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Socioeconomic Determinants of Labor Informality in The Department of Puno, Peru

Lucio Ticona-Carrizales[1], Henry Amiel Condori Portillo[2], Omar Moisés Rodríguez-Limachi[3], Duverly Joao Incacutipa-Limachi[4], Cristóbal Rufino Yapuchura-Saico[5], Lenin Huayta-Flores[6], Varanny Nelyda Ticona-Campos[7]

Abstract

Labor informality is a phenomenon that impacts the economic and social development of various regions, including the department of Puno, by limiting access to labor rights and perpetuating poverty and inequality. This study aims to determine the socioeconomic factors that influence labor informality in the department of Puno. To achieve this objective, a methodology with a quantitative approach of explanatory scope and a non-experimental cross-sectional design was used, analyzing data from the National Household Survey (ENAHO) of the National Institute of Statistics and Informatics (INEI), whose sample was made up by 1,771 individuals of working age from the department of Puno. The results revealed that factors such as sex ($p = 0.0470$), educational level ($p = 0.0000$), age ($p = 0.0000$), area of residence ($p = 0.0040$), financial inclusion ($p = 0.0000$), the type of employer occupation ($p = 0.0290$), the type of contract ($p = 0.0000$), the monthly income ($p = 0.0000$), the size of the company ($p = 0.0010$) and the type of commercial economic activity ($p = 0.0000$) were determining factors of labor informality. In conclusion, it is established that socioeconomic factors significantly influenced labor informality in the department of Puno, which implies that public policies should focus on improving access to education and financial services to promote the formalization of employment and, therefore, improve the living conditions of the working population.

Keywords: *Labor Informality, Socioeconomic Determinants, Labor Inequality, Public Policies, Puno, Peru.*

Introduction

Labor informality is a phenomenon that affects millions of workers worldwide and its prevalence has intensified in contexts of economic and social crisis. Internationally, it is estimated that more than 60% of workers in developing countries work in the informal sector, which represents a challenge for economic development and social protection (Chalup et al., 2023). In Peru, the situation is no different; according to data from the Ministry of Labor and Employment Promotion (MTPE, 2023), approximately 76% of workers in the country were employed in the informal sector during 2022, reflecting high labor vulnerability and precariousness (Bazdresch, 2018). In the department of Puno, this problem is accentuated due to specific socioeconomic factors, such as poverty, limited access to education and lack of formal labor opportunities. Informality not only affects workers, but also has an impact on the local and national economy, hindering tax collection and the development of effective public policies (Phélan & Osorio, 2020)

From a theoretical perspective, several theories explain labor informality. Human capital theory, proposed by Becker in 1964, argues that the education and skills of workers are key determinants of their productivity and, therefore, of their inclusion in the formal labor market (Urquidi et al., 2023). The opportunity structure theory, formulated by Granovetter in 1973, emphasizes how labor opportunities are influenced by social and economic factors, which can limit access to formal jobs for certain groups (Rangel & López, 2021). Informal economy theory, developed by Portes and Haller in 2002, argues that informality is an adaptive response to exclusion from the formal market (Cortés et al., 2022). Finally, the theory of migration and

[1] National University of Juliaca, Peru, Email: l.ticonac@unaj.edu.pe. ORCID: https://orcid.org/0000-0003-2073-8857
[2] National University of Juliaca, Peru, Email: hacondorip@unaj.edu.pe. ORCID: https:// orcid.org/0000-0001-8860-5896.
[3] National University of the Altiplano, Puno, Piura, Peru, Email: orodriguez@unap.edu.pe. ORCID: https://orcid.org/0000-0002-4688-5989.
[4] National University of the Altiplano, Puno, Peru, Email: djincacutipa@unap.edu.pe. ORCID: https://orcid.org/0000-0002-0067-3147.
[5] National University of the Altiplano, Puno, Peru, Email: cyapuchura@unap.edu.pe. ORCID: https://orcid.org/0000-0003-1956-3922
[6] National University of the Altiplano, Puno, Peru, Email: lhuayta@unap.edu.pe. ORCID: https://orcid.org/0000-0003-2759-9095
[7] National University of San Marcos, Lima, Peru, Email: ynnarav@gmail.com. ORCID: https://orcid.org/0000-0002-0806-3941

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informality, put forward by Massey et al. in 1993, highlights how migrants are often forced to work informally due to barriers in accessing formal employment (García et al., 2023).

