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Individual and Structural Determinants of Underemployment: A Comparative Study between Colombia and the Atlantic Coast*

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Abstract

This article analyzes the determinants of underemployment in Colombia and in the Atlantic Coast departments (Sucre, Cesar, La Guajira, Magdalena, and Córdoba), using microdata from the 2024 Great Integrated Household Survey (GEIH). A probit model corrected for heteroskedasticity is estimated to identify individual, labor-related, and household variables associated with the probability of being underemployed. The results reveal significant differences between the Atlantic Coast and the national average. In the coastal region, variables such as education and gender lose statistical significance, suggesting broader precarization of the labor market. Employment stability, occupation type, and industry sector emerge as the most relevant determinants of underemployment. These findings support the need for regionally targeted labor policies to address structural underemployment, particularly in areas where informality and poor job quality remain pervasive.

Keywords

Underemployment; informality; regional disparities; labor market.

JEL code

R58, O18, Q01

Determinantes individuales y estructurales del subempleo: estudio comparativo entre Colombia y la Costa Atlántica

Resumen

Este artículo analiza los determinantes del subempleo en Colombia y en los departamentos de la Costa Atlántica (Sucre, Cesar, La Guajira, Magdalena y Córdoba), utilizando microdatos de la Gran Encuesta Integrada de Hogares (GEIH) correspondientes al año 2024. A partir de la estimación de un modelo probit corregido por heterocedasticidad, se identifican las variables individuales, laborales y del hogar que inciden en la probabilidad de estar subempleado. Los resultados muestran diferencias significativas entre la Costa Atlántica y el promedio nacional. En la región costera, variables como el nivel educativo y el género pierden significancia estadística, lo que sugiere una precarización generalizada. La estabilidad laboral, el tipo de ocupación y el sector de actividad resultan ser los determinantes más relevantes del subempleo. Los hallazgos confirman la necesidad de políticas diferenciadas para enfrentar el subempleo estructural, especialmente en regiones donde la informalidad y la baja calidad del empleo siguen siendo predominantes.

Palabras clave

PSubempleo; informalidad; disparidades regionales; mercado laboral.

Clasificación JEL

R58, O18, Q01.

Introduction

The job market exhibits a series of imperfections, including involuntary unemployment, wage rigidity, rising non-salary costs, and information asymmetry (Albertini et al., 2020; Doukas & Zhang, 2020; Johan & Zhang, 2020; McLaren, 2019; Romer, 2012). Nonetheless, theoretical models have mostly focused on the interaction between labor supply and demand, overlooking employment quality. The study on employment quality is of great interest because it allows identifying, understanding, and explaining inadequate conditions in the job market and their impact on social welfare (Checa et al., 2021; Eisenberg et al., 2020; Ollé et al., 2020; Zheng et al., 2020).

Informality and underemployment are among the most important indicators to measure the quality of employment. Indeed, informality measures quality from the labor demand side; by contrast, underemployment measures quality from the labor supply side. Therefore, informality groups low-productive companies, and underemployment refers to workers feeling unsatisfied with their jobs (Ollé et al., 2020; Zheng et al., 2020).

Underemployment is a more general welfare measure than the unemployment rate because, on the one hand, it captures employees' work expectations and degree of satisfaction, and, on the other hand, it permits estimating job-productivity losses caused by the underutilization of the workforce and human capital. Indeed, the unemployment rate measures total job underutilization, while the unemployment rate measures partial job underutilization (Valiente et al., 2020). So, underemployment is a phenomenon that gets workers away from a full-employment situation and therefore reduces the economy's productive capacity. In this sense, Bravo (2016) lists the negative consequences of underemployment, including harm to workers' mental health, loss of productive abilities, reduced motivation and job commitment, reduced productive contribution to the economy, and slower economic growth.

In Colombia, underemployment is classified into subjective and objective forms. Subjective underemployment refers to workers who wish to improve their income, increase working hours, or obtain tasks better aligned with their skills, while objective underemployment includes those who have already taken steps toward making such changes. The National Administrative Department of Statistics (DANE, 2012) additionally distinguishes between visible underemployment, working fewer than 48 hours per week and wanting more, and invisible under-

employment, which occurs when workers earn less than expected or perform tasks for which they are overqualified. In 2024, 63.9 % of the population was economically active, the employment rate was 57.4 %, and the unemployment rate was 10.2 %. Despite a downward trend, as shown in Table 1, underemployment remains high, subjective underemployment reached 21.9 %, and objective underemployment 8.7 %. Across dimensions, income-related underemployment (19.7 %) and skills-related underemployment (13.9 %) were the most prevalent, followed by hour-related underemployment (5.9 %), highlighting persistent job dissatisfaction and significant underutilization of human capital.

