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Personal, Household, and Sociodemographic Factors of Women's Labor Force Participation in Ancash, 2022

Factores personales, del hogar y sociodemográficos de la participación laboral de las mujeres en Áncash, 2022

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Abstract

The objective of this research is to identify the personal, household and sociodemographic factors that influence the labor participation of women in Ancash during 2022, by means of a logit model using data from the ENAHO for that year, which obtained a pseudo-R^2 equal to 0.11 and an area under the ROC curve equal to 0.72. The methodology used is quantitative, explanatory and non-experimental design. The results reveal that, on a personal level, the probability of women's labor participation increased by 0.28% when the woman was older (up to a maximum age of 64 years), by 16.4% when she had higher education and by 8% when she had or had had a partner (married, cohabiting, widowed or divorced). In terms of household factors, being head of household increases the probability by 17.5%, while households with more than 2 recipients increase it by 5%. On the other hand, at the sociodemographic level, residing in urban areas reduces participation by 13.4% compared to rural areas and having learned Spanish as a mother tongue decreases the probability by 9.5% compared to Quechua. Variables such as ethnicity, asset ownership (cell phone, TV and internet), household poverty, total number of household members, social programs (food and subsidies) and household income did not show statistical significance ($p<0.05$). It is concluded that education, the role of head of household and area of residence are relevant determinants of female labor participation, reaffirming the human capital theory.

Keywords: labor participation, women, labor market, logit model, Áncash.

Resumen

El presente trabajo de investigación tiene por objetivo, identificar los factores personales del hogar y sociodemográficos que influyen en la participación laboral de las mujeres en Áncash durante el año 2022, mediante modelo Logit usando datos de la ENAHO, el cual obtuvo un pseudo R^2 igual a 0.11 y un área bajo la curva ROC igual a 0.72. La metodología empleada es de enfoque cuantitativo, explicativo y diseño no experimental. Los resultados revelan que, en el plano personal, la probabilidad de la participación laboral de la mujer se incrementó en 0.28% cuando la edad de la mujer era mayor hasta los 64 años, en 16.4% al contar con educación superior y 8% cuando se tiene o ha tenido pareja sea: casada, conviviente, viuda o divorciada. En cuanto a los factores del hogar, ser jefa del hogar aumenta la probabilidad en 17.5%; mientras que hogares con más de 2 perceptores la elevan en 5%. Por otro lado, en el plano sociodemográfico, residir en áreas urbanas reduce la participación en 13.4% frente a las zonas rurales y haber aprendido el castellano como lengua materna, disminuye la probabilidad en 9.5% en comparación con el quechua. Variables como etnia, tenencia de activos como: celular, TV e internet, pobreza del hogar, número total de

miembros del hogar, programas sociales: alimentarios y subvenciones e ingresos del hogar no mostraron significancia estadística (p<0.05). Se concluye que la educación, el rol de jefa del hogar y el área de residencia son determinantes relevantes de la participación laboral femenina, reafirmando la teoría del capital humano.

Palabras clave: Participación laboral, mujeres, mercado laboral, modelo logit, Áncash.

1.   Introduction

Throughout the twentieth century, women have achieved significant progress in labor and educational rights, which has driven their greater participation in the labor market. However, a marked gender gap in labor force participation persists, which has decreased at a slow pace worldwide.

In 2022, the female participation rate reached 47.3%, considerably lower than the male rate (72.5%) (International Labour Organization [ILO], 2023). Studies estimate that if women participated in equal proportion to men, global GDP could increase by 26% by 2025 (United Nations, 2017).

In Latin America, ILO (2022) states that female labor force participation was 51% compared to 74% for men in 2022, with a gap worsened by the COVID-19 pandemic. According to ECLAC (2021), the health crisis led to an increase in inequality, as many women abandoned job seeking due to caregiving responsibilities. In the region, factors such as the overload of unpaid work, concentration in less productive sectors, and overrepresentation in informal employment limit women's labor market insertion (Vaca, 2019).

Although Peru presents one of the smallest gender labor gaps in the region, it still faces challenges. According to Morrison (2021), most Peruvian women work in vulnerable jobs, characterized by high informality, scarce social benefits, and limited access to digital devices. The 2021 crisis reflected this precariousness, with an 8% drop in female labor force participation, in contrast to 2.7% for men (National Institute of Statistics and Informatics [INEI], 2021).

