RESEARCH PAPER

Influence of Education on Monetary Poverty in the San Martín, Loreto and Amazonas Regions, 2010-2020

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Abstract

This study examines the influence of education and other socioeconomic factors on monetary poverty in the regions of Amazonas, San Martín, and Loreto between 2010 and 2020. A quantitative, non-experimental, longitudinal, and correlational design was used. A hypothetical-deductive method was used to develop an econometric model of panel data with fixed effects based on secondary information from the National Institute of Statistics and Informatics (INEI) and the National Household Survey (ENAHO). The findings suggest that the illiteracy rate negatively and significantly impacts monetary poverty ($\beta = -0.16$), as does economic growth ($\beta = -6.92$). Conversely, the unemployment rate directly correlates with monetary poverty ($\beta = 0.73$). The model has high explanatory power ($R^2 = 0.968$), validating the importance of these variables in poverty dynamics in these regions. Additionally, monetary poverty has continuously decreased over the last decade, primarily due to economic growth, which accounted for approximately 87% of this reduction; redistributive effects accounted for the remaining 13%.

In summary, the results support the idea that education is fundamental to reducing monetary poverty in the studied regions, underscoring the urgency of strengthening public policies focused on developing human capital as an additional strategy to economic growth.

Keywords: Monetary Poverty, Education, Economic Growth, Unemployment.

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1. Introduction

The lack of financial resources is one of the most enduring and complicated challenges facing developing nations due to its connection to well-being, opportunity, and wealth distribution. Poverty manifests in many ways, including deprivations in health, education, housing, and social participation. However, its monetary evaluation is still widely accepted in economic research because it offers a quantifiable way to analyze households' quality of life based on income or expenditure. Monetary poverty indicates an inability to afford a basic set of goods and services necessary for a dignified life.

Eradicating poverty has been established as a key objective for sustainable development at the global level. The United Nations (UN) describes poverty as "a state of severe deprivation of basic human needs such as food, drinking water, sanitation, health, housing, education, and information" (2015) and considers eliminating it one of the central goals of the 2030 Agenda. Despite achievements in many parts of the world, poverty continues to disproportionately affect groups with structural limitations in areas such as human capital, formal employment, and access to quality public services. This shows that economic growth alone does not ensure permanent improvements in population well-being.

In Latin America, poverty reduction has been closely linked to economic growth cycles, particularly during periods of rising international commodity prices. However, empirical evidence shows that the effectiveness of this growth in reducing poverty depends on the productive structure, labor market, and degree of inequality. The World Bank states, "No effort to reduce poverty will have lasting effects if it is not complemented by a solid economic growth program. However, it is essential to address poverty directly since the benefits of growth are not equitably distributed" (INEI, 2000). This statement emphasizes the importance of complementing economic growth with policies that empower the population, particularly through education.

In Peru, monetary poverty has shown a downward trend in recent decades, mainly due to economic growth driven by the export sector and, in certain areas, by increased agricultural activity. However,

this process has been uneven geographically, with high levels of poverty persisting in less developed regions and difficulties in employment quality and the education system. The regions of San Martín, Loreto, and Amazonas are representative examples of this situation. Although these regions have experienced economic growth, they continue to face significant disparities in areas such as education, human capital, and institutional capacity.

In these regions, poverty reduction has mainly been linked to the vitality of primary activities, such as agriculture and livestock, as well as the favorable evolution of product prices, including rice, corn, bananas, cocoa, and coffee. However, this type of growth has structural limitations because it tends to create low-productivity jobs with high levels of informality and few opportunities for social advancement. In this context, education is crucial because it optimizes employability, increases labor productivity, and raises household incomes in the long term.

Despite education's fundamental role in development, Peru has seen inadequate investment in its education system, deficiencies in budget execution, and weaknesses in public management at the subnational level. Although policies aimed at improving educational facilities, equipment, and teacher training have been implemented, the results in terms of poverty reduction have not clearly manifested. This has sparked a debate about the true impact of education compared to other factors, such as economic growth and employment.

Theoretically, education is considered a vital component of human capital that directly impacts productivity and individual income. However, the link between education and poverty is neither automatic nor linear since it is mediated by labor market behavior, productive structure, and institutional conditions. In contexts where informal or poor-quality jobs predominate, even relatively high levels of education may not translate into significant income improvements, generating phenomena such as underemployment and overeducation. These phenomena limit the impact of education in the fight against poverty.

While empirical research at the international and national levels recognizes an inverse relationship between education and poverty, most studies in Peru focus on national-level or specific-period analyses, leaving a gap in understanding this relationship from regional and long-term perspectives. Specifically, little research examines the combined effects of education, economic growth, and unemployment on monetary poverty using panel data econometric models for particular regions of the country.

