an increase in income raises the probability of affiliation by several points—often exceeding 10 percentage points rather than just 1 % or less.

Regarding head of household status and marital status, the results are consistent with Vargas (2014), who mentions that informal workers in the role of head of household or in legal marital relationship exhibit a higher probability of affiliation compared to other household members, such as spouses, children, or grandchildren, as well as single individuals. This may be attributed to the fact that social security benefits extend to the rest of the household members, meaning that the affiliation of one family member ensures coverage for the entire household. As established by Barona and Cisneros (2014), in Ecuador

as of 2008, social benefit coverage was extended to spouses and children up to the age of eighteen.

In terms of residence, the results indicate that informal workers living in urban areas are more likely to enroll in social security than those in rural areas. This can be explained by the fact that rural economic activities, particularly in agriculture, tend to generate lower incomes compared to urban employment opportunities.

With respect to gender, the results suggest that women have a higher probability of voluntarily affiliating with social security than men. This contrasts with Vargas (2014), who estimates that average female contributions stood at approximately 10 %, compared to 14 % for men. However, the present results agree with Lara (2009), who found a 52 % higher probability of social security contributions among women. Additionally, Li and Olivera (2009) argue that marital status influences women's likelihood of affiliation, as married women are less inclined to enroll in voluntary insurance due to their generally lower earnings compared to men.

Concerning educational level, the results indicate that workers with higher education have a greater probability of affiliating with voluntary social security. This finding aligns with previous studies, as individuals with advanced professional training are more likely to contribute to social security than those with only primary or secondary education.

Age is another factor that influences the probability of affiliation. Informal workers over 40 years old are more inclined to enroll in voluntary social security compared to their younger counterparts. This coincides with the findings of Amarante and Espino (2009), who state that workers over 35 years old have a higher probability of contributing to social security. This trend may be explained by the fact that as individuals approach retirement, they become increasingly interested in securing health and pension benefits. Additionally, the probability of illness tends to rise with age. Workers aged 30 to 49 may exhibit higher affiliation rates due to their increased chances of transitioning into the formal sector, possibly because they have more work experience. In contrast, young workers, who are just entering the labor market, often struggle to secure stable employment and are therefore less inclined to enroll in voluntary insurance.

Informal workers living in poverty are less likely to enroll in voluntary social security than non-poor workers. Although Li and Olivera (2009) found that household poverty status was not a statistically significant factor, our research indicates otherwise. Specifically, workers from non-poor households are more likely to enroll in voluntary insurance, possibly due to their income level. In contrast, workers from poor households often need to prioritize other essential needs over social security contributions. Our findings are consistent with Galvis (2012), who states that although poverty is not exclusive to the informal sector, it remains a key challenge for this group of workers.

In relation to the economic activity, the results indicate that workers in the agricultural and livestock sector are less likely to enroll in voluntary insurance than those in other industries. This result is consistent with Amarante and Espino (2009) and Robles et al. (2022), who mention that workers engaged in primary sector activities are less likely to contribute to social security, possibly due to their low-income levels. However, classifications of economic activity differ from others; for instance, Raveendran and Vanek (2017) highlight waste pickers as a notable occupation in countries such as India.

In summary, higher labor income, urban residence, advanced education, and being over 40 years old—particularly for workers in the middle of their careers—are key determinants that increase the probability of voluntary social security affiliating. On the other hand, informal workers facing poverty, engaged in primary sector economic activities, younger in age, and having only primary or secondary education are less likely to enroll in voluntarily social security.

5. CONCLUSIONS AND DISCUSSION

Based on the research findings, it can be concluded that reducing labor informality still represents a significant challenge for the structure of the Ecuadorian economy. Although informal work constitutes one of the primary sources of income for approximately half of the employed population in Ecuador, this sector is characterized by labor precariousness. From a legal standpoint, informal workers often lack employment contracts, do not contribute to tax revenues, and have minimal or nonexistent social security coverage. From an economic perspective, informality is associated with higher poverty rates and lower level of education among workers.