Áncash region is not exempt from this issue. Employment there is predominantly informal, precarious, low in productivity, and concentrated in micro and small enterprises, as stated by the Peruvian Institute of Economics [IPE] (2022). This region presents low levels of social protection for both genders, both in health insurance and pension system affiliation, reaching 26% of the employed EAP in 2021. However, for women, the situation is more unfavorable, as only 16.8% of the employed female EAP have access to both social protection systems (IPE, 2022).

Regarding the educational level attained by the employed female EAP, the Socioeconomic Labor Observatory [OSEL] (2022) reports that those who reached secondary and primary education represent the highest percentages, with 35.8% and 34%, respectively. Additionally, women employed with university-level higher education account for 18.6%, three percentage points higher than men.

In terms of the number of hours employed women dedicate to paid work, most of them choose fewer than 48 hours per week (70%), whereas 52% of employed men work equal to or more than 48 hours (OSEL, 2022).

In summary, women's labor force participation faces numerous challenges that require policies fostering labor equity and the formalization of female employment. These challenges not only affect their economic and social well-being but also have repercussions on Peru's economic development.

Given this context, the general objective of this study is to identify the personal, household, and socio-demographic factors that influence women's labor force participation in Áncash, 2022.

This research is relevant for its contribution to gender equity, a fundamental pillar of the "Sustainable Development Goals." In Peru, studies on female labor force participation remain limited, which makes a deeper and updated analysis necessary, especially in regional contexts where dynamics may differ from the national landscape.

1.1   Background

Marjanović et al. (2024) examined the main determinants of female labor force participation (FLFP) in the countries of the European Union. For this purpose, panel data covering the period from 2000

to 2021 were employed, and a fixed-effects regression model was used to assess the effect of variables such as GDP per capita, the presence of anti-discrimination laws, equal opportunity laws, women's participation in parliament, fertility rate, paid parental leave, women's educational attainment, and annual net income on the female labor force participation rate in that geographical context. The findings indicate that GDP per capita, fertility rate, annual net income, and women's secondary and higher education are significant determinants of FLFP with positive effects. It is concluded that improvements in educational levels, annual net income, and gender equity policies encourage greater female participation in the labor market.

Xiaoyi et al. (2022) analyzed the impact of childcare, old-age pensions, and spousal support on the labor force participation of married women in rural China, using data from the Child Survival and Development Survey (CSDS) and a multinomial Logit model. They found that household size influences the participation of married rural women more than that of men, with significant effects from children's age and spousal support. They recommend strengthening regional industries, diversifying vocational training, and improving the childcare system.

Valencia (2021) analyzed the determinants of female labor force participation in Piura through a quantitative approach, non-experimental design, and a Logit model based on the leisure-consumption theory, using data from ENAHO. The findings indicate that higher education increases the probability of labor market insertion, while poverty and the presence of children under six years of age reduce it. In addition, public transfers have a significant negative effect, and factors such as food assistance, childcare services, and training were not statistically significant due to limited access to these programs.

Cano (2023) studied the sociodemographic factors affecting female labor force participation in Piura in 2022, using ENAHO data and a Logit model. He found that 60% of women participated in the labor market, with participation being negatively influenced by the number of children and household income, while age, household headship, and educational attainment had a positive impact. He concludes that the number of children under six years old negatively affected women's labor force participation, while age, household headship, and educational attainment had a positive effect.

Jilaya (2024) analyzed the factors influencing labor force participation of female heads of household in a district of the El Collao province during 2023. For this purpose, a quantitative approach was adopted, and the study was classified as explanatory with a non-experimental design. A survey technique was applied, and a questionnaire was administered to a sample of 138 female heads of household. After collecting the information, two models (Probit and Logit) were estimated, with the Probit model being selected based on the Akaike and maximum likelihood criteria values. The results indicate that sociodemographic characteristics such as age and educational attainment have a positive and significant effect on labor force participation, while the economic factor of non-labor income negatively affected the dependent variable. The author concludes that labor force participation of female heads of household in the studied geographical context is determined by sociodemographic and economic factors.