Within this framework, the current study aims to investigate the impact of education on monetary poverty in San Martín, Loreto, and Amazonas from 2010 to 2020 while considering the effects of economic growth and unemployment. Using a quantitative approach and econometric panel data models, this study aims to provide empirical data to better understand the factors determining poverty in these regions. This will contribute to developing public policies that boost economic growth and reinforce the development of human capital, which is essential for an effective strategy to reduce poverty sustainably.

2. Theoretical framework

In the field of economics, monetary poverty has been widely analyzed as a phenomenon linked to insufficient income or expenditures to cover essential basic needs. Although poverty is a multidimensional concept encompassing social, educational, and health deprivations, the monetary approach remains prevalent in economic literature due to its ability to measure household well-being through observable indicators. In this context, the National Institute of Statistics and Informatics defines monetary poverty as the difference between each household's per capita expenditure and the cost of a basic consumption basket. This strategy facilitates the objective and comparable identification of poor and non-poor individuals over time.

Conceptually, the United Nations (UN, 2015) states that poverty is "a situation of serious deprivation of basic human needs such as food, drinking water, sanitation, health, housing, education, and information," which highlights the connection between monetary and non-monetary dimensions of well-being. Therefore, while this study employs a monetary approach, it acknowledges the impact of structural factors such as education, employment opportunities, and overall economic status on poverty.

One significant theoretical framework for understanding the relationship between education and poverty is Becker's (1975) theory of human capital. According to this theory, human capital refers to the set of productive skills people acquire through education, experience, and training throughout their lives. According to this theory,

individuals "make investments in education while facing an opportunity cost for being out of the labor market and not receiving immediate income, in the hope that their future salaries will be higher." Within this framework, education is an investment that provides future returns in the form of higher incomes, productivity, and job prospects, thus contributing to the alleviation of poverty.

Human capital theory suggests that a higher level of education increases the likelihood of accessing formal, better-paying jobs, which leads to an increase in per capita income and consumption and decreases the likelihood of households falling into poverty. However, this process is not automatic because it depends on the labor market's ability to incorporate skilled workers and the quality of the education system. As Arias and Sucari (2019) mention, investing in education enhances human capital, favoring growth in capital, output, and consumption per capita and subsequently reducing poverty.

Additionally, Berg (2008) states that education affects poverty through three mechanisms: directly increasing people's incomes, stimulating economic development, and creating broader social benefits, such as improvements in health, decreased birth rates, and greater women's participation in the labor market. These effects consolidate education's role as a fundamental factor in economic and social development.

However, the theory of internal labor markets, formulated by Doeringer and Piore (1971), questions the linear connection between education, productivity, and wages postulated by the neoclassical approach. According to this theory, labor markets are divided into internal and external segments where wages and opportunities for advancement depend on more than just educational level; institutional structures, internal firm rules, and job trajectories also play a role. Therefore, a higher level of education does not automatically ensure access to high-quality jobs, especially in situations of high informality and low demand for specialized work.

From this perspective, education can improve employment prospects, but its impact on wages and poverty depends on structural labor market factors and productive opportunities. As Rahona López (2008) points out, this theory "questions education as a promoter of equal opportunities" by demonstrating that access to quality jobs does not depend solely on educational credentials.

Conversely, economic growth is recognized as a key factor in reducing monetary poverty. According to Iradian (2005), economic growth increases the average income of the population and, under certain conditions, can benefit lower-income groups as well. Tello (2015) mentions different channels through which economic growth reduces poverty, including the "trickle-down effect," job creation, increased wages, strengthened institutions, and increased public spending on social programs.

However, multiple authors warn that economic growth does not always result in permanent reductions in poverty, especially when high levels of inequality are present. Guiga and Ben Rejeb (2012) note that growth can occur without a reduction in poverty, particularly when inequality in access to productive resources and income limits growth's ability to benefit the most disadvantaged sectors. The World Bank (1999) argues that "no effort to reduce poverty will have a lasting effect if it is not accompanied by a coherent program of economic growth," stressing that poverty must be addressed directly due to the unequal distribution of growth's benefits.

Employment and lack thereof are another fundamental aspect of understanding monetary poverty. Economic growth can create jobs, but it does not necessarily guarantee formal or high-quality employment. In economies with high rates of informality, such as in Latin America, informal employment can temporarily lift people out of poverty. However, in the long term, it tends to perpetuate low wages and job insecurity (OECD). In this scenario, unemployment and underemployment limit the positive impact that education and economic growth can have on reducing poverty.

In summary, both theory and empirical evidence demonstrate that monetary poverty stems from the intricate relationship between education, economic growth, and labor market conditions. Education is a key element in developing human capital and improving income, though its impact varies based on the economic and institutional context. Therefore, analyzing these variables together is essential to understanding the factors that determine monetary poverty in different regions.