Table 1. Dimensions of Underemployment in Colombia and the Atlantic Region

Dimension	Colombia (%)	Atlantic Region (%)
Subjective underemployment by hours	5.86	5.38
Subjective underemployment by income	19.65	23.47
Subjective underemployment by skills	13.91	15.66
Objective underemployment by hours	2.96	2.72
Objective underemployment by income	7.47	9.32
Objective underemployment by skills	5.74	7.16
Total subjective underemployment	**21.87**	**25.04**
Total objective underemployment	**8.71**	**10.25**
Total underemployment	**21.87**	**25.04**

Source: Own calculations based on GEIH (DANE, 2024).

In 2024, informal employment remained persistently high in Colombia (57.7 %), underscoring structural deficiencies in job quality. The Atlantic region exhibited the highest informality rates nationwide, with cities such as Sincelejo (68.9 %), Valledupar (64.7 %), Riohacha (62.0 %), Santa Marta, and Montería consistently surpassing the national urban average of 41.5 %. In these cities, more than six out of ten workers lacked access to social security and job stability. At the same time, the 2024 Great Integrated Household Survey (GEIH) data show that total underemployment in the Atlantic region reached 25.0 %, exceeding the national average of 21.9 %. Subjective underemployment (25.0 %) and objective underemployment (10.3 %), particularly regarding income (23.5 %) and skills (15.7 %), highlight widespread dissatisfaction and significant underutilization of human capital.

These labor outcomes reflect Colombia's deep regional heterogeneity. While regions such as Bogotá and Antioquia concentrate higher productivity and formality, the Atlantic Coast faces persistent development gaps characterized by low productivity, pervasive informality, and greater labor market vulnerability (Bonet & Meisel, 2006; Galvis, 2012). The region's diverse Afro-descendant and Indigenous populations also experience historical structural disadvantages that shape labor dynamics (Comisión Económica para América Latina y el Caribe [CEPAL], 2022). These contextual factors help explain the persistence of underemployment and informality, as they restrict access to formal employment, limit the returns to education, and reduce opportunities for social mobility, reinforcing the need for a targeted regional analysis.

In this context, the purpose of this study is to determine the probability that an individual will be underemployed in Colombia during the year 2024, with a specific focus on cities in the Atlantic region—Sincelejo, Valledupar, Riohacha, Santa Marta, and Montería—identified by DANE as those with the highest levels of labor informality in the country. This geographic focus responds to the need to analyze the quality of employment in regions where informal and precarious work predominates. The analysis is conducted from the labor supply perspective, that is, from the workers' standpoint. For this purpose, data from the GEIH is used. An econometric probit model with robust standard errors, adjusted for heteroscedasticity, is applied to estimate the probability of being underemployed, given a set of individual and labor-related characteristics.

Given the purpose of this study, to analyze the determinants of underemployment in Colombia, particularly in the Atlantic region, the following research hypothesis is proposed: individual and labor-related characteristics, especially education, age, occupation type, and economic sector, significantly influence the probability of being underemployed. These effects are expected to vary across regions and be more pronounced on the Atlantic Coast, where higher levels of informality and labor precariousness persist.

Literature Review

Employment quality is commonly assessed through informality and underemployment, yet empirical studies in Colombia have mostly focused on factors associated with informality and its impact on the labor market (Arango & Flórez, 2020; Bernal et al., 2020; Ramoni & Orlandoni, 2020), with fewer works address-

ing employment quality from the supply side. Labor informality is a structural and persistent challenge with deep socioeconomic implications, and recent literature has highlighted its complexity as the result of regulatory, socioeconomic, structural, and geographical factors. Arango et al. (2020) show that increases in the minimum wage are directly associated with higher probabilities of informal employment, a relationship that is accentuated in cities with already high informality rates and particularly affects young people and individuals with lower levels of education. Complementing these findings, Arango and Flórez (2020) argue for adopting a differentiated regional minimum wage to reduce national labor disparities, stressing that uniform wage policies that fail to consider local contexts may unintentionally intensify the vulnerability of specific groups of workers. Overall, these studies underscore the need for policy designs that account for territorial heterogeneity and structural disadvantages in the Colombian labor market.

External shocks and the country's productive structure play a central role in shaping informality dynamics. Álvarez et al. (2022) show that the COVID-19 pandemic disproportionately affected economic sectors with high informal employment, highlighting that informality in Colombia is driven not only by regulatory factors, such as minimum wage rigidities, but also by the predominance of small firms marked by business informality. Human capital and demographic characteristics are equally important. Galvis (2012) for Colombia and Quiroga and Fernández (2021) for Argentina find that more years of schooling increase the likelihood of formal employment. Informality follows a life-cycle pattern, higher among youth, lower in adulthood, and rising again with aging (Galvis, 2012), while Ariza and Retajac (2021) document an increase in the age and schooling levels of informal workers. Gender gaps persist as well. Baquero et al. (2018) show that women face higher informality rates, although Galvis (2012) notes that higher education considerably narrows this gap. Evidence from other contexts complements these patterns; Venechuk (2025), for instance, finds widening job-quality disparities in the United States, affecting women and minorities most severely.