In recent years, several studies have approached labor informality from different angles. At the international level, a study conducted in Colombia by Gómez et al. (2023) analyzed the relationship between macroeconomic variables and informality, highlighting that factors such as international trade (explained by increased competition) and strict labor policies influenced the prevalence of informality in the labor market. In addition, Batz et al. (2023) conducted an analysis relating informality to variables such as gender, education and technology, suggesting that financial inclusion and access to education are crucial to reduce labor informality. Finally, the study by Acevedo et al. (2021) on the impact of COVID-19 on labor informality in Latin America shows how economic crises can exacerbate labor informality, highlighting the need for adaptive policies that respond to crisis situations, an aspect also relevant to the context of the department of Puno.

In the Peruvian context, Gamarra and Taipe's (2018) research on the relationship between informality and poverty in the Southern Highlands of Peru revealed that labor informality was strongly associated with conditions of poverty and lack of access to basic services. Likewise, the study by Cueva et al. (2023) focused on labor informality in the Peruvian manufacturing sector, identifying that informality can be a determining factor in the competitiveness of firms. This finding is relevant for the department of Puno, where the local economy depends heavily on informal manufacturing. Finally, the study by Arredondo et al. (2023) provides an analysis of labor informality in Peru. Their results reveal that labor informality is significantly more prevalent among women and people with lower levels of education. Despite advances in research, there are still gaps in the literature that justify the need to study the socioeconomic determinants of labor informality in the department of Puno. In addition, the existing literature often does not consider factors such as age, area of residence, financial inclusion, occupation and firm size, which limits a comprehensive understanding of the phenomenon. This study proposes to fill these gaps, thus contributing to a deeper and more contextualized understanding of the problem.

The objective of this research article is to determine the socioeconomic factors that influence labor informality in the department of Puno. Using a quantitative approach of explanatory scope, with a non-experimental design, it seeks to provide valuable information for the formulation of public policies that promote the formalization of employment and improve labor conditions in the Puno region and the country.

Methodology

The purpose of this study is to identify the socioeconomic factors that affect labor informality in the department of Puno. For this purpose, a quantitative approach with an explanatory scope was adopted, using a non-experimental cross-sectional design. This type of design allows examining the relationship between variables without manipulating them, which is appropriate for the analysis of complex social phenomena such as labor informality. According to Hernández et al. (2014), the non-experimental cross-sectional design is suitable for studies that seek to describe and analyze the relationship between variables at a specific moment in time, without the intervention of the researcher.

The study sample consisted of 1,771 individuals of working age in the department of Puno. To select this sample, we used the database of the National Household Survey (ENAHO) of the National Institute of Statistics and Informatics (INEI) for the year 2023. This database is a reliable source that provides detailed information on various socioeconomic aspects of the population. The specific modules of the database used were: Housing and Household Characteristics (module 100), Characteristics of Household Members (module 200), Education (module 300), Employment and Income (module 500) and Summaries (module 500).

To analyze the variables, several statistical techniques were used. First, descriptive techniques, such as bivariate tabulation, were used to summarize and visualize the data. Then, inferential techniques, such as the chi-square test and robust logit and probit regressions, were applied. The choice of the logit and probit

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econometric models was based on their ability to model the relationship between a binary dependent variable (labor informality: yes/no) and multiple explanatory variables, including social and economic factors. These methods make it possible to estimate the probabilities of an individual's entry into labor informality as a function of his/her socioeconomic characteristics.

Table 1 presents the characteristics of the variables included in this study. These variables were selected based on the theoretical framework and the background information reviewed, and the econometric model formulated for the multivariate analysis is as follows:

$$P(informal = 1) = \beta\_0 + \beta\_1\, sex + \beta\_2\, niveled + \beta\_3\, age + \beta\_4\, estcivil + \beta\_5\, lenmat + \beta\_6\, tamhogar\ldots + \ldots + \beta\_8\, tipoviv + \beta\_9\, areag + \beta\_10\, migra + \beta\_11\, incfinan + \beta\_12\, tipoocup + \beta\_13\, tipocont + \ldots + \ldots + \beta\_14\, ingresom + \beta\_15\, horastrab + \beta\_16\, expelab + \beta\_17\, poverstat + \beta\_18\, tamemp + \beta\_19\, ramas + u\_i$$

Where: β_0 : value of the intercept, $\beta_1, \beta_2 \ldots, \beta_{19}$: coefficients of the explanatory variables and y u_i : error term of the regression.