Within this theoretical framework, this study hypothesizes that education negatively affects monetary poverty, economic growth reduces it, and unemployment increases it. This allows us to empirically analyze these interrelationships in the

San Martín, Loreto, and Amazonas regions from 2010 to 2020.

3. Objectives

3.1 General objective

To analyze the influence of education on monetary poverty in the regions of San Martín, Loreto, and Amazonas, 2010-2020.

3.2 Specific objectives

- To describe the situation of education in the regions of San Martín, Loreto and Amazonas 2010-2020.
- To describe the behavior of monetary poverty in the regions of San Martín, Loreto and Amazonas, 2010-2020.
- To determine the influence of the relationship between education and monetary poverty in the regions of San Martín, Loreto, and Amazonas, 2010-2020.

4. Methodology

This study employs a quantitative approach focused on empirically evaluating the impact of education on monetary poverty in the San Martín, Loreto, and Amazonas regions from 2010 to 2020. The study is based on a non-experimental, longitudinal, and correlational design because it examines data collected over time without intentional alterations to the variables to discover relevant connections between explanatory factors and monetary poverty.

The longitudinal component of the study allows us to observe the development of monetary poverty and its main determinants over time. The correlational approach attempts to determine the direction and magnitude of the relationship between education, economic growth, unemployment, and monetary poverty. The hypothetical-deductive method is used to test the hypothesis. This method is based on previous theories to formulate hypotheses that are then tested with empirical evidence.

4.1 Data source and unit of analysis

The research is based on secondary information from official sources, specifically from the National Institute of Statistics and Informatics (INEI) and the National Household Survey (ENAHO). These databases provide time series that are consistent and comparable at the regional level, which ensures the reliability and validity of the findings obtained.

The unit of analysis covers the regions of San Martín, Loreto and Amazonas, which are observed annually in the period from 2010 to 2020. Therefore, the population and sample are equivalent, as the totality of the available observations for the relevant variables in that time interval are examined.

4.2 Defining Variables

The dependent variable in this study is monetary poverty, quantified by the monetary poverty rate, which is defined as the percentage of the population whose per capita expenditure is below the threshold of the basic consumption basket.

The independent variables considered are:

- Education, assessed through the illiteracy rate, used as an indicator of the educational level of the population.
- Economic growth, estimated by the Gross Domestic Product (GDP) per capita at constant prices.
- Unemployment, quantified through the unemployment rate at the regional level.

These variables were chosen based on a review of the theoretical and empirical literature, which identifies education, economic growth, and the labor market as important determinants of monetary poverty.

4.3 Econometric strategy

To investigate the relationship between the variables of the study, an econometric model of panel data is constructed, which allows capturing both the temporal variability and the structural differences between the various regions analyzed. This approach is particularly suitable when working with diverse territorial units, as it adjusts for unobservable effects that are specific to each region, which could distort estimates.

The panel model incorporates fixed effects for each region to control for unobservable characteristics that remain constant over time, such as geographical, cultural, and institutional factors, which can affect monetary poverty levels. The general formulation of the model is expressed as follows:

$$\text{Pobreza}_{it} = \beta_0 + \beta_1 \text{Educación}_{it} + \beta_2 \text{De}$$

where μi represents the region-specific effects and εit the random error term. The estimation of the model was performed using the Generalized Least Squares (EGLS) method, incorporating corrections for possible problems of heteroskedasticity and contemporaneous correlation between the crossed sections.

4.4 Model Validation

To ensure the robustness of the findings, diagnostic statistical tests were implemented in order to verify the assumptions of the econometric model. In particular, tests were carried out on normality in the residues, as well as heteroskedasticity and autocorrelation, the results of which validated the econometric specification used. Additionally, the explanatory power of the model was examined through the adjusted coefficient of determination, showing a significant degree of adjustment between the explanatory variables and monetary poverty.

4.5 Ethical considerations

The research was carried out in accordance with the current academic regulations of the National University of Trujillo. Since only secondary information of an open and aggregated nature was used, it was not necessary to obtain informed consent and there were no ethical risks for individuals or institutions. The responsible handling of the information and the appropriate reference to the official sources used were always ensured.

5. Results

5.1 Information procedure

This section covers both the descriptive analysis and the econometric analysis of the research, according to the methodological strategy outlined. The descriptive analysis includes the study of the behavior of determinants of monetary poverty, throughout the study period, while econometric analysis includes the study of the magnitude of the estimated parameters of the main determining factors.

5.2 Analysis of the results

5.2.1 Analysis of the monetary poverty variable, 2010 -2020

Rodríguez's (2021) report for the economic and social research consortium (CIES) indicates that one of the factors that has led to a lower decrease in poverty this year has been the growth in prices. This has been manifested in the fact that the basic consumption basket has become 5.2% more expensive in 2021. It should be remembered that poverty is calculated by comparing the values of per capita expenditure and the lines, both at current prices. The current value of expenditure each year is the observed (calculated) value in the year of the survey, while the value of the line in that year is the updated value considering inflation (using the weights of the reference population).