1.2   Theoretical Bases

Neoclassical Theory

The labor market is the space where the labor supply (available workers) and labor demand (organizations requiring personnel) interact. In this context, labor services represent the physical and mental effort of employees, whose price is the wage (Parkin & Loría, 2015). Since working involves an opportunity cost in terms of leisure, a wage incentive is required to motivate labor force participation (Parkin & Loría, 2015).

a. Leisure-Comsumption Model
  This model states that consumption and leisure generate utility for individuals, who must allocate their time between work (L) and leisure (S), subject to a time constraint (Nicholson & Snyder, 2015).

$$L + S = 24 \text{ hours per day} \tag{i}$$

Their budget constraint, considering a real hourly wage w, is expressed as:

$$c = wL + \gamma_n \tag{ii}$$

$$c = w(24 - s) \tag{iii}$$

$$c + sw = 24w + \gamma_n \tag{iv}$$

Equation (iv) represents the combined budget and time constraint faced by individuals, showing that the opportunity cost of leisure is equivalent to the hourly wage (w), that is, the income forgone by not working. It also demonstrates that devoting more time to work allows individuals to achieve higher levels of consumption (Nicholson & Snyder, 2015).

b. Individual Labor Supply

Individuals decide between working or enjoying leisure, which determines the labor supply curve (Mankiw, 2017). A wage increase can encourage both work (substitution effect) and leisure (income effect). The labor supply curve initially has a positive slope but may become negative if the income effect dominates (Pindyck & Rubinfeld, 2009).

Labor supply with a positive slope is defined within a wage range between the reservation wage (w*) and a maximum wage (w**). The reservation wage represents the minimum income for which an individual is willing to work. As the wage rises above w*, labor supply increases because working becomes more attractive.

In the long term, labor supply may show a negative slope, as over the years, working hours have been reduced in most countries and minimum living wages have increased.

c. Labor Demand

Labor demand is indirect, as workers represent inputs for the production of other goods, and firms will hire more workers depending on the sales level of their products. In competitive markets, firms hire until the wage equals the value of the marginal product of labor (VMPL). Factors such as wages, product demand, the price of other production factors, technology, and productivity affect labor demand (Mankiw, 2017).

The labor demand curve has a negative slope in both the short and long run, with the difference being that in the short term, the slope is steeper.

d. Labor Market Equilibrium

Under the assumption of perfect competition, labor market equilibrium is reached when labor supply equals labor demand, allowing all firms to fill their vacancies and all workers willing to work to find employment. In other words, the interaction between labor supply and demand determines the number of working hours and remuneration (Kenton, 2023).

An excess supply of labor pushes wages downward, while a labor shortage drives them upward until equilibrium is restored (Mankiw, 2017). However, this equilibrium does not completely eliminate unemployment, as there will always be a portion of the population without a job by choice or because they consider available opportunities inadequate, a phenomenon known as voluntary unemployment (Universidad Nacional de Santiago del Estero, 2022).

Human Capital Theory

Adam Smith and Alfred Marshall laid the foundations of human capital theory by recognizing the acquired human capabilities as a source of wealth and economic progress for a nation (Eide & Showalter, 2020). Centuries later, relevant figures emerged, such as Jacob Mincer, who measured the returns on education; Theodore Schultz, who disseminated the economic value of education; and Gary Becker,

who organized all the existing theoretical and empirical work within a solid framework (Eide & Showalter, 2020).

The modern human capital theory developed by Gary Becker holds that individuals, similar to physical capital, generate a flow of net benefits over time. Education and training allow individuals to obtain better-paid jobs and thus increase the flow of future income (Fernández-Baca, 1996).

According to Farid (2022), human capital formation is "a process through which people's knowledge, skills, and abilities are improved," and it is key to the evolution of the social institutions that every nation aspires to have.

Education and training for a worker are considered an investment decision that will yield a monetary return in the labor market, usually in the form of higher income levels—studies show that the growth rate of income throughout life follows an inverted "U" shape with respect to years of education, along with access to better jobs (Brewer et al., 2020). In this regard, the costs of this investment include daily expenses (such as transportation and internet service), foregone income (those not earned while dedicating time to study), and health-related costs (associated with stress due to exam pressure). Therefore, a higher educational level is associated with a greater likelihood of being employed, better job opportunities, and greater job stability (Brewer et al., 2020).

Eide & Showalter (2020) estimated that the monetary returns for an individual who invests in education with the expectation of future benefits amount to approximately 10% for each additional year of education. Beyond monetary benefits, investment in human capital also leads to a longer life—one additional year of schooling can increase life expectancy by 1.7 years—among other personal values. Likewise, this investment can influence decisions regarding marriage and having children (which reduces labor supply), wage inequality, and divorce rates.

