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Article

Social Programs and Socioeconomic Variables: Their Impact on Peruvian Regional Poverty (2013–2022)

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Abstract: The aim of this research is to establish the extent to which social programs and socioeconomic variables have been influencing poverty in the 24 Peru regions (2013–2022). The study is quantitative, non-experimental, and correlational. We use secondary data obtained from official sources such as the National Institute of Statistics and Informatics, Ministry of Economy and Finance, as well as the Peruvian Institute of Economics. For estimations, we use the Generalized Method of Moments System and dynamic panel data. The results indicate that Juntos, Pensión 65, Qali Warma, and Trabaja Perú social programs, with *p*-values of 0.383, 0.715, 0.681, and 0.870, respectively, have not had favorable impacts on reducing poverty. On the contrary, negative coefficients for human capital and physical infrastructure mean that improving them will reduce poverty at the regional level. A year more in schooling for the population aged over 15 years reduces poverty between 1.7% and 1.2%. Increasing 10% of the proportion of national roads in paved condition reduces poverty levels between 1.9% and 2.4%.



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Keywords: social programs; infrastructure; paved roads; human capital; poverty; economic and social development; dynamic panel data

1. Introduction

Since the implementation of social programs, they have been controversial, epitomized by the famous phrase “giving fish or teaching to fish”. Generally, social programs are accused of perpetuating the vicious cycle of poverty among vast sectors of the population instead of promoting entrepreneurship and stimulating individual initiative and personal development. Conversely, other perspectives argue that these programs do not perpetuate the poverty cycle; they serve as temporary protection mechanisms for the less privileged social sectors, against the highest income inequalities generated by imperfectly competitive markets. In recent decades, social programs have become the main instruments of public policy to fight against poverty and extreme poverty worldwide. This is evident in the “2000 Millennium Goals”, endorsed by 189 nations under the United Nations (UN) “The Member States of the UN commit to reducing extreme poverty manifestations: hunger, disease, gender inequality, lack of education, and access to basic infrastructure” (UN 2022a, para. 1). Similarly, in 2015, all UN member states approved the 2030 Agenda for Sustainable Development Goals (SDGs), calling for “universal action to end poverty, protect the planet, and improve the lives and prospects of people everywhere” (UN 2022b, para. 1).

In this context, the Peruvian government, since the early 1990s, has been strengthening and expanding social programs, creating more than thirty to address social inequities. Currently, the Ministry of Economy and Finance (MEF 2022) divides social programs into those by their nature, such as the Universal Program and the Targeted Program; it also classifies them by their geographic location, as they are applied at the national or

district level. Finally, they are separated by their benefits, i.e., whether they are individual or collective.

According to the National Institute of Statistics and Information (INEI 2022a, 2022b), between 2011 and 2021, the budget executed by the General Government for programs to reduce poverty, extreme poverty, and social inclusion programs steadily increased. While in 2011, the total amount allocated to these programs was S/ 7655 million, in 2021, this amount had increased to S/ 17,126 million, representing an increase of more than 123.7% in just a decade. However, overall, social programs accounted for 8% of the total national budget for 2021.

In this sense, our general problem of research is to what extent have social programs and socioeconomic variables influenced the evolution of regional poverty levels in Peru (2013–2022)? Our objective is to determine how these programs and variables have influenced the evolution of regional poverty. Finally, the general hypothesis is as follows: Social programs have positively influenced the evolution of regional poverty. These issues have not been studied profoundly. Most of the time, governments wrongly believed that increasing social programs would reduce poverty.

This research is structured as follows. In the next section, we review some authors' literature who have worked on these poverty-related topics and split it into three subsections. In the Section 3, the methodology of this working paper and the theoretical framework are developed for applying the econometric model, also we assess the data for our empirical analysis. In the Section 4, we evaluate the explanatory variables behavior on poverty and contrast the main statistical results under econometric GMMS models. In the following section, we discuss our econometric results compared with other research results. Finally, this working paper includes conclusions, recommendations to reduce poverty rates, and, naturally, some limits in our research.