Spatial heterogeneity further reinforces labor market inequalities. Acosta et al. (2024) identify clusters of high informality in the Colombian Southwest and the southern Atlantic region, where low educational quality, geographic isolation, and higher poverty converge. Beyond informality, underemployment provides another dimension of labor underutilization. In Colombia, Figueroa (2010) finds that the probability of underemployment increases with education and age, decreases for women and married individuals, and rises in households with minors. Com-

plementing this, Puyana et al. (2011) argue that underemployment reflects not only workers' personal characteristics but also firm-level contracting conditions, emphasizing the interplay between individual determinants and structural job constraints.

Arango et al. (2013), using Colombian labor market data, analyzed income underemployment and found that its likelihood increases with age, education, being female, unemployment duration, working in small firms, and employment in agriculture or services. Conversely, the probability decreases with squared age, longer job tenure, and roles such as being a husband, a boss, or working in the commercial sector.

A growing body of research highlights the importance of incorporating a gender perspective in analyses of employment quality. Berniell et al. (2021) underscore the "motherhood effect," showing that women, especially mothers, are more likely to work in informal and lower-quality jobs due to persistent caregiving responsibilities that limit access to formal employment. Similarly, Arora et al. (2023) find that gender-based occupational segregation places women in low-productivity sectors with weaker institutional protections, thereby reducing the returns to their human capital and increasing the risks of informality.

Complementing these findings, Maurizio (2021) shows that women are disproportionately affected by informality during economic crises, as seen during the COVID-19 pandemic, when feminized sectors such as services and domestic work were severely hit. In the Colombian context, Dávalos et al. (2023) document persistent gender gaps in access to stable and formal employment, particularly affecting young women, while Mondragón et al. (2010) argue that labor market rigidities, such as high non-wage labor costs, interact with gender inequalities and hinder women's transitions into formality, especially in contexts where informality becomes a fallback option.

Studies consistently show a strong relationship between informality and poverty. Orjuela (2021) finds that Colombian regions with higher informality also display larger income gaps and greater monetary and multidimensional poverty. Similarly, Sánchez et al. (2022) argue that informality significantly contributes to poverty in Bogotá and its Metropolitan Area, and that formalization could help reduce its incidence in vulnerable regions such as the Pacific, Atlantic, and Orinoquía. However, they also warn that formalization alone has a limited effect on narrowing poverty gaps, as labor discrimination and economic dependency continue to shape poverty outcomes.

Labor market segmentation offers a key framework for understanding inequalities in developing economies, given the coexistence of formal and informal sectors with different levels of stability, earnings, and social protection. Fields (2011) argues that this dual structure limits worker mobility and reinforces disparities in job quality. Evidence for Colombia supports this perspective. Posso (2010), using quantile regressions, shows heterogeneous returns to education across the income distribution; Prada (2012) identifies strong transitions from formal employment to informal self-employment among vulnerable workers; and Mora and Muro (2015) document regional wage segmentation even among university graduates. Together, these findings highlight structural divides in the Colombian labor market and their persistent effects on employment outcomes.

Previous studies indicate that underemployment in Colombia is associated with factors such as age, education, gender, unemployment duration, household composition, prior job characteristics, firm size, and economic sector. Building on this evidence, this article examines how workers' individual attributes, the size and sector of their firms, and their occupational type influence the probability of being underemployed. The analysis focuses on the Atlantic Coast region, which exhibits the highest informality rates in the country. This regional lens allows identifying potential heterogeneities and specific underemployment dynamics that differ from national patterns, providing a more contextualized understanding of labor conditions in a particularly vulnerable area and offering insights for more targeted and effective public policies to improve employment quality.

Methodology

The empirical analysis is based on the hypothesis that individual and job-related characteristics determine the probability of underemployment, with regional differences associated with the structural conditions of local labor markets. To test this hypothesis, a probit model with robust standard errors is estimated to identify the factors associated with underemployment in Colombia during 2024. The data are drawn from DANE's GEIH, which provides detailed information on the composition and characteristics of the national labor force. This methodological approach enables a comparative analysis of the determinants of underemployment both at the national level and in the main cities of the Atlantic Coast departments, Sincelejo, Valledupar, Riohacha, Santa Marta, and Montería, where these effects

are expected to be more pronounced due to higher levels of informality and labor precariousness.