This means that not all the increase in nominal spending implies greater household wealth, since more money is needed to buy the same basket now. When one compares the incidences of poverty of, for example, this year 2021 with that of 2020, this variation already includes the loss of purchasing power of households (since the value of the basket is already indexed to inflation).

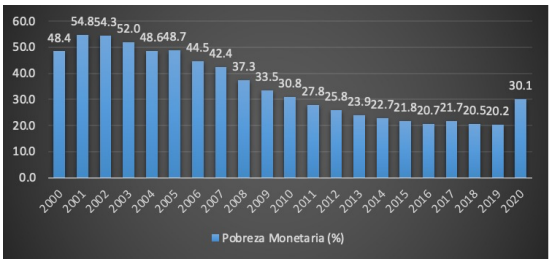

Figure 1: Total monetary poverty (%)
Source: INEI Statistics
https://www.inei.gob.pe/estadisticas/indice-tematico/sociales/

In 2020, 30.1% of the country's population were in a situation of poverty, that is, they had a level of expenditure lower than the cost of the basic consumption basket composed of food and non-food. When comparing these results with the level obtained in 2007-2020, poverty decreased by 12.3 percentage points, from 42.4% to 30.1% in 2020. Which can be seen in the graph that in the last year monetary poverty has increased by 9.9 p.p.

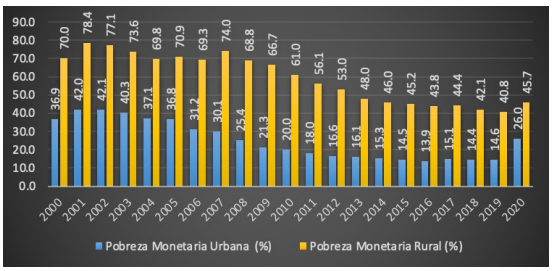

Figure 2: Urban and Rural Monetary Poverty (%)
Source: INEI Statistics
https://www.inei.gob.pe/estadisticas/indice-tematico/sociales/

Poverty levels in relation to population and by region

According to the Technical Report on Monetary Poverty 2007-2016 by the INEI, the reduction in 2016 was 1.1 percentage points compared to 2015. This means that approximately 264 thousand people transitioned from poverty to vulnerability. The report also mentions that the greater the gaps and severity of poverty, the more difficult it is to reduce poverty through neutral economic growth with respect to the poor. Inequality and poverty are linked.

Evidence indicates that extreme poverty decreased from 4.1% to 3.8%; that is, 70 thousand people left this condition. Clearly, as poverty decreases, the amount of marginal progress decreases. However, rural areas have higher percentages of poverty and extreme poverty: 48.5% and 80.8%, respectively.

Evidently, the incidence of monetary poverty increased in both rural and urban areas in 2020, but poverty increased more in urban areas due to the nature of the economic shock during the pandemic. The agricultural sector continued operating even under the strictest confinement measures while the service and commerce sectors, which are the main employers in cities, faced greater restrictions. The pandemic of 2020 brought a significant setback to the well-being of households in both urban and rural areas, returning it to a level not seen since 2010.

According to reports from the Central Reserve Bank of Peru (BCRP), by the end of 2020, the percentage of households with annualized expenditures below the poverty line was between 22.4 and 26.2 percent at a 95 percent confidence level. In other words, poverty in the fourth quarter of 2020 was substantially lower than the annual average, due to the strong—albeit partial—economic recovery and the delivery of monetary bonds to households. Monetary support was substantially extended to households in the third and fourth quarters with the extension of the Universal Family Bonus and a second payment to households that had received previous bonuses through the Universal Bonus, which began being deposited in October.

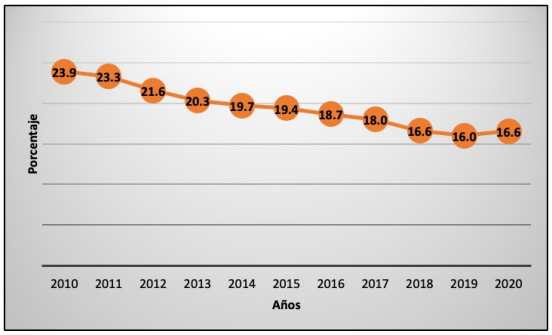

Figure 3: Population with at least one unmet basic need, 2010 – 2020 (Percentage of total population)

Source: INEI-2022 Statistics https://www.inei.gob.pe/estadisticas/indice-tematico/sociales/

As of 2020, 16.6% of the total population is considered poor. But examining by region, a greater disparity can be seen in Peru.