The impact on markets of investing in human capital is estimated through positive externalities, where the gains from education can benefit individuals beyond the original investor, which justifies government participation in promoting inclusive and quality education (Eide & Showalter, 2020).

Deming & Silliman (2024) explain that in an individual's life cycle there is an optimal moment for investment, where investments in human capital are most effective at an early age in order to take advantage of a longer horizon to reap benefits. It has also been evidenced that wages grow rapidly during adulthood, which benefits the job position performed, and for this reason, firms promote this type of investment through periodic training and postgraduate scholarships.

Furthermore, Deming & Silliman (2024) point out that human capital theory is often unidimensional (measured by years of schooling or test scores) and that workers are considered mere productive factors. However, since the 2000s, the monetary returns of soft skills such as extroversion, emotional stability, teamwork, empathy, and others have increased significantly, while the returns from hard skills have either decreased or remained stable (Deming & Silliman, 2024). Nevertheless, the key lies in complementing both types of skills for better job performance.

Investment in education is seen as the acquisition of a "machine" that integrates into the individual and enhances their job performance, with the expectation that future benefits will outweigh the initial cost in time and money. This perspective is crucial for considering the stock of human capital as one more factor of production. In this regard, the production function (of the Cobb-Douglas type) would take on a more modern approach and would be constituted as follows:

$$Y = AK^{\alpha}L^{(1-\alpha)} \tag{1}$$

Donde:

- α it is the participation of capital in production.
- A it is the total productivity of capital and labor.
- K is the stock of capital: physical and human capital .
- L is the number of workers (or hours of work).

Throughout a working life, investment in education generates higher incomes, but over time, human capital depreciates, reducing its impact. In a competitive environment, companies must invest in training and education to optimize labor productivity and organizational sustainability (Wuttaphan, 2017).

Institutionalist Approach

Female labor force participation does not depend only on the educational level; it is also conditioned by the dynamics of labor institutions and the structural characteristics of the labor market (Maurizio, 2018).

Such is the case of family responsibilities that fall disproportionately on women and the consequent distribution of household tasks, which consume many hours of unpaid work (National Institute against Discrimination, Xenophobia and Racism [INADI], 2021). The number of children and access to childcare services are also factors that limit the increase of female paid labor or generate interruptions in their occupational trajectories, such as pauses for the exclusive care of children or sick relatives (Maurizio, 2018).

In relation to the above, INADI (2021) specifies that this unequal distribution of roles within the household is, without a doubt, one of the main obstacles for women's competitive participation in hierarchical positions that require full-time or even extended working hours. Likewise, this distribution is driven by cultural norms that instill in women from an early age the idea of acting for the benefit of others. In this regard, Cerrato & Cifre (2018) argue that women engage more in household chores and are reluctant to fully delegate them due to the belief that this is key to their gender identity and their source of power within the family; whereas husbands, whose gender identity has been shaped by paid employment, would not object to doing fewer household tasks than their wives.

Another relevant characteristic concerns wages, which tend to be lower in female-dominated jobs, thereby widening the gender wage gap, which increases with higher educational levels (Maurizio, 2018). Likewise, there is greater occupational turnover accompanied by higher income instability. This phenomenon, which has a more sociocultural explanation, is often reinforced by employers' decisions: given the evidence of higher turnover rates among women as a group, employers tend to assign them a greater number of precarious jobs (Maurizio, 2018).

In this context, there are relevant public policies that have been implemented—whose strengthening is necessary to consolidate progress in developing countries—from a gender perspective, as outlined below.

- Minimum wage: According to several empirical studies, countries that set higher minimum wages report lower levels of inequality (ILO, 2008). This is especially important in the female labor market, since women are generally overrepresented in wage levels close to the minimum. Thus, the effectiveness of this policy in reducing the gender wage gap depends on the strict enforcement of legislation, which gives significant importance to the respective monitoring mechanisms (Maurizio, 2018).
- Collective bargaining: Although it is a relevant instrument to achieve greater equality of opportunities in the labor market, it does not reach a significant portion of the employed female population, since women are more exposed to informality and to jobs excluded from this policy, such as domestic service and rural work (Maurizio, 2018).
  Nevertheless, several advances have been achieved through this mechanism. Such is the case of guarantees related to pregnancy—it is now prohibited to require a pregnancy test to access a job, employees are allowed to be absent from work to attend prenatal checkups, and pregnant women are forbidden from performing tasks that could affect their health or the baby's development. In contrast, there are other areas in which no progress has been made, or improvements have been very slow; such is the case of work–family reconciliation for both women and men, where measures should aim at greater equality of opportunities (Maurizio, 2018).