Underemployment is a labor market condition in which workers' productive capacity is not fully utilized, usually due to limitations in the economic system. It is commonly classified into three dimensions: insufficient working hours, inadequate income, and underutilization of skills. The first occurs when workers have fewer hours than desired; the second, when compensation does not reflect effort or ability; and the third, when low productivity stems from poor work organization or lack of tools, training, and infrastructure. These dimensions highlight structural inefficiencies affecting labor market outcomes.

Workers expressing only dissatisfaction with their jobs are considered subjectively underemployed, while those who intend or are prepared to take steps to change their situation are objectively underemployed. This study covers all forms of underemployment, insufficient employment, low income, and underutilized capacities, both subjective and objective, among Colombians aged 18–65.

To examine determinants of underemployment in Colombia and the Atlantic Coast region, a probit model with robust standard errors was estimated. This limited-dependent-variable model estimates the probability of underemployment, ensuring predictions remain between 0 and 1 and allowing the marginal effects of continuous variables, such as age and education, to vary across their ranges.

In the probit model, the dependent variable (Y) is binary, taking a value of 0 if an individual is satisfied with their current employment—across the three occupational categories—expresses no desire for change, and has taken no action, and a value of 1 if the individual is underemployed, as defined previously. The model includes a vector of explanatory variables (Xn), corresponding to those detailed in Table 1, and is specified in Equation 1:

$$p(y=1/x)=f(\beta_0+\beta_1x_1+\beta_2x_2+...+\beta_nx_n)=f(\beta_0+\beta x) \qquad (1)$$

Where F is a function assuming values strictly between one and zero, $0<F(z)<1$, for all real numbers z. This ensures that all predicted probabilities lie strictly between zero and one. Probit models are generally preferred over logit models because they are based on the normal cumulative distribution function, consistent with the common assumption of normality in economic phenomena, while logit models, based on a logistic distribution, can introduce greater complexities in specification.

The dependent variable in the model is a binary indicator that takes the value 1 when the individual reports being in a situation of underemployment according to the established criteria, and 0 when their current job is considered adequate to their preferences and conditions. Regarding the explanatory variables, these are organized into four main groups. The first includes individual characteristics such as gender, educational level, age groups (youth, adults, and older adults), marital status, household headship, potential work experience, weekly hours worked, hourly income, and employment stability.

The second group corresponds to household characteristics, including household size, homeownership, socioeconomic status (low, middle, and high), and rural or urban location. The third group classifies the economic sector in which the individual is employed, distinguishing between agriculture (the reference category) and industry, mining, construction, commerce, transportation, services, finance, and public utilities (electricity, gas, and water). Finally, the fourth group details the occupational categories, distinguishing between salaried workers, public-sector employees, employers, domestic workers, day laborers, self-employed workers, and other occupations.

Although underemployment and informality share elements such as job insecurity and mismatches between employment and worker profiles, they are not equivalent. Not all underemployed workers are informal, nor are all informal workers underemployed. Underemployment encompasses subjective and objective aspects related to dissatisfaction or underutilization of time and skills, while informality mainly concerns the lack of social security affiliation or a formal contract. This distinction is important for interpreting model results, as some variables may affect each phenomenon differently.

Results

Table 2 shows the results of the probit model, which highlight the main factors associated with underemployment in Colombia, particularly in the Atlantic Coast departments. The analysis emphasizes regional structural differences, given persistent labor informality and low employment quality in the Atlantic zone, while considering both subjective and objective underemployment among the employed population.

Table 2. Results of the Model Estimation

Individual characteristics	Colombia	Atlantic
Female	0.0183***	0.0097
	(-0.006)	(0.0162)
Years of education	-0.0061***	0.0036
	(-0.001)	(0.0023)
Adult	0.0818***	0.0749***
	(-0.009)	(0.0235)
Older adult	-0.078***	-0.0880*
	(-0.019)	(0.0457)
Lives with a partner	-0.0826***	-0.0472**
	(-0.0072)	(0.0191)
Divorced or widowed	0.0681***	0.1064***
	(-0.009)	(0.0232)
Potential work experience	-0.0122***	-0.0132***
	(-0.0004)	(0.0009)
Head of household	0.0383***	0.0324**
	(-0.0064)	(0.0151)
Hours of work per week	-0.009***	-0.0067***
	(-0.0002)	(0.0005)
Hourly income in logarithm	-0.0181***	-0.0338***
	(-0.0181)	(0.0046)
Stable employment	-1.0324***	-1.1388***
	(0.006)	(0.0142)
Household characteristics	**Colombia**	**Atlantic**
Lives in rural areas	0.054***	0.0130
	(0.009)	(0.0202)
Own home	-0.089***	-0.0704***
	(-0.006)	(0.0154)
Middle socioeconomic level	-0.1093***	-0.1722***
	(-0.0076)	(0.0242)
High socioeconomic level	-0.3417***	-0.5695***
	(-0.021)	(0.0893)
Number of household members	0.0073***	0.0062*
	(-0.002)	(0.0037)