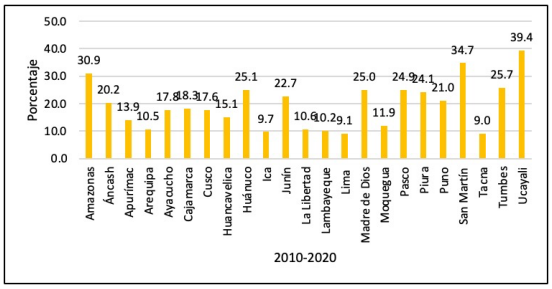

Figure 4: Population with at least one unmet basic need, by region, 2010 – 2020 (Percentage of total population)

Source: INEI-2022 Statistics https://www.inei.gob.pe/estadisticas/indice-tematico/sociales/

Figure 4 shows the percentage of poverty by region in 2020. It can be seen that Ucayali, Amazonas and San Martín have a poverty percentage of more than 30%. On the other hand, Arequipa, Lambayeque Lima, Ica and Tacna have poverty percentages of less than 12%.

5.2.2 Factors of monetary poverty

Public expenditure

Expenditure is considered as an indicator of well-being to measure monetary poverty, where the value of the total minimum basket (food and non-food) was valued for the year 2020 at S/.360 soles per month per person, which is equivalent to S/.1,440 soles for an average family of four, considering as poor those people who have a monthly expenditure of less than S/. 360 soles mentioned above.

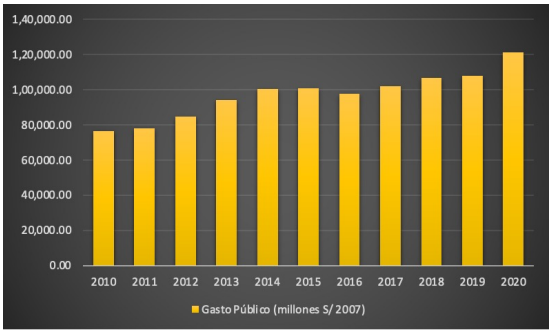

Figure 5: Public Expenditure (million S/)
Source: Central Reserve Bank of Peru (BCRP)-2022
https://estadisticas.bcrp.gob.pe/estadisticas/series/anuales/gastos

Education

The relationship between poverty and education can be considered from two perspectives. First, the lower classes and their low income reflect the disadvantage of accumulating a greater number of risk factors, such as low education, poor employability, among others. And, secondly, they introduce distortions in the dynamics of the household and its economy. The lack of resources together with a traditional distribution of gender roles (which disadvantage women) causes negative balances. To this end, in this study, the literacy rate is used as an indicator of education.

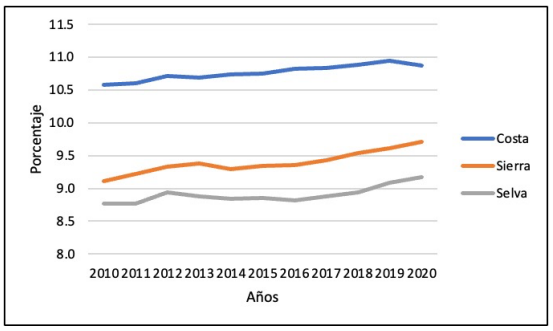

Figure 6: Literacy rate of the population aged 15 and over, by (Percentage of total working-age population)
Source: INEI-2022 Statistics
https://www.inei.gob.pe/estadisticas/indice-tematico/sociales/

The figure indicates that there are higher levels of literacy on the coast, which was to be expected. The figure shows that literacy levels have improved in the highlands, in 2010 the rate was 9.1% and by 2020 it is 9.7%. On average, over the last 11 years the illiteracy rate by region has increased by 0.3% for the coast and 0.4% for the jungle.

Economic growth

In 2021, according to ENAHO, there is evidence of a reduction in poverty by -4.3 percentage points. Decomposing this reduction, it estimates that the effect of growth has been -3.7 points and the distributional effect was -0.6 points. In relative terms, we can say that "pure" growth has contributed 87% to poverty reduction while redistribution explains the remaining 13%.
Between 2019 and 2021, poverty increased by 5.7 points. 114% corresponds to the growth effect and -0.8% to redistribution. During the period of strong growth (2006-2011), poverty was reduced by 21.3 points. The redistribution effect was 23% and the remaining 73% corresponded to growth.

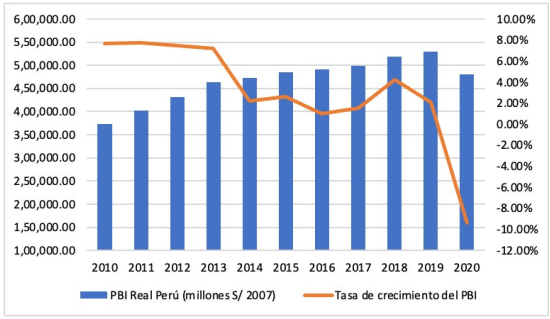

Figure 7: Peru's economic growth 2010-2020
Source: INEI-2022 Statistics
https://www.inei.gob.pe/estadisticas/indice-tematico/economia/

The contraction in expenditure during the period of strict confinement showed a generalized fall throughout all strata of households, while in the partial recovery of the last year 2021 it has been achieved with little redistribution. This is due to multiple factors that have not yet been elucidated: little growth in sectors oriented towards the domestic market, not yet a total recovery of employment, an increase in inadequate employment, with informality, and lower incomes.