Table 1. Characteristics of the Variables Considered in the Study

Variables		Notation	Values
Social factors	Sex	*sex*	0: Female, 1: Male
	Educational level	*niveled*	1: No level, 2: Primary school, 3: Secondary school, 4: Higher non-university level, 5: Higher university level, 6: Postgraduate level.
	Age	*age*	1: <= 20 years old, 2: 21 to 30 years old, 3: From 31 to 40 years old, 4: From 41 to 50 years old, 5: From 51 to 60 years old, 6: > 60 years old.
	Marital status	*estcivil*	1: Cohabitant, 2: Married, 3: Widowed, 4: Divorced, 5: Separated, 6: Single.
	Mother tongue	*lenmat*	1: Quechua, 2: Aymara, 3: Spanish, 4: Sign language.
	Household size	*tamhogar*	1: 1 to 3 members, 2: 4 to 6 members, 3: > 6 members
	Household type	*tipoviv*	0: Owned, 1: Rented
	Area of residence	*areag*	0: Urban, 1: Rural
	Migration	*migra*	0: Did not migrate, 1: Yes migrated
Economic factors	Financial inclusion	*incfinan*	0: No access, 1: Yes access
	Type of occupation	*tipoocup*	1: Employer, 2: Self-employed, 3: Employee, 4: Laborer, 5: Others.
	Type of contract	*tipocont*	1: With contract, 2: Service lease, 3: No contract.
	Monthly income	*ingresom*	1: <= 1.000 soles, 2: 1.001 2.000 soles, 3: 2.001 3.000 soles, 4: 3.001 4.000 soles, 5: 4.001 a 5.000 soles, 6: > 5.000 soles

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	Weekly working hours	*horastrab*	1: <35 hours, 2: 35 to 47 hours, 3: 48 hours, 4: 49 to 59 hours, 5: >= 60 hours.
	Work experience	*expelab*	1: <= 10 years old, 2: 11 to 20 years old, 3: 21 to 30 years old, 4: 31 to 40 years old, 5: 41 to 50 years old, 6: > 50 years old.
	Poverty status	*poverstat*	1: Extremely poor, 2: Non-extremely poor, 3: Non-poor
	Company size	*tamemp*	1: Micro enterprise. 2: Small enterprise, 3: Medium enterprise, 4: Large enterprise.
	Branches of economic activity	*ramas*	1: Agriculture, 2: Fishing, 3: Extraction, 4: Manufacturing, 5: Construction, 6: Trade, 7: Transportation, 8: Administration, 9: Others.
Informal employment	Informal labor employment	*informal*	0: Formal, 1: Informal

In this study, Stata statistical software (version 17) was used for data processing and analysis. The choice of this program was based on its ability to perform robust bivariate and multivariate analyses with cross-sectional data.

Results

Table 2 shows the evolution of informal employment in the department of Puno and Peru between the period 2016 and 2023, where the informal employment rate increased both in the department of Puno and nationally, from 85.30% in 2016 to 88.97% in 2023. In 2021, during the COVID-19 pandemic, this rate reached 90.36%.

Table 2. Evolution of Formal and Informal Employment in the Department of Puno, 2016 - 2023 (%)

Scope	2016	2017	2018	2019	2020	2021	2022	2023
National:								
Informal	71.97	72.55	72.44	72.74	75.35	76.85	75.70	73.89
Formal	28.03	27.45	27.56	27.26	24.65	23.15	24.30	26.11
Department of Puno:								
Informal	85.30	88.14	87.57	87.61	89.57	90.36	90.21	88.97
Formal	14.70	11.86	12.43	12.39	10.43	9.64	9.79	11.03

Note: ENAHO and INEI databases were used for the period 2016-2023.

Table 3 presents the informal employment rate and average monthly income in Peru's departments for the year 2023. The results revealed that the department of Puno registered a labor informality rate of 88.97%, placing it among the departments with the highest rate of informal employment, followed by Huancavelica with 89.73%, Apurímac with 89.19% and Huánuco with 88.99%. In addition, the average monthly income in the department of Puno was 823 soles for workers in the informal sector and 2,753 soles for those in the formal sector. Likewise, significant differences were observed in the type of employment (formal and informal) between the departments of Peru ($p = 0.0000$).