(continued)

Household characteristics	Colombia	Atlantic
N	311,520	52,932
McFadden R2	0.215	0.2217
AIC	258190	46687
Working sector	**Colombia**	**Atlantic**
Services	-0.104***	-0.1456***
	(-0.0075)	(0.0182)
Mining	-0.108***	-0.1321***
	(-0.014)	(0.0383)
Industry	-0.182***	-0.2863***
	(-0.013)	(0.0330)
Utilities	-0.078***	-0.1202***
	(-0.013)	(0.0305)
Construction	-0.128***	-0.1306***
	(-0.018)	(0.0423)
Commerce	0.108***	0.1234***
	(-0.016)	(0.0380)
Transport	-0.114***	-0.0743
	(-0.019)	(0.0521)
Finance	-0321***	-0.4832***
	(-0.044)	(0.1494)
Kind of occupation	**Colombia**	**Atlantic**
Salaried	-0.261***	-0.4284***
	(-0.007)	(0.0163)
Domestic	0.071***	0.0068
	(-0.016)	(0.0347)
Government	-0.799***	-1.2194***
	(-0.02)	(0.0594)
Employer	-0.608***	-0.8921***
	(-0.026)	(0.0830)
Day laborer	0.523***	0.5766***
	(-0.125)	(0.1802)
Other occupations	-0.262***	-0.3433***
	(-0.021)	(0.0504)
_cons	0.739***	0.9***
	(-0.024)	(0.054)

(continued)

Correctly classified	0.7521	0.7282
Sensitivity	0.7247	0.7708
Specificity	0.7599	0.7138
t-statistics in parentheses * $p < 0,1$, ** $p < 0,05$, *** $p < 0,01$		

Source: Authors' elaboration.

The estimated coefficients maintain the same sign across both models, although they differ in statistical significance and magnitude. At the national level, gender is a relevant determinant; being a woman increases the likelihood of underemployment. However, this variable is not significant on the Atlantic Coast, suggesting that gender gaps in employment quality are less pronounced there. Education also behaves differently across models. While years of schooling significantly reduce the probability of underemployment in the national model, this effect disappears on the Atlantic Coast, indicating that education does not provide the same level of protection against underemployment in that region.

Regarding age, adults aged 29-59 are more likely to be underemployed than younger individuals aged 18–28, both nationally and on the Atlantic Coast. In contrast, older adults aged 60 and above are less likely to be underemployed in both contexts. Marital status also yields relevant findings; living with a partner is associated with a lower probability of underemployment compared to single individuals, whereas being divorced or widowed increases the risk, likely reflecting greater economic vulnerability in the absence of a supportive partner in precarious labor market conditions.

Heads of household are more likely to be underemployed, a finding that runs counter to expectations, since their greater economic responsibilities should lead them to hold more stable, higher-quality jobs. This pattern likely reflects their increased willingness to accept inadequate employment under income pressures. At the same time, job-related characteristics play a decisive role: working more hours per week and earning higher hourly income significantly reduce the probability of underemployment, while having a stable job is one of the strongest protective factors in both Colombia and the Atlantic Coast.

Living in rural areas increases the likelihood of underemployment at the national level, reflecting the high level of informality outside urban centers. On the Atlantic Coast, however, this effect is not significant, likely because informality

is similarly widespread across rural and urban areas. Homeownership reduces the likelihood of underemployment, though only at the national level, suggesting greater stability in more structured labor markets. Likewise, belonging to the middle or upper socioeconomic levels acts as a protective factor in both models, with a stronger effect on the Atlantic Coast, highlighting the role of social stratification in shaping employment quality.

The results by economic sector confirm labor market segmentation. Working in activities such as finance, services, industry, utilities, or construction reduces the likelihood of underemployment compared with the agricultural sector, which serves as the reference category. This reflects the concentration of formal and stable jobs in modern sectors, whereas agriculture, particularly on the Atlantic Coast, remains dominated by informal or subsistence occupations where underemployment is structurally more prevalent. Regarding occupation, being a salaried worker, government employee, or employer significantly lowers the risk of underemployment, with even stronger effects in the Atlantic region. In contrast, self-employed workers, day laborers, and domestic workers—common in informal settings—face greater labor instability and low incomes, increasing their vulnerability to underemployment.