- Inspection of working conditions

This measure is of utmost importance for achieving better working conditions and reducing levels of occupational segregation. Sexual harassment—especially in Peru, where it affects 50% of working women—and illegal migration are issues in which women often represent a significant group of those affected. At the same time, these topics are not usually addressed effectively in corporate labor policies (Maurizio, 2018; Solar, 2025).

Therefore, a greater degree of training and awareness is required from labor inspectors, both public and private. It is also essential that the inspection process incorporate new information technologies (such as Artificial Intelligence) and specialized human resources trained to provide appropriate treatment to victims who file complaints.

2. Materials and y Methods

Table 1. *Variable Operationalization Matrix*

Name	Symbol	Measurement	Variable type
Women's labor force participation	pea_i	1 = If the woman participates in the workforce (PEA). 0 = If it does not.	Qualitative nominal
Age	$edad_i$	Whole number in the range of 14 to 64 years.	Discrete quantitative
Marital status	$pareja_i$	1 = If the woman is married, cohabiting, divorced, separated, or widowed. 0 = If the woman has the marital status of single.	Qualitative nominal
Higher education	$esuperior_i$	1 = With higher education, it includes non-university higher education and university higher education (undergraduate and postgraduate). 0 = No higher education, includes those who reached secondary level as their highest level of education plus special education.	Qualitative nominal
Household members	$mieperho_i$	Whole number in the range of 1 to 11 members.	Discrete quantitative
Income recipients	$percep2_i$	1 = Includes households with more than 2 income earners. 0 = Includes households with up to 2 income earners.	Qualitative nominal
Head of household	$jefah_i$	1 = If the woman assumes the headship of the household. 0 = If it does not.	Qualitative nominal
Poverty	$pobre_i$	1 = If the household is poor or extremely poor. 0 = If the household is not poor.	Qualitative nominal
Household income	$ingresohogar_i$	A number that may include decimal places.	Continuous quantitative
Household spending	$gastohogar_i$	A number that may include decimal places.	Continuous quantitative
Asset holdings	$celular_i$, $contv_i$, $coninternet_i$	1 = If the household has the asset in question. 0 = If the household does not have this asset.	Qualitative nominal
Area of residence	$area_i$	1 = If the household resides in the urban area. 0 = If the household resides in the rural area.	Qualitative nominal
Ethnicity	$etnia_i$	1 = If the respondent considers himself to be indigenous (Quechua). 0 = If the respondent considers themselves as non-indigenous (Afro-Peruvian, white, mestizo, and others).	Qualitative nominal
Native language	$castellano_i$	0 = If the respondent learned Quechua as their mother tongue. 1 = If the respondent learned Spanish.	Qualitative nominal
Food aid programs	$progali_i$	1 = Household benefiting from some social program (glass of milk, community dining hall, among others). 0 = Non-beneficiary household.	Qualitative nominal
State economic subsidy	$subvencion_i$	1 = Household receiving some subsidy (rural bonus, universal family bonus, among others). 0 = Non-beneficiary household.	Qualitative nominal

Source: Authors. Note: The variables come from various modules of the survey: 3- Education, 5- Employment and income, 34- Summary and 37- Social programs.

2.1 Population and Sample

According to the technical report of ENAHO 2022, the study population is defined as: "the set of all private dwellings and their resident occupants in the urban and rural areas of the country, excluding members of the armed forces and residents of collective dwellings" (INEI, 2022, p.3). For the sampling frame, information from the Population and Housing Censuses and the updated cartographic material was employed. Likewise, the sample is stratified, probabilistic, and multi-stage, with representativeness at the national level (by urban/rural area and by region), under a 95% confidence level for the sample results.

The unit of analysis of this research is women residing in the department of Áncash who belong to the Economically Active Population (EAP). To delimit the working sample, the national ENAHO 2022 sample (87,661 individual observations) was used as a starting point, and the following inclusion criteria were progressively applied using STATA v.16:

- Department filter: Only observations corresponding to the Áncash region were selected.
- Age filter: The sample was restricted to the working-age population, between 14 and 65 years of age.
- Sex filter: Only female individuals were included.