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Table 3. Average Monthly Income and Type of Employment in The Departments of Peru, 2023 (%)

Department	Average monthly income S/			Type of employment			*Chi²* *p*-value
	Informal	Formal	Total	Informal	Formal	Total	
Huancavelica	752	2,496	991	89.73	10.27	100	
Apurímac	1,023	3,693	1,406	89.19	10.81	100	
Huánuco	860	3,258	1,177	88.99	11.01	100	
Puno	823	2,753	1,069	88.97	11.03	100	
Ayacucho	870	2,579	1,138	87.08	12.92	100	
San Martín	1,110	2,858	1,372	86.95	13.05	100	
Amazonas	1,067	2,928	1,367	86.44	13.56	100	
Cajamarca	771	2,654	1,094	85.04	14.96	100	
Cusco	1,034	2,560	1,340	83.52	16.48	100	
Loreto	974	3,025	1,361	83.47	16.53	100	
Ucayali	1,022	2,699	1,333	83.35	16.65	100	
Junín	1,052	2,845	1,411	82.69	17.31	100	
Ancash	1,084	2,699	1,447	80.67	19.33	100	
Pasco	868	2,678	1,285	79.87	20.13	100	0.0000
Piura	986	2,455	1,319	78.99	21.01	100	
Madre de Dios	1,732	3,103	2,054	78.42	21.58	100	
Tumbes	1,100	2,379	1,386	78.32	21.68	100	
Tacna	1,182	2,630	1,534	77.14	22.86	100	
Lima Provinces	1,129	2,446	1,481	75.21	24.79	100	
Lambayeque	1,032	2,494	1,427	74.55	25.45	100	
La Libertad	1,087	2,557	1,527	71.89	28.11	100	
Arequipa	1,337	2,921	1,856	68.99	31.01	100	
Moquegua	1,242	3,363	2,027	65.12	34.88	100	
Ica	1,443	2,534	1,849	64.73	35.27	100	
Callao	1,211	2,391	1,683	60.80	39.20	100	
Metropolitan Lima	1,320	2,875	1,961	59.81	40.19	100	
Total	1,106	2,755	1,577	73.89	26.11	100	

Note: ENAHO and INEI databases were used for the period 2023.

Table 4 presents an analysis of the relationship between various social factors and the type of employment (formal and informal) in the department of Puno for the year 2023. When relating sex with type of employment, it was observed that 86.18% of men and 91.92% of women had informal employment. This indicates a significant association between both variables ($p = 0.0010$). In relation to educational level, the data showed that 66.42% of the individuals with a university education had informal jobs. This figure rose to 98.07% for those with primary education. There was also a significant association between educational level and type of employment ($p = 0.0000$).

Age also proved to be a relevant factor. Eighty-six percent of individuals between 41 and 50 years of age had informal jobs, while this proportion increased to 98.21% among those under 20 years of age. Similarly, a significant association between both variables was evidenced ($p = 0.0034$). In addition, we examined the relationship between mother tongue and type of employment, finding that 84.75% of Spanish speakers and 92.80% of Aymara speakers had informal employment. There was a significant association between mother tongue and type of employment ($p = 0.0605$).

Regarding the area of residence, the analysis revealed that 95.79% of the residents in rural areas and 84.40% of the residents in urban areas had informal jobs. Likewise, a significant association was found between both variables ($p = 0.0000$). In contrast, no significant associations were found between marital status, household size, type of housing and migration and type of employment.

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Table 4. Social Factors, Income and Type of Employment in The Department of Puno, 2023

Variable	Categories	Average monthly income S/		Type of employment %			*Chi² p-value*
		Informal	Formal	Informal	Formal	Total	
Sex	Woman	702	2,782	91.92	8.08	100	0.0010
	Male	941	2,737	86.18	13.82	100	
Educational level	No level	346	-	100.00	0.00	100	0.0000
	Elementary	657	3,240	98.07	1.93	100	
	Secondary	850	1,910	94.25	5.75	100	
	Higher non-university	1,013	2,521	74.12	25.88	100	
	Higher university	1,157	3,273	66.42	33.58	100	
	Postgraduate	2,526	3,682	17.30	82.70	100	
Age	<=20 years	683	2,013	98.21	1.79	100	0.0034
	21-30 years	1,001	3,068	91.48	8.52	100	
	31-40 years	955	2,723	82.76	17.24	100	
	41-50 years	800	2,853	86.00	14.00	100	
	51-60 years	817	2,272	88.36	11.64	100	
	>60 years	396	3,008	94.00	6.00	100	
Marital status	Cohabitant	898	2,805	86.59	13.41	100	0.3006
	Married	744	2,688	88.80	11.20	100	
	Widowed	429	3,266	94.30	5.70	100	
	Divorced	474	3,127	84.19	15.81	100	
	Separated	793	2,185	92.51	7.49	100	
	Single	919	2,806	89.83	10.17	100	
Mother tongue	Quechua	840	2,292	88.80	11.20	100	0.0605
	Aymara	738	2,791	92.80	7.20	100	
	Spanish	909	3,373	84.75	15.25	100	
	Sign Language	840	2,292	100.00	0.00	100	
Household size (members)	From 1 to 3	717	2,727	87.79	12.21	100	0.2658
	From 4 to 6	912	2,924	90.73	9.27	100	
	Greater than 6	990	1,964	81.82	18.18	100	
Type of housing	Own	826	2,703	88.89	11.11	100	0.7340
	Rented	795	3,615	90.13	9.87	100	
Area of residence	Urban	881	2,844	84.40	15.60	100	0.0000
	Rural	740	2,250	95.79	4.21	100	
Migration in 5 years	No	896	5,083	91.13	8.87	100	0.6007
	Yes	819	2,639	88.83	11.17	100	