The probit model performs well in terms of predictive accuracy and statistical fit in both regions. The percentage of correctly classified cases is 75.2 % nationally and 72.8 % on the Atlantic Coast, indicating adequate overall precision. McFadden's pseudo R^2 reaches acceptable levels (0.215 for Colombia and 0.222 for the Atlantic Coast), supporting the model's validity. Notably, departmental-level controls were included in the estimations, enhancing the model's explanatory power by accounting for relevant regional heterogeneity. Additionally, heteroskedasticity-robust standard errors were used to ensure the statistical reliability of the estimates.

To quantify the individual impact of each explanatory variable on the probability of being underemployed, marginal effects were estimated from the probit model. These represent the partial change in the probability of being underemployed given a unit change in an explanatory variable, holding all others constant. The calculation of these marginal effects is shown in Table 3. Based on the predicted probabilities, the likelihood of being underemployed in Colombia is 13.98 %, while

on the Atlantic Coast it rises to 15.64 % when all explanatory variables are held at their mean values.

Table 3. Marginal Effects of Variables

Individual characteristics	Colombia	Atlantic
Female	0.0042***	0.0024
Years of education	-0.0014***	0.0009
Adult	0.019***	0.018***
Older adult	-0.018***	-0.022*
Lives with a partner	-0.019***	-0.012**
Divorced or widowed	0.016***	0.026***
Potential work experience	-0.0028***	-0.003***
Head of household	0.009***	0.008**
Hours of work per week	-0.002***	-0.0016***
Hourly income in logarithm	-0.004***	-0.008***
Stable employment	-0.239***	-0.281***
Household characteristics	**Colombia**	**Atlantic**
Lives in rural areas	0.0125***	0.0032
Own home	-0.0207***	-0.017***
Middle socioeconomic level	-0.079***	-0.042***
High socioeconomic level	-0.025***	-0.14***
Number of household members	0.002***	0.0015*
Working sector	**Colombia**	**Atlantic**
Services	-0.024***	-0.036***
Mining	-0.025***	-0.031***
Industry	-0.042***	-0.071***
Utilities	-0.018***	-0.031***
Construction	-0.031***	-0.032***
Commerce	0.025***	0.03***
Transport	-0.026***	-0.018
Finance	-0.074***	-0.119***

(continued)

Kind of occupation	Colombia	Atlantic
Salaried	-0.06***	-0.11***
Domestic	0.016***	0.0017
Government	-0.185***	-0.301***
Employer	-0.141***	-0.221***
Day laborer	0.121***	0.142***
Other occupations	-0.061***	-0.085***
Mean prob.	0.1398***	0.1564***

Source: Authors' elaboration.

Among individual characteristics, being a woman increases the probability of underemployment by 0.42 % in Colombia; this effect is not statistically significant on the Atlantic Coast, possibly due to regional differences in female labor market share. Education (in years) has a negative and significant effect in Colombia; each additional year reduces the probability of underemployment by 0.14 %, but this effect is not significant in the Atlantic region. Being an adult increases the probability of underemployment by 1.9 % in Colombia and 1.8 % on the Atlantic Coast compared to younger individuals, likely due to higher economic pressures that compel them to accept inadequate jobs.

Household-related variables are also important. Being the head of household increases the probability of underemployment by 0.9 % in Colombia and 0.8 % on the Atlantic Coast. Living with a partner reduces underemployment by 1.9 % nationally and 1.2 % on the Coast. In contrast, being divorced or widowed increases the probability of underemployment (1.6 % and 2.6 %, respectively), with stronger effects on the Coast, likely due to heightened economic vulnerability.

Human capital variables show expected effects. Each additional year of potential experience reduces the probability of underemployment by 0.28 % in Colombia and 0.3 % on the Coast. Similarly, more hours worked per week and higher hourly wages reduce underemployment, with particularly strong effects of hourly income, a 0.4 % reduction in Colombia and 0.8 % on the Coast, suggesting that wage improvements have a greater impact on lower-income regions.

Job stability shows the strongest effect; having a stable job reduces underemployment by 23.9 % nationally and 28.1 % on the Atlantic Coast, confirming that informal and precarious employment forms are central to explaining underemployment.

Concerning household characteristics, rural residence increases underemployment by 1.25 % in Colombia, but has no significant effect on the Coast. Homeownership reduces underemployment in both regions (2.07 % in Colombia and 1.7 % on the Coast). Belonging to the middle socioeconomic level reduces underemployment by 7.9 % in Colombia and 4.2 % on the Coast, while being in the upper socioeconomic level reduces it by 2.5 % and 14 %, respectively, compared to the lower socioeconomic level. Each additional household member slightly increases the probability of underemployment (0.2 % in Colombia and 0.15 % on the Coast), possibly reflecting greater economic pressures.