Public policies implemented in recent years have sought to reduce these labor characteristics by eliminating outsourcing, expanding social security coverage, and recognizing the rights of domestic workers. However, government economic data indicate that by 2020, seven out of ten informal sector workers remained unaffiliated with any form of social security. This suggests that while certain temporary achievements were recorded—such as an increase in the number of affiliated workers in earlier periods—the overall effectiveness of these labor policies remains limited.

The evolution of labor informality in Ecuador presents characteristics aligned with both institutionalist and structuralist economic theories. According to structuralist theory, informality is an involuntary decision by workers, as it responds to market behavior. It can be considered as an alternative to structural unemployment, with workers opting for low-investment ventures in response to job scarcity. Between 2019 and 2020, informality in Ecuador increased by 1,85 % because of a decline in formal employment opportunities due to the

economic crisis and the subsequent impact of the COVID-19 pandemic. This indicates that the displacement of workers from the formal to the informal sector was primarily a consequence of declining demand in the formal labor market.

Additionally, Ecuador's informal sector evidences characteristics of institutionalist theory, which attributes informality to the high costs associated with formalization, which lead to a non-compliance with legal regulations and, therefore, limit access to a social security plan. Currently, only 5 % of total social security affiliates belong to the informal sector, underscoring the fact that the expansion of social security coverage is one of the main challenges facing the government in the economic area.

According to the results of the model, labor income is the primary determinant—and limiting factor—for affiliation to voluntary social security. On the one hand, social security is a contributory system, and on the other hand, contribution rates are calculated based on income, which cannot be lower than the Unified Basic Wage, as mandated by law.

Other significant constraints include poverty and level of education, as workers in a precarious financial situation or with only primary or secondary education are less likely to enroll in voluntary insurance. Age is also an important factor, as young workers with limited formal education struggle to find a stable job due to their lack of experience and low qualifications. This, in turn, pushes a significant portion of the labor force into the informal sector, with the aforementioned consequences.

The inflexibility of public policy regarding contribution rates—whereby all sectors must contribute based on a minimum wage level that remains out of reach for many informal workers—possibly contributes to the low levels of social security coverage. As Ecuador's economic structure struggles to absorb the existing labor supply, many workers are forced into precarious, low-income employment. An in-depth analysis based on the socio-economic characteristics of this group would make it possible, to some extent, to raise social security coverage rates and guarantee the right to health and other social benefits for informal sector workers who, for now, are in a highly vulnerable condition. Furthermore, policies aimed at reducing informal employment should focus on specific population segments, such as female heads of household, young workers, and individuals with low levels of education, through instruments such as accessible credit for production initiatives, support programs for individuals without work experience, continuous training to prevent frictional unemployment and later informal employment, and social assistance programs.

Future research could explore each of these policies to measure effectiveness in reducing informal employment in Ecuador. Additionally, further studies in Ecuador's labor market dynamics could help inform the design of policies that encourage formalization, with the aim of achieving poverty reduction and guaranteeing compliance with the human rights protections enshrined in the Constitution.