Note: Prepared with data from INEI's National Household Survey, 2023.

Table 5 presents the relationship between various economic factors and the type of employment (formal and informal) in the department of Puno during the year 2023. The results showed that 97.33% of those who did not have access to financial services and 69.21% of those who did had informal employment, indicating a significant association between both variables (p = 0.0000). Considering the type of occupation, 95.83% of the self-employed and 54.13% of the dependent employees had a type of informal employment, with a significant association (p = 0.0000). Likewise, 99.39% of those who did not have an employment contract were informally employed, compared to 20.44% of those with a contract, highlighting a significant association between both variables (p = 0.0000).

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Regarding monthly income, 20.36% of individuals with incomes of 4,001 to 5,000 soles had informal employment, compared to 85.11% of those with incomes of 1,001 to 2,000 soles, showing a significant association (p = 0.0000). In addition, 88.74% of those who worked between 49 and 59 hours per week and 85.76% of those who worked between 35 and 47 hours had informal employment, with a significant association between both variables (p = 0.0121). Work experience also showed a significant association with the type of informal employment (p = 0.0509), where 83.57% of those with between 31 and 40 years of experience and 92.11% with 11 to 20 years of experience had informal employment. In addition, 99.56% of individuals with households in extreme poverty and 84.65% of non-poor households had informal employment, showing a significant association between both variables (p = 0.0000).

The size of the company where they worked also showed a significant association (p = 0.0000), where 96.69% of the employees in micro companies, 37.17% in medium companies and 29.95% in large companies had informal employment. Finally, 88.72% of those working in the commerce sector and 89.08% in the manufacturing sector had informal employment, with a significant association (p = 0.0000).

Table 5. Economic Factors, Income and Type of Employment in the Department of Puno, 2023

Variable	Categories	Average monthly income S/		Type of employment %			*Chi²* *p - value*
		Informal	Formal	Informal	Formal	Total	
Financial inclusion	No access	844	2,102	97.33	2.67	100	0.0000
	Yes you do	814	2,875	69.21	30.79	100	
Type of occupation	Employer	1,578	4,025	73.27	26.73	100	0.0000
	Self-employed	649	1,682	95.83	4.17	100	
	Employee	889	3,070	54.13	45.87	100	
	Laborer	1,100	2,482	93.42	6.58	100	
	Other	942	553	98.90	1.10	100	
Type of contract	With contract	1,190	2,930	20.44	79.56	100	0.0000
	Service lease	1,429	4,821	98.05	1.95	100	
	Without contract	988	809	99.39	0.61	100	
Monthly income (soles)	<=1,000	442	576	98.45	1.55	100	0.0000
	1,001 - 2,000	1,360	1,455	85.11	14.89	100	
	2,001 - 3,000	2,369	2,472	53.83	46.17	100	
	3,001 - 4,000	3,419	3,346	29.03	70.97	100	
	4,001 - 5,000	4,407	4,554	20.36	79.64	100	
	>5,000	6,562	6,632	25.87	74.13	100	
Weekly working hours	<35 hours	541	2,261	93.53	6.47	100	0.0121
	35-47 hours	837	2,890	85.76	14.24	100	
	48 hours	1,201	3,411	84.45	15.55	100	
	49-59 hours	965	2,665	88.74	11.26	100	
	>=60 hours	1,096	2,876	85.34	14.66	100	
Work experience	<=10 years	911	2,667	88.22	11.78	100	0.0509
	11 - 20 years	669	2,945	92.11	7.89	100	
	21 - 30 years	651	2,805	89.80	10.20	100	
	31 - 40 years	530	3,383	83.57	16.43	100	
	41 - 50 years	364	2,930	98.83	1.17	100	
	>50 years	457	-	100.00	0.00	100	
Poverty status	Poor extreme	526	410	99.56	0.44	100	0.0000
	Non-extreme poor	807	1,629	94.36	5.64	100	
	Not poor	890	2,939	84.65	15.35	100	
Company size	Microenterprise	755	2,002	96.69	3.31	100	0.0000
	Small enterprise	1,503	2,385	88.42	11.58	100	