5.3 Panel Model Econometric Estimation

In this research, an econometric panel data model was considered to determine how public spending, unemployment, education, and economic growth influence monetary poverty in the regions of San Martín, Loreto, and Amazonas, 2010-2020.

Panel econometric model:

$$Pobreza_{it} = \mathrm{B}_0 + \mathrm{B}_1 Edu_{it} + \mathrm{B}_2 Des_{it} + \mathrm{B}_3 \log\left(PBIpc_{it}\right) + \mu_{it}$$

Where:

$Pobreza_t =$ Variable quantified through the indicator of unsatisfied basic needs, monetary poverty rate.

$Gpsspc_t$= Public sector expenditure on Social Services. At constant 2007 prices.

$PBI_t =$ Variable quantified through GDP per capita. At constant 2007 prices.

$Edu_t =$ Variable quantified through the literacy rate.

$Des_t =$ Variable quantified through the unemployment rate.

μ_{it} = Error Term

$i: Región \quad t: Tiempo$

5.3.1 Econometric estimation

Dependent Variable: POVERTY
Method: EGLS Panel (Cross-section weights)
Date: 03/31/25 Time: 13:57
Sample (adjusted): 2011 2020
Periods included: 10
Cross-sections included: 3
Total panel (unbalanced) observations: 25
Linear estimation after one-step weighting matrix
White period standard errors & covariance (no d.f. correction)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	105.978382	32.31752	3.279252	0.0042
EDU	-0.16969887	0.044273	-3.831773	0.0012
UNEMPLOYMENT	0.73603066	0.060977	12.07277	0.0000
LOG(CRECI)	-6.92993001	2.393353	-2.895553	0.0096
POVERTY(-1)	0.89680683	0.022956	39.02056	0.0000

Effects Specification
Cross-section fixed (dummy variables)

Weighted Statistics			
R-squared	0.976197	Mean dependent var	55.17054
Adjusted R-squared	0.968262	S.D. dependent var	30.41843
S.E. of regression	1.904585	Sum squared resid	65.29400
F-statistic	123.0333	Durbin-Watson stat	2.269871
Prob(F-statistic)	0.000000		

Table 1. Regression of the Panel Model with Individual Fixed Effects

The panel econometric estimation with fixed effects. It shows the inverse relationship between education and economic growth on monetary poverty, while a direct relationship with unemployment is evidenced in the regions studied. There is evidence of statistical significance of the variables education and unemployment at 95% confidence.

According to the theoretical framework and the empirical studies reviewed, the hypothesis is being fulfilled: Education has an inverse impact (B_1= -0.16), economic growth inversely (B_3= -6.92) and unemployment directly (B_2= 0.73); have a significant incidence (R2=0.96.8) on monetary poverty in the regions analyzed.

Estimated equation:
==========
POVERTY = C(1) + C(2)*EDU1 + C(3)*UNEMPLOYMENT + C(4)*LOG(CRECI) + C(5)*POVERTY(-1) + [CX=F,ESTSMPL="2010 2020"]

Coefficients:
==========
POVERTY = 57.1273758074 - 0.387064907452*EDU1 + 0.0653359711322*UNEMPLOYMENT - 1.03951091599*LOG(CRECI) + 0.707669714902*POVERTY(-1) + [CX=F,ESTSMPL="2010 2020"]

Table 2. Economic evaluation of the model
Source: Authors. Results obtained with the Eviews 11.0 program

Holding each variable constant, the coefficients in the equation represent the following:
C(2); Faced with a variation of 1% in the education rate, poverty levels decrease by 0.16% on average.
C(3); In the face of a 1% variation in the unemployment rate, poverty levels would increase by 0.73% on average.
C(4); Faced with a 1% variation in the economic growth rate, poverty levels decrease by 6.92% on average.
The interpretations are consistent with economic theory, previous studies, and the results obtained in the previous section, since the higher the levels of public spending aimed at solving social problems, the lower the levels of monetary poverty.

Individual fixed effects of regions
The following table represents the quantitative estimation of the coefficients of the individual fixed effects by region, which shows the heterogeneous and unobservable characteristics (coast, mountains, jungle, lifestyle and idiosyncrasies), therefore, the marked difference that exists between the regions and how they affect the levels of monetary poverty is demonstrated.