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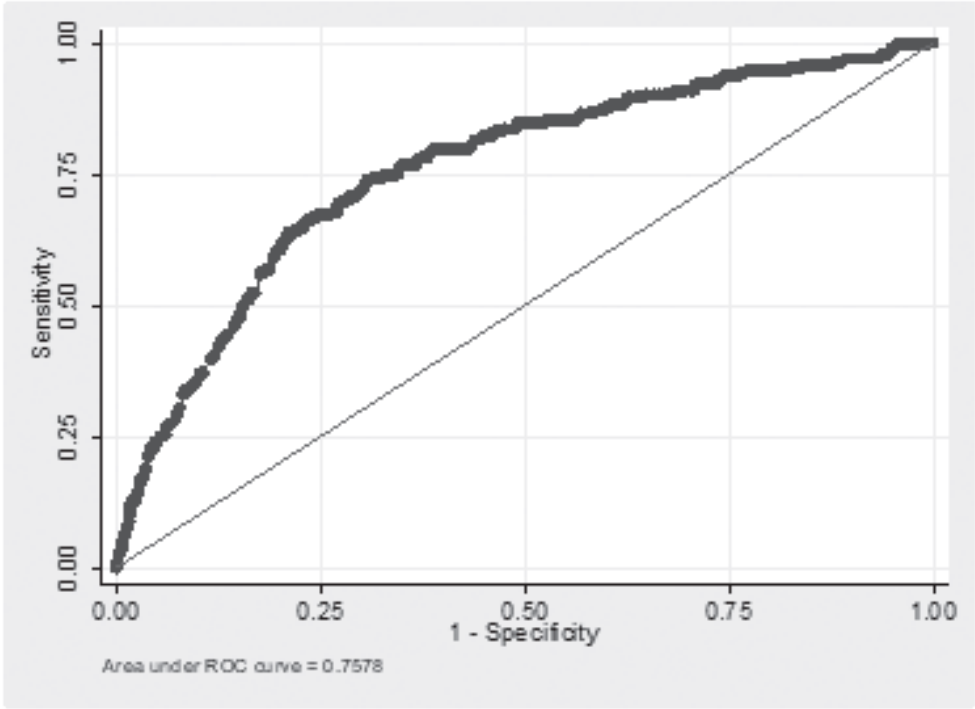
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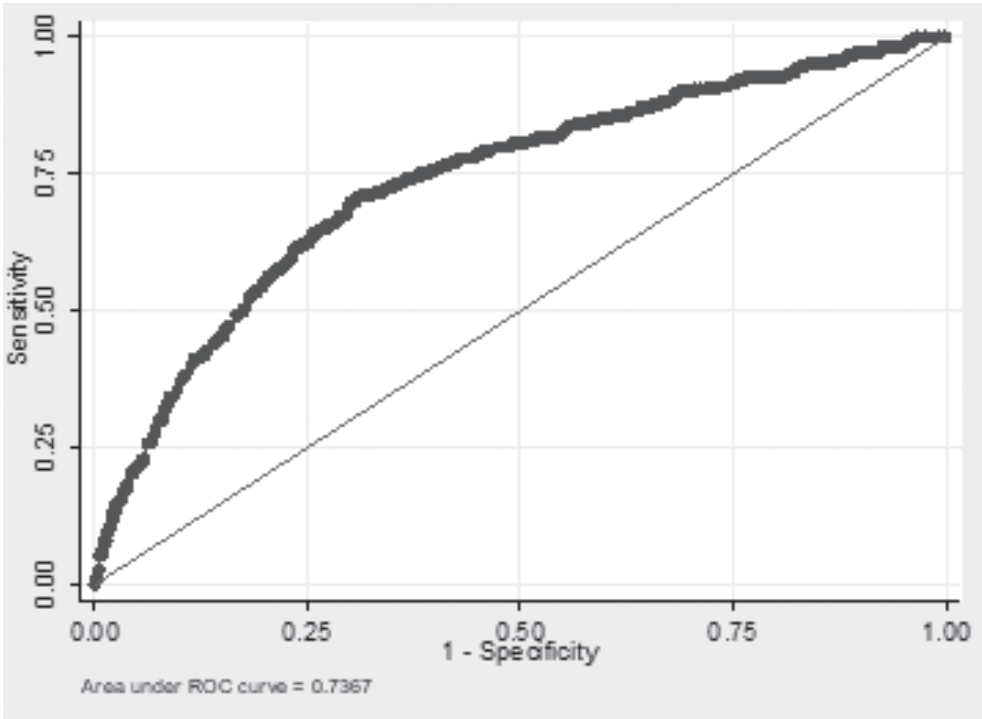
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APPENDIX

Appendix A. ROC Curve 2018



Appendix B. ROC Curve 2019



Appendix C. ROC Curve 2020