As shown in Table 4, the predicted probabilities from the probit model reveal a consistent pattern of vulnerability to underemployment across Colombia and, more acutely, on the Atlantic Coast. Job stability emerges as the strongest protective factor; individuals in unstable jobs face a probability of 36.7 % nationally and 41.5 % on the Atlantic Coast, compared with only 8.5 % and 8.8 % among those with stable employment. Occupational categories also reflect sharp disparities, with day laborers showing the highest probabilities (28.8 % and 33.5 %, respectively), followed by domestic workers (15.6 % and 19.9 %), whose elevated risks signal persistent regulatory weaknesses. In contrast, public sector workers exhibit the lowest probabilities, around 3 % in both regions, underscoring the stabilizing role of public employment.

Table 4. Probabilities of Becoming Underemployed According to the Explanatory Variables

Individual characteristics		Colombia	Atlantic
Female	No	0.138	0.1554
	Yes	0.142	0.1578
Adult	No	0.1272	0.1437
	Yes	0.145	0.1613
Older adult	No	0.1411	0.158
	Yes	0.1243	0.1377
Lives with a partner	No	0.1501	0.1633
	Yes	0.1316	0.1519
Divorced or widowed	No	0.137	0.151
	Yes	0.1526	0.1772

(continued)

Head of household	No	0.1353	0.1524
	Yes	0.1438	0.1602
Stable employment	No	0.1421	0.4154
	Yes	0.0789	0.0881
Household characteristics		**Colombia**	**Atlantic**
Lives in rural areas	No	0.1294	0.1538
	Yes	0.1412	0.1568
Own home	No	0.1465	0.1617
	Yes	0.1269	0.1451
Middle socioeconomic level	No	0.1461	0.1619
	Yes	0.1224	0.1233
High socioeconomic level	No	0.1421	0.1582
	Yes	0.0789	0.0581
Working sector		**Colombia**	**Atlantic**
Services	No	0.1473	0.1678
	Yes	0.1247	0.1339
Mining	No	0.1473	0.1575
	Yes	0.1247	0.1278
Industry	No	0.1421	0.1597
	Yes	0.1051	0.1
Utilities	No	0.1406	0.1579
	Yes	0.1239	0.1306
Construction	No	0.1406	0.1573
	Yes	0.1139	0.1279
Commerce	No	0.139	0.1555
	Yes	0.1644	0.1868
Transport	No	0.1404	0.1568
	Yes	0.1165	0.1396
Finance	No	0.1402	0.1568
	Yes	0.0806	0.068
Kind of occupation		**Colombia**	**Atlantic**
Salaried	No	0.1674	0.1943
	Yes	0.1102	0.0984
Domestic	No	0.1393	0.1564
	Yes	0.1556	0.158

(continued)

Government	No	0.15	0.1733
	Yes	0.0332	0.0154
Employer	No	0.1428	0.1595
	Yes	0.0469	0.0295
Day laborer	No	0.1397	0.1563
	Yes	0.2883	0.3324
Other occupations	No	0.1411	0.1582
	Yes	0.0905	0.0892

Source: Authors' elaboration.

Sectoral patterns reinforce these vulnerabilities. Commerce and transportation pose the highest risks, particularly on the Caribbean Coast, where the probabilities are 18.6% and 13.9%, respectively. More productive and regulated sectors such as finance and industry maintain significantly lower risks, consistently below 10% in both territories. Although national and regional trends align, the Atlantic Coast shows systematically higher underemployment rates among the most vulnerable groups. These results highlight the need for regionally targeted policies aimed at strengthening job stability, promoting formalization, and expanding access to quality occupations to mitigate the structural nature of underemployment.

Discussion

The findings of this study align broadly with the empirical literature, though important regional nuances emerge. Underemployment in Colombia, especially in the Atlantic departments, reflects a structural logic shaped by both individual characteristics and labor market conditions. While prior studies document an inverse relationship between human capital and underemployment (Brunckhorst et al., 2024; Kemper & Renold, 2024), the results for the Atlantic region indicate that this pattern weakens in areas where the productive structure fails to generate sufficient high-quality jobs to absorb highly educated workers. This mismatch between educational attainment and labor demand helps explain the non-significance of education in the region. Similar conclusions are drawn by Surjya (2025), who shows that education alone does not guarantee improved employment outcomes in low-growth territories, such as in India.

These findings gain relevance when compared with other Colombian regions and Latin American cases. Evidence from Argentina (Quiroga & Fernández, 2021)

and Mexico (Dougherty & Escobar, 2019) consistently shows that the relationship between education, informality, and employment quality depends heavily on local productive structures and institutional capacity. In some contexts, education reduces informality or facilitates entry into formal jobs, while in others, particularly in low-growth or highly informal regions, its returns are limited, creating conditions such as "informality traps." These comparisons help explain why education appears non-significant on Colombia's Atlantic Coast.