After this process, the final sample amounted to 1,533 women.

To ensure statistical validity, it is necessary to consider the complex survey design of ENAHO and the use of the sample weight provided in the database, which adjusts the sample so that the inferential results are valid at the population level. By applying this weight, the sample of 1,533 women represents an estimated 399,469 women of working age in the Áncash region for the year 2022.

2.2 Econometric Model

A binary Logit model is proposed, where the dependent variable is qualitative; that is, female labor force participation is a dichotomous decision, taking two values: 1 if the woman is in the labor force and 0 if she is not.

According to Gujarati (2010), the estimation of the Logit model is carried out using the Maximum Likelihood (ML) method, and starts from the following equation:

$$\text{logit}(p) = \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n \tag{2}$$

The Logit model and variable processing were estimated and analyzed using STATA MP version 16 statistical software.

3. Results

3.1 Estimation of the Logit Model

According to the results of Table 2, the following variables are not statistically significant as they exceed the 5% significance level: cellphone (0.511), television (0.485), internet connection (0.079), household poverty (0.140), number of household members (0.430), ethnicity (0.776), and economic subsidy (0.409). In addition, the variable progali (household beneficiary of food assistance programs) did not yield coefficients nor inferential estimates, since no beneficiary households were identified in the sample; therefore, STATA omitted it.

Due to their lack of statistical significance, these variables will be excluded and the model will be re-estimated. In the initial model, the pseudo R^2, which measures the goodness of fit, was 0.1152. On the other hand, the variable household income will be preferred over household expenditure for the analysis.

Table 2. *First estimate of the model*

Number of observations: 1,533
LR chi^2(16): 202.50
Prob > chi^2: 0.0000
Log likelihood: -777.68772
Pseudo R^2: 0.1152

Variable (pea)	Coef.	Standard error	z	P>z	[95% confidence interval]
celular	0.4093114	0.6220406	0.66	0.511	-0.8098658 -1.628489
contv	0.1047032	0.1500972	0.7	0.485	-0.189482 -0.3988884
coninternet	-0.2857843	0.162494	-1.76	0.079	-0.6042667 -0.0326982
edad	0.0137406	0.0061349	2.24	0.025	0.0017164 0.0257649
esuperior	1.002278	0.1663711	6.02	0	0.6761962 1.328359
pareja	0.5295109	0.1753362	3.02	0.003	0.1858582-0.8731636
castellano	-0.477981	0.1975491	-2.42	0.016	-.8651702- .0907919
jefah	1.016479	0.1982651	5.13	0	0.6278871 1.405072
pobre	-0.2786735	0.1888095	-1.48	0.140	-0.6487334 0.0913864
percep2	0.3582727	0.1527551	2.35	0.019	0.0588782 0.6576672
mieperho	0.0395062	0.0500169	-0.79	0.43	-0.1375375-0.0585251
area	-0.7037363	0.1824086	-3.86	0	-1.407473
etnia	-0.0540761	0.1771628	-0.28	0.776	-0.3977088 0.2967566
subvencion	0.1240512	0.1502421	0.83	0.409	-0.1704179 0.4185202
ingresohogar	0.0000112	3.77E-06	2.98	0.003	3.83e-06 -0.0000186
gastohogar	-0.0000147	6.35E-06	-2.32	0.021	-0.00002946
progali	0(omitted)				
cons	0.1612582	0.6805595	0.24	0.813	-1.172614-1.49513

Source: Own elaboration

In Table 3, it can be observed that all independent variables are statistically significant with p–values below 0.05 (see Table 3), except for the variable ingreso–hogar, whose value of 0.059 exceeds the significance threshold.

The Logit2 model shows global significance (Prob > chi² < 0.05) and a pseudo-R² of 0.1073, which is slightly lower than the previous model. According to Hemmert et al. (2016), this value is considered appropriate for samples greater than 200 observations with an unbalanced binary distribution, which is the case here.

It should be noted that a 5% significance level was employed, which is standard in the social sciences, meaning that a 5% margin of error is accepted in statistical inference (Hurtado, 2023; Ventura–León, 2017). This final model will be subjected to diagnostic testing and marginal analysis.