No	Region	Effect
1	Amazon	-1.435298
2	San Martín	0.267917
3	Loreto	0.960696

Table 3. Estimating Individual Fixed Effects by Region

The fixed-effect panel model evidences some of the heterogeneous characteristics of each region and this determines the positive or negative incidence that should exist between the study variables.

5.3.2 Validation of the nonlinear econometric model
Normality test: To determine if the residuals of the estimated model are statistically distributed normally, under the following hypotheses:
H0: The residuals of the model are distributed in a normal way
H1: Model residuals are not distributed in a normal manner

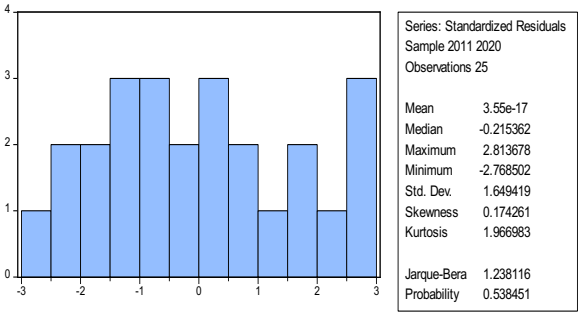

Figure 8: Normality test results
Source: Authors. Results obtained with the Eviews 11.0 program

When reviewing the null hypothesis, statistically it is corroborated that there is a normal distribution of the residues. With a Jarque – Bera (J-B) = 1.23 < 5.99, and a probability of 53.84% > 5%. The interpretation of the test indicates that the hypothesis null at 54% confidence is not rejected.

Heteroskedasticity test:
To determine whether the residuals of the model are statistically homoscedastic, the following hypotheses are considered:
H0: The model residuals are homoscedastic
H1: The model residuals are heteroscedastic

Test for Equality of Variances of RESID Categorized by values of RESID Date: 03/31/25 Time: 14:08 Sample (adjusted): 2011 2020 Included observations: 25 after adjustments			
Method	Mexico City	Value	Probability
Brown-Forsythe	(4, 20)	1.009779	0.4259

Table 5: Heteroskedasticity test result

With the test shown in the table above, the residual equality of variances in the different crossed sections of the model (p-value greater than 0.05) is not rejected. There is no heteroskedasticity in the panel model residuals. Brown's method was used.

Autocorrelation Test
To test whether or not there is autocorrelation in the model, the test is used for the different crossed sections of the panel and contrasted with the

residuals of the model under the following hypotheses:

H0: The explanatory variables considered do not correlate with the model residuals
Ha: The explanatory variables considered correlate with the model residuals

Residual Cross-Section Dependence Test			
Null hypothesis: No cross-section dependence (correlation) in weighted residuals			
Equation: Untitled			
Periods included: 10			
Cross-sections included: 3			
Total panel (unbalanced) observations: 25			
Test employs centered correlations computed from pairwise samples			
Test	Statistic	D.F.	Prob.
Breusch-Pagan LM	1.740819	3	0.6279
Pesaran scaled LM	-0.514059		0.6072
Bias-corrected scaled LM	-0.680725		0.4960
CD Will Weigh	1.087326		0.2769

Table 5: Autocorrelation test results

Therefore, the null hypothesis is not rejected when the p-value is greater than 5%. With the test shown in the table above, it is not rejected that the explanatory variables considered are not correlated with the residuals of the panel model (p-value greater than 5% in all methods). There are no autocorrelation problems in the econometric estimation performed.

5.4 Discussion

With the results evident, the hypothesis is contrasted: Education has an inverse impact (B1 = -0.16), economic growth has an inverse impact (B3 = -6.92), and unemployment has a direct impact (B2 = 0.73). These factors have a significant impact (R2 = 0.968) on monetary poverty in the Amazonas, San Martín, and Loreto regions.

Rodríguez (2020) identifies a constant decrease in poverty, going from an average poverty gap of 11.4% in 2000 to 3.05% in 2017. Uruguay has the lowest poverty rate, with only 0.10% of its population living in poverty. In contrast, Honduras has an average poverty gap of 16.08%, making it the poorest country in Latin America. Additionally, public social spending in Latin American countries has steadily grown, focusing on covering the community's basic needs. Notably, the Latin American countries with the highest percentages of public social expenditure are Chile, Brazil, and Uruguay, averaging 13.28%. In contrast, countries such as Ecuador, Paraguay, and the Dominican Republic average 7.15%, establishing themselves as countries with the lowest public social expenditure.

Hopkins (2017) concludes that higher public spending on irrigation increases net and secondary household income in non-poor districts. However, an increase in spending would have no effect on the net and secondary income of households in poor districts.

Solano (2018) concludes that public spending does not positively impact the quality of life in the studied regions because inefficiency and misallocation of expenditures generate this relationship.