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	Medium enterprise	1,784	2,515	37.17	62.83	100	
	Large enterprise	1,371	3,139	29.95	70.05	100	
Branches of economic activity	Agriculture	563	-	100.00	0.00	100	0.0000
	Fishing	680	-	100.00	0.00	100	
	Extraction	1,711	4,780	79.19	20.81	100	
	Manufacturing	648	3,072	89.08	10.92	100	
	Construction	1,267	1,379	97.58	2.42	100	
	Commerce	873	1,728	88.72	11.28	100	
	Transportation	760	1,938	96.81	3.19	100	
	Administration	1,362	2,602	55.22	44.78	100	
	Others	950	2,929	58.74	41.26	100	

Note: Prepared with data from INEI's National Household Survey, 2023.

Table 6 presents the results of the multivariate analysis carried out using logit and robust probit regression techniques. In this analysis, the dependent variable is informal employment in the department of Puno, while the explanatory variables correspond to the social and economic factors formulated in the econometric model in the Methodology section.

Table 6. Logit And Probit Regression for The Type of Informal Employment in The Department of Puno, 2023 - Model 1

Type of informal employment	Logit model		Probit model	
	Coefficient	P>z	Coefficient	P>z
Sex: male	-0.5600	0.0480	-0.2228	0.1110
Educational level	-0.5133	0.0000	-0.2703	0.0000
Age	-0.0050	0.6840	-0.0040	0.5060
Marital status: single	0.8004	0.0430	0.3963	0.0500
Mother tongue: Spanish	0.2504	0.4900	0.0662	0.7210
Household size	0.0838	0.3740	0.0479	0.2930
Type of housing: rented	0.6631	0.2430	0.4036	0.1270
Area of residence: rural	0.9681	0.0060	0.4509	0.0100
Migration: yes migrated	-0.9678	0.0630	-0.5465	0.0320
Financial inclusion: yes access	-1.2226	0.0000	-0.5463	0.0000
Occupation: employer	-1.3570	0.0190	-0.6103	0.0350
Type of contract: with contract	-1.8968	0.0000	-0.9475	0.0000
Monthly income	-0.0005	0.0000	-0.0003	0.0000
Hours worked per week	-0.0002	0.9770	-0.0001	0.9850
Years of work experience	-0.0108	0.3440	-0.0021	0.7160
Poverty status	-0.4384	0.1420	-0.1840	0.2170
Company size	-0.6281	0.0010	-0.3421	0.0010
Economic activity: commerce	-1.7415	0.0000	-0.7626	0.0000
_cons	8.8300	0.0000	4.4674	0.0000
Number of observations		1,771		1,771
Wald $chi^2(18)$		270.55		361.65
Prob > chi^2		0.0000		0.0000
Pseudo R^2		0.6428		0.6378

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Note: Prepared with data from INEI's National Household Survey, 2023.

First, the general econometric model was estimated, in which logit and probit regression analysis revealed that several variables were significantly associated with informal employment in the department of Puno. The results indicated that the individual's sex (p = 0.0480), educational level (p = 0.0000), single marital status (p = 0.0430), area of residence (p = 0.0060), migration (p = 0.0630), financial inclusion (p = 0.0000), type of occupation (p = 0. 0190), type of contract (p = 0.0000), monthly income (p = 0.0000), firm size (p = 0.0010) and trade as type of economic activity (p = 0.0000) were shown to be statistically significant factors in explaining informal employment. On the other hand, factors such as age of the individual (p = 0.6840), mother tongue Spanish (p = 0.4900), household size (p = 0.3740), type of housing (p = 0.2430), number of hours worked per week (p = 0.9770), years of work experience (p = 0. 3440) and household poverty status (p = 0.1420) turned out to be statistically non-significant factors, suggesting that they did not influence the determination of informal employment in the department of Puno during the year 2023.