3.2   Model Diagnostic

- ROC Curve
  Figure 1 shows that the area under the curve is equal to 0.7155, a value considered acceptable. This indicates that the model has a reasonable discriminatory capacity to categorize women belonging to the Economically Active Population (EAP) and those who do not.
  According to Table 4, the Variance Inflation Factors (VIF) for each variable at the individual level are low, and the mean VIF is equal to 1.41. According to Ender (2008), in order to determine the presence of a collinearity problem, attention must be paid to high VIF values: individual VIFs should not exceed 10, and the mean VIF should not exceed 6.
  Since the observed VIFs are below these thresholds, it is concluded that there are no multicollinearity problems in the model. Consequently, the regression coefficient estimates are precise and reliable for interpretation.

Table 3. *Second estimate of the logit model (logit2)*

Number of observations: 1533
LR chi^2(8)   =   188.67
Prob > chi^2 =   0.0000
Pseudo R^2 =   0.1073
Log likelihood   =   -784.60212

Variable	coefficient	standard error	z	P> |z|	Lower limit	Upper limit
edad	0.016448	0.005743	2.86	0.004	0.0051919	0.0277041
esuperior	0.9691446	0.1621555	5.98	0.000	0.6513257	1.2869964
pareja	0.4766461	0.1693404	2.81	0.005	0.144745	0.8084572
jefah	1.038533	0.1960771	5.3	0.000	0.654049	1.422657
percep2	0.2986611	0.1313645	2.27	0.023	0.0411941	0.5561308
area	-0.79643	0.165854	-4.8	0.000	-1.121498	-0.471362
castellano	-0.565627	0.1675956	-3.37	0.001	-0.894107	-0.2371452
ingresohogar	3.59E-06	1.90E-06	1.89	0.059	-1.38E-07	7.32E-06
cons	0.3057819	0.216114	1.41	0.157	-0.1177938	0.7293575

Source: Own elaboration

Figure 1. Graph of the area under the ROC curve
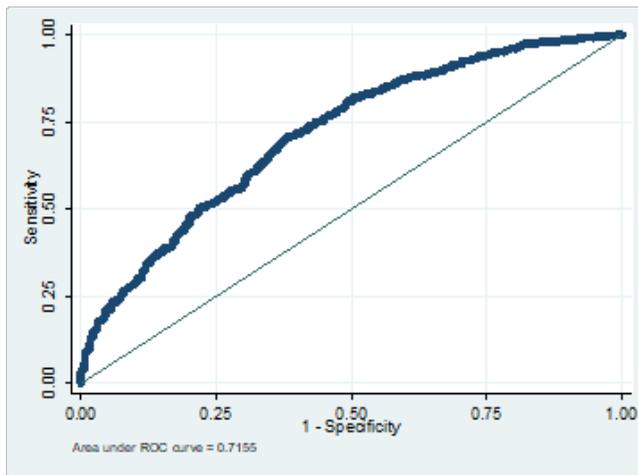
Source: Own elaboration.

3.3   Marginal Effects

The marginal effects represent the change in the probability that a woman residing in Áncash partici-pates in the Economically Active Population (EAP), associated with a unit (or state) change in each independent variable, holding all others constant.

According to Table 5, the model shows positive effects of age, higher education, marital status, household headship, and the number of income earners on the dependent variable, while area of residence and Spanish as mother tongue have negative effects. Each marginal effect is detailed below:

- Age:
  An increase of one year in age raises the probability of labor force participation by 0.3%, holding other variables constant. This effect is small, although statistically significant (P>|z|=0.004).
- Higher education (esuperior):

Table 4. *Diagnosis of the presence of collinearity*

Variable	VIF	SQRT VIF	Tolerance	R squared
pea	1.13	1.06	0.8843	0.1157
edad	1.75	1.32	0.5716	0.4284
esuperior	1.21	1.1	0.8235	0.1765
pareja	1.64	1.28	0.6096	0.3904
jefah	1.22	1.11	0.8171	0.1829
percep2	1.09	1.04	0.9202	0.0798
area	1.65	1.28	0.6062	0.3938
castellano	1.56	1.25	0.6411	0.3589
Average VIF	**1.41**			