Marcelo (2016) found that poverty increases significantly with backwardness and decreases with increases in public spending and GDP per capita. However, factors such as the decentralization of public spending and changes in government have not been decisive in reducing monetary poverty. In accordance with the reviewed scientific literature, it is concluded that public spending helps reduce monetary poverty and is important because it is a variable the government controls, unlike economic growth or inequality. Additionally, its effect is significant, as an increase of one percentage point in lagging per capita public expenditure is expected to reduce poverty by between -0.18% and -0.28%.

Regarding the theories in this line of research: The discussion of the effect of public spending on poverty reduction is based on the discussion of economic growth and the role of the state in capitalist economies (Zegarra & Minaya, 2008). We consider the macroeconomic models of endogenous growth, which aim to overcome the limitations of the neoclassical growth model based on exogenous technological change and increased production factors in a context of free and perfect markets, to be valid. These models are discussed by Easterly and Levine (2001), Barro (1990), and Barro and Sala-i-Martin (1996). Beyond these macroeconomic models for national economies as a whole, this study uses departmental and empirical studies on the relationship between public spending and poverty. In particular, it uses studies that begin to evaluate the role of the state in growth and poverty reduction. Finally, the present research's

evidence aligns with the aforementioned empirical studies and theories of poverty.

6. Conclusions

This research empirically demonstrates that education is an essential factor in reducing monetary poverty in San Martín, Loreto, and Amazonas from 2010 to 2020. An econometric model of panel data with fixed effects shows that education, as measured by the illiteracy index, has an inverse and significant effect on monetary poverty. These results support the initial hypothesis and reaffirm theories of human capital.

Specifically, the data suggest that a 1% increase in educational attainment is related to an average 0.16% reduction in the poverty rate, all other variables being equal. These results indicate that education not only complements economic growth but also improves job opportunities, productivity, and household incomes in the long term, particularly in regions with structural labor market constraints.

Additionally, economic growth has an inverse and significant effect on monetary poverty, with an estimated coefficient of −6.92. This underscores its strong capacity to reduce poverty in the short and medium term. However, the results also show that poverty reduction has mostly depended on "pure" economic growth, which accounted for approximately 87% of the observed decline. Redistributive effects accounted for only 13%. This pattern suggests that although economic growth is fundamental, its impact could be limited without policies that strengthen human capital and improve employment quality.

Conversely, unemployment is directly and significantly correlated with monetary poverty, with a coefficient of 0.73. This suggests that an increase in the unemployment rate significantly increases poverty levels. This finding underscores the importance of the labor market in linking education, economic growth, and well-being. It also shows that persistent unemployment and informal employment hinder the positive effects of education and growth on poverty reduction.

The estimated model's high explanatory power (adjusted $R^2 = 0.968$) implies that the analyzed variables offer a solid explanation of the monetary poverty dynamics in the studied regions. In turn, including regional fixed effects highlights structural heterogeneities between Amazonas, San Martín, and Loreto linked to geographical, productive, and institutional factors that affect the impact of education and economic growth on poverty.

From a theoretical standpoint, the analysis's results are consistent with human capital theory, showing that education plays a significant role in alleviating poverty; however, its impact depends on the labor market situation and the region's economic structure. At the same time, the findings are related to the theory of internal labor markets, showing that education alone does not automatically improve quality of life without sufficient job opportunities.

Overall, the collected empirical information allows us to conclude that the sustainable eradication of poverty in San Martín, Loreto, and Amazonas requires a comprehensive plan combining economic growth, educational system strengthening, and active employment policies. In this context, education emerges as a vital instrument for breaking intergenerational cycles of poverty and fostering fairer and more sustainable regional development.

7. Recommendations

The following policy measures and guidelines are recommended for public authorities in education and employment promotion, higher education institutions, companies, and other entities aligned with economic growth and decent, productive work. These measures include strengthening institutions to improve the quality of human capital and higher education, reinforcing family awareness of vocational guidance, and strengthening occupational guidance measures on web portals and employment centers.

The findings indicate that improving education levels considerably reduces poverty in Peru's regions over the last ten years. Regional and local governments must constantly monitor and estimate this impact. In order to develop long-term structural policies by redistributing resources in sectors that show greater levels of social inequality in priority functions, it is recommended to consider the behavior of education and unemployment. Otherwise, inefficiency in the allocation of resources would have little or no impact on poverty reduction.

It is recommended that subsequent studies include microdata from the region, especially from surrounding areas, considering variables such as expenses, culture, crime, migration, health, and others. The aim is to make the analysis of poverty more rigorous to develop national, regional, and

local public policies to reduce poverty more effectively in our country.

To future researchers, it is recommended that, in promoting future studies related to this subject and other poverty-related phenomena, they mention that, in addition to identifying determining factors, they should include measurements of the impact of these phenomena on well-being. This was not considered in the present investigation."

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