Table 7 presents the results of the robust logit and probit regression, performed after excluding from the general model those variables that were not shown to be statistically significant in determining informal employment. This new modeling of the econometric equation allowed us to obtain more precise results regarding the type of relationship between the variables and their corresponding impact. The results showed that all the explanatory variables included in Table 7 turned out to be statistically significant. Thus, the factors that increased the probability or prevalence of informal employment in the department of Puno during the year 2023 were: the female sex of the individual (p = 0.0470), a low educational level (p = 0.0000), a young age (p = 0.0000), residence in rural areas (p = 0. 0040), lack of financial inclusion (p = 0.0000), type of occupation other than employer (p = 0.0290), absence of an employment contract (p = 0.0000), low monthly income (p = 0.0000), smaller size of enterprise (e.g. microenterprise) (p = 0.0010) and type of economic activity other than trade (p = 0.0000).

Table 7. Logit And Probit Regression for The Type of Informal Employment in The Department of Puno, 2023 - Model 2

Type of informal employment	Logit model		Probit model		Odds ratio
	Coefficient	P>z	Coefficient	P>z	
Sex: male*	-0.5484	0.0470	-0.2070	0.1320	0.5779
Educational level	-0.4605	0.0000	-0.2502	0.0000	0.6310
Age	-0.0275	0.0000	-0.0135	0.0000	0.9729
Area of residence: rural*	0.9653	0.0040	0.4509	0.0070	2.6257
Financial inclusion: yes accesses*	-1.2107	0.0000	-0.5300	0.0000	0.2980
Occupation: employer*	-1.3770	0.0290	-0.6232	0.0410	0.2523
Type of contract: with contract*	-1.9328	0.0000	-0.9553	0.0000	0.1447
Monthly income	-0.0005	0.0000	-0.0003	0.0000	0.9995
Company size	-0.5810	0.0010	-0.3293	0.0000	0.5594
Economic activity: trade*	-1.6459	0.0000	-0.7358	0.0000	0.1928
_constante	7.9935	0.0000	4.0734	0.0000	2961.7
Number of observations		1,771		1,771	
Wald chi2(10)		264.41		337.87	
Prob > chi^2		0.0000		0.0000	
Pseudo R^2		0.6329		0.6283	

Note: (*) dichotomous variables.

Table 8 shows the marginal effects of the variables that were found to be significant in explaining informal employment in the department of Puno. The results indicated that being male reduced the probability of

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informal employment by 0.9%. An increase in educational level decreased the probability by 0.7%, and each additional year of age by 0.004%. Residing in rural areas increased the probability by 1.7%. Access to financial services reduced it by 2.4%, and being an employer by 4.4%. Having an employment contract decreased the probability by 7.2%, and an increase of every 100 soles in monthly income reduced it by 0.10%. Working in a larger company decreased the probability by 0.9%, and working in the commerce sector by 5%.

Table 8. Marginal Effects for The Type of Informal Employment in the Department of Puno, 2023

Variable	dy/dx	Standard error	z	P>z
Sex: male*	-0.00915	0.0045	-2.0200	0.0430
Educational level	-0.00745	0.0028	-2.6700	0.0080
Age	-0.00044	0.0001	-3.1600	0.0020
Area of residence: rural*	0.01764	0.0071	2.4700	0.0130
Financial inclusion: yes accesses*	-0.02493	0.0068	-3.6700	0.0000
Occupation: employer*	-0.04458	0.0341	-1.3100	0.1910
Type of contract: with contract*	-0.07210	0.0318	-2.2700	0.0230
Monthly income	-0.00001	0.0000	-3.2200	0.0010
Company size	-0.00939	0.0033	-2.8200	0.0050
Economic activity: trade*	-0.05205	0.0195	-2.6700	0.0080

Note: (*) dy/dx is for discrete change of dummy variable from 0 to 1.

Discusión

The present research on the socioeconomic factors that influence labor informality in the department of Puno reveals significant findings consistent with previous scientific literature. Variables such as gender, educational level, age, area of residence, financial inclusion, occupation, type of contract, monthly income, firm size and commercial economic activity are found to be key determinants of labor informality. These variables not only show similar patterns to other studies, but also pose some differences that deserve detailed discussion.

Regarding gender, it was observed that women presented higher rates of informal employment than men, which is associated with gender discrimination and scarcity of educational opportunities, as suggested by Dávila (2021). Furthermore, Medina (2021) reinforces this idea, noting that its effects are negatively associated with health and well-being. Educational level proved to be a relevant factor, as people with higher educational levels tend to have access to formal jobs. This finding is aligned with the studies of Ñiquen (2019) and Cerquera et al. (2022), who emphasize that education not only improves job opportunities, but also strengthens the ability to understand and manage the complexities of the labor market, which influences their decision to accept or reject informal jobs (Hernández et al., 2022).