Source: Own elaboration

Table 5. *Marginal effects of the Logit model*

Average marginal effects
Number of observations: 1533
Expression: **Prob.(pea), predict()**

variable	dv/dx	Standard error (delta method)	z	P>z	95% level of confidence Lower limit	Upper limit
edad	0.0029587	0.0009564	3.09	0.002	0.0010842	0.0048333
esuperior	0.1766268	0.025397	6.95	0	0.1268496	0.2264039
pareja	0.0780517	0.0282457	2.76	0.006	0.022691	0.1334123
jefah	0.1655859	0.0320276	5.17	0	0.1028129	0.228359
percep2	0.0562556	0.021766	2.58	0.010	0.0135951	0.0989161
area	-0.121666	0.0266258	-4.57	0	-0.1738519	-0.0694806
castellano	-0.093695	0.027999	-3.35	0.001	-0.1485721	-0.0388818

Source: Own elaboration

Women with higher education are 17.7% more likely to participate in the EAP compared to those without higher education. This is one of the strongest effects and highly statistically significant (P>|z|=0.000).

- Marital status (pareja):
  Having a partner (married, cohabiting, divorced, separated, or widowed) increases the probability of labor force participation by 7.8% compared to single women. This effect is statistically significant (P>|z|=0.004).
- Household headship (jefah):
  Women who are household heads are 16.6% more likely to participate in the EAP than those who are not. This is a highly statistically significant effect (P>|z|=0.000).
- Number of income earners (percep2):
  In households with more than two income earners, women's probability of labor force participation increases by 5.6%. This effect is statistically significant (P>|z|=0.010).
- Area of residence (area):
  Residing in urban areas decreases the probability of labor force participation of women in Áncash by 12.2%, compared to rural areas. This effect is highly significant (P>|z|<0.000).
- Native language (castellano):
  Having learned Spanish as a mother tongue reduces the probability of participating in the EAP by 9.4%, compared to those whose mother tongue is Quechua. This effect is statistically significant

(P>|z|=0.001).

4. Discussion

Regarding personal characteristics, having higher education increases the probability of female labor force participation in Áncash by 17.7%, consistent with the findings of Valencia (2021) for the working-age female population in Piura.

Unlike Rodríguez and Muñoz (2018), who found that age and having a partner had a negative effect on the female labor force participation rate, this study found that having a partner increases such probability, while age raises it up to 64 years.

With respect to household characteristics, household size was not significant, in contrast to Xiaoyi et al. (2022). However, the number of income earners was significant, increasing participation by 5.6% when there are more than two earners, consistent with the results obtained by Valencia (2021). In contrast, Cano (2023) argues that the number of income earners in the household is a significant determinant that negatively influences women's labor participation, thus highlighting the diversity of findings depending on the study context.

Household headship had a positive impact, similar to what was reported by Hernández (2011) in Colombia. Variables such as asset ownership, poverty, and household income were not significant.

Residing in urban areas reduces female labor force participation by 12.2% compared to rural areas, a result that differs from Rodríguez and Muñoz (2018), who found that labor participation decreases in rural areas (β = –0.685) due to lower job diversification and lower wages. The difference could be explained by the particular context experienced in 2022, when the national state of emergency due to COVID-19 still restricted mobility, leading many women to move to rural areas to reduce the risk of contagion, thereby altering traditional labor market participation patterns.

Identification with an indigenous ethnic group, compared to mestizo, did not show a significant effect on the variability of the dependent variable. In contrast, having Spanish as the mother tongue did influence the probability of labor participation compared to those women whose mother tongue is Quechua.

These variables lack prior comparative studies that would allow for a contrast of results, as the cultural dimension has been little explored in economic analyses.

Food assistance programs could not be analyzed due to the low presence of observations in the sample, which led STATA to omit them automatically. On the other hand, economic subsidy programs such as Yanapay and Wanuchay did not have a significant impact on female labor force participation in Áncash, 2022.

5. Conclusion

- Various personal, household, and sociodemographic factors that significantly influence women's labor force participation in Áncash in 2022 were identified. The factors are: age, higher education, marital status, household headship, number of income earners, area of residence, and mother tongue. On the other hand, no statistically significant relationship was found between female labor force participation and variables such as asset ownership (cell phone, television, and internet connection), household poverty, household income, total number of household members, ethnicity, and the receipt of economic subsidies.
- The personal factors identified have a positive effect on the probability of women's labor participation; that is, age, higher education, and having a partner increase such probability.
- The household factors identified also have a positive effect on the probability of women's labor participation; that is, being the head of household and having more than two income earners in the household increase such probability.
- The sociodemographic factors identified have a negative effect on the probability of women's labor participation; that is, area of residence and having Spanish as the native language decrease such

probability

Author Contribution

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Conflict of Interest

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