Gender patterns also exhibit regional variation. Nationally, being a woman increases the likelihood of underemployment, consistent with Arora et al. (2023), who highlight persistent barriers to quality employment despite educational progress. Yet in the Atlantic region, this effect is not significant, suggesting more homogeneous labor conditions between men and women in local economies marked by high informality.

Yet this uniformity does not suggest equity, but rather generalized labor precariousness. While the results show that the variable "woman" loses significance in the Atlantic, this finding should not be interpreted as evidence of the elimination of gender gaps, but rather as an indication of generalized precariousness affecting both men and women in contexts of high informality. As noted by Maurizio (2021), informality can homogenize labor conditions, thereby diluting the visibility of specific inequalities and undermining job quality. Albinowski (2024) further emphasizes that underemployment particularly affects women in manual occupations, underscoring the importance of incorporating occupational type in gender-based analyses.

The life-cycle analysis shows that working-age adults face a higher risk of underemployment, likely due to economic pressures that push them into inadequate jobs. This differs from Székely and Karver (2021), who find that Latin American youth are more likely to be employed in low-quality jobs. In Colombia, older adults display lower underemployment rates, possibly reflecting more stable job trajectories or gradual exit from formal labor markets.

Marital status also shapes underemployment outcomes. Living with a partner appears to reduce risk by providing greater support and stability, whereas being separated or widowed increases vulnerability, particularly in informal labor settings. Similar patterns are documented by Surjya (2025) in India, where the absence of spousal ties is associated with greater job insecurity.

Territorial differences also add important nuances. Nationally, living in rural areas increases the likelihood of underemployment, consistent with De Janvry et al.

(2022), who show that weak rural infrastructure hinders proper labor market integration. In the Atlantic region, however, this variable is not significant, suggesting a homogenization of informality between urban and rural areas, likely driven by the spread of informal labor markets into intermediate urban zones.

Sectoral results indicate that modern industries, such as finance, manufacturing, and public services, offer greater formalization and lower risks of underemployment. In contrast, the agricultural sector, used as the model's reference category, remains structurally associated with underemployment. This pattern is consistent with Espinosa et al. (2025), who document high informality levels in agriculture, retail, and domestic services.

Occupational categories also reveal consistent patterns. Salaried workers, public sector employees, and employers face significantly lower underemployment risks, supporting the hypothesis that these employment forms are associated with greater stability, access to benefits, and better working conditions (Guven et al., 2018). Conversely, self-employed workers, day laborers, and domestic workers remain structurally exposed to underemployment, partly because they are concentrated in poorly regulated informal sectors.

Overall, these results support the need to design regionally differentiated employment policies that address not only the quantity but also the quality, stability, and adequacy of jobs in relation to workers' profiles. The Atlantic region, in particular, requires comprehensive interventions aimed at tackling the structural weaknesses of its labor market.

Conclusions

The analysis of the determinants of underemployment in Colombia, particularly in the Atlantic region, shows that it is a structural phenomenon shaped by individual attributes and broader labor market and territorial conditions. Job stability is the strongest factor reducing underemployment, highlighting the role of temporary, informal, or precarious work arrangements in sustaining it. Although education and gender typically influence job quality, their effects vary across regions. Nationally, higher education reduces underemployment, but women face higher risks; however, these patterns disappear on the Atlantic Coast due to weak local labor markets. Underemployment is also more common among working-age adults, household heads, and individuals with greater family responsibilities, whereas cohabiting individuals, those from middle- or upper-socioeconomic

levels, and homeowners face lower risks. Territorial disparities matter nationally, rural areas show higher underemployment, but these differences fade in the Atlantic region due to widespread labor precariousness. Lastly, modern sectors such as finance, industry, and public services provide greater protection, while agriculture, commerce, transportation, and domestic work remain highly vulnerable.

The findings point to the need for regionally tailored policies that not only expand employment opportunities but also enhance job quality, formalization, and stability. In the Atlantic region, it is essential to align education with local productive needs, strengthen technical training, and build an institutional environment that promotes formal labor relations and protects workers in vulnerable occupations. These policies must also explicitly prioritize inclusion and equity, as women, youth, and low-skilled workers face a higher risk of precarious employment. Strategies such as demand-driven training programs, incentives to formalize female-dominated sectors, and policies that support the stable integration of young and less-educated workers into quality jobs would help reduce inequalities and prevent the reproduction of labor market segmentation. Without such structural reforms, underemployment will remain a survival strategy in a labor market that fails to fully harness the potential of a more educated workforce.

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