In relation to age, a decrease in labor informality was observed as age increases, a result that coincides with the studies of Segura (2022) and Germano and Brenlla (2022), who point out that young people tend to accept informal jobs due to lack of experience and labor networks. The area of residence was another determinant of informal employment, as people residing in rural areas have higher rates of informality, due to limited access to formal jobs (Guzmán, 2023). In addition, the lack of infrastructure, basic services and low educational levels increase their informality (Rodríguez, 2022).

Financial inclusion was identified as a significant variable determining informal employment, as individuals with access to financial services had lower rates of informal employment. This finding coincides with studies such as Coaquira (2021) and Grados (2021) that highlight that financial inclusion allows individuals to

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improve their economic situation and, therefore, access more stable jobs. Employer occupation has been identified as a key variable in labor informality, given that individuals with this occupation have lower rates of informal employment. This finding is consistent with the study by Yancari et al. (2022), which suggests that encouraging entrepreneurship can be an effective approach to reduce labor informality.

Likewise, the type of labor contract shows that those with formal contracts have lower rates of informality. This finding is consistent with Guzmán (2023) and Franco et al. (2022), who argue that formalization not only improves labor stability, but also promotes economic development and social cohesion. Income was a significant variable in the reduction of labor informality, aligning with studies that associate higher income with better formal employment opportunities. Gómez et al. (2019) suggest that adequate wages can decrease reliance on informal jobs, while poverty status, although not statistically significant, is still relevant, as studies such as those by Tudela (2020) and Sánchez et al. (2022) show that in situations of vulnerability, individuals resort to the informal sector for subsistence

Firm size also contributes to the determination of formal employment. This finding coincides with studies by Duarte et al. (2023) and García (2022), which link larger firms with formal job creation due to better wages and benefits. In addition, the research by Sánchez et al. (2023) highlights that micro and small enterprises (MYPES) face greater difficulties in formalizing their operations, which perpetuates informality. Commercial economic activity proved to be another significant variable, with low informality rates in this sector, suggesting that the formal business environment favors the creation of regulated and stable jobs (Osorio and López, 2022).

In terms of research limitations, it is important to note that the lack of longitudinal studies limits the understanding of how socioeconomic factors interact over time to influence labor informality. Finally, the implementation of policies that promote education and job training is critical to address the causes of labor informality. Collaboration between government and educational institutions could be key to developing programs that improve the skills of workers

Conclusions

The results of this research have shown that socioeconomic factors, such as gender ($p = 0.0470$), educational level ($p = 0.0000$), age ($p = 0.0000$), area of residence ($p = 0.0040$), financial inclusion ($p = 0.0000$), occupation ($p = 0.0290$), type of contract ($p = 0.0000$), monthly income ($p = 0.0000$), firm size ($p = 0.0010$) and commercial economic activity ($p = 0.0000$), significantly influenced labor informality in the department of Puno. In addition, there is a marked difference in monthly income between those with formal and informal jobs, with the latter receiving the lowest income. These findings are consistent with the existing literature that suggests that labor informality is a multidisciplinary phenomenon, determined by several interrelated variables.

The estimation of the marginal effects of the variables analyzed on informal employment identified key factors that significantly increase the probability of having this type of employment. In particular, having a labor contract reduced the probability of informal employment by 7.2%, while belonging to the commercial sector reduced this probability by 5.2%, and being an employer reduced it by 4.4%. Likewise, access to financial services was associated with a decrease of 2.4%, and residing in rural areas reduced it by 1.7%.

In response to the research objective, which sought to determine the socioeconomic factors that influence labor informality in the department of Puno, we have been able to identify and comprehensively analyze the variables mentioned. This approach has made it possible not only to meet the stated objective, but also to contribute to the understanding of labor dynamics in the region, providing a solid basis for future research and public policies.

Finally, the implications of this work are significant, not only for the understanding of labor informality in Puno, but also for the development of policies to address socioeconomic inequalities in the region. It is suggested that future research should focus on longitudinal analysis of labor informality and on exploring qualitative approaches to capture the experiences of informal workers. In addition, it would be beneficial

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to investigate how public policies can be designed to foster labor inclusion and reduce informality in similar contexts.

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