2. Literature Review

2.1. Social Programs

Quispe Quispe (2017) assessed the impact of social programs on reducing monetary and extreme monetary poverty (2009–2015). Durand Gonzales (2021), using a quantitative methodology, analyzes the impact of social programs on child malnutrition in Peru. Public spending on social programs is significantly related to chronic child malnutrition, as 1% budget increases for social programs reduced the malnutrition rate by 0.07% during the study period. Rahmer et al. (2022) analyzed the causal relationships between cash transfers and poverty in Cartagena de Indias using Bayesian autoregressive vectors, concluding that the effects of family subsidies on monetary income are almost null.

Regarding the analysis of four social programs. The National Program of Direct Support to the Poorest (JUNTOS) implemented by 2005, is a conditional cash transfer program aimed at reducing poverty in the country by stimulating the demand for health and education services, offering 200 soles every two months for both rural and urban populations (MIDIS 2022). Maco (2022) highlights discrepancies within the Ministry of Development and Social Inclusion (MIDIS). Most experts believed that social policy could not solve rural poverty, suggesting that this program's deficiencies affect the target population in rural areas.

Pensión 65 provides S/ 250 bi-monthly monetary transfer to individuals aged 65 and over who are in extreme poverty due to high levels of labor informality, with non-contributory pension programs aiming to address the survival issues of individuals who could not generate a pension fund due to remaining in informality. Orco Díaz et al. (2020), citing studies commissioned by the MEF about the Pensión 65 effects, argued that their impacts were positive on several levels, such as the fact that 4% of older adults stopped working after being admitted to this program. Additionally, households with at least one program beneficiary increased their consumption by 40%, and the level of psychological depression among the target population decreased by 9%. Orco for Peruvian case reveals that being a beneficiary of this program increases the likelihood of not being poor by 0.10597

compared to those who are not beneficiaries of the program. Also, living in urban areas reduces the probability of being poor by 0.19433 compared to those living in rural areas. [Rivera Medrano \(2023\)](#), a microeconomic study, researches the impact of the Pensión 65 on the well-being of users in Chupaca (Junín), finding a non-direct correlation between the effectiveness of this program and the quality of life. This suggests that the program had neither positive nor negative impacts, meaning it did not alter the quality of population life.

The Qali Warma was implemented by MIDIS since 2012, replacing the National Food Assistance Program (PRONAA), aimed at providing daily food to children in all public schools. This program receives the largest budget from the National Treasury in 2021, about S/ 1777 million. It has the particularity of operating under a “co-management” pattern; it involves the participation of the beneficiary population, such as parents, who are directly engaged in the management of the program that benefits their children. [Francke and Acosta \(2021\)](#) revealed no impacts of this program on reducing anemia and chronic child malnutrition, children received much more iron and protein content at home than in schools. Citing [Lavado and Barrón \(2019\)](#), they found that Qali Warma contributed only 16.7% to their iron intake and that 93% of beneficiaries received an iron intake lower than expected. [Ayala Beas \(2022\)](#) stated that the school feeding received by children through this program has no significant effect on improving learning in reading comprehension or mathematics. The author questions the effectiveness and efficiency of this program for children’s learning.

Trabaja Perú (Lurawi Perú) was implemented in 2011, with the aim of addressing employment issues by creating temporary inclusive social employment for underemployed and unemployed people, both in rural and urban areas, poverty, and extreme poverty areas. This program received S/ 74 million in 2021 and S/ 390 million in 2020. Considering that the Peruvian problem is not so much unemployment as underemployment, precarious employment affected almost 80% of the EAP. [Briceño Avalos \(2017\)](#) indicates that during the period 2009–2014, the product–employment elasticity fluctuated only between 0.211 and 0.263, reflecting the high informality in the labor market. [Tumi \(2015\)](#), at a macro-evaluation of this program, reveals that this program contributed significantly and increasingly to the creation and promotion of employment for the target population in rural and urban areas, having generated, according to the author, in the period 2011–2014, 122,148 jobs with a total of 2700 projects, including river defenses, roads, sanitation, and irrigation infrastructure, with a total investment of approximately S/ 364 million, most of the beneficiaries were women.

[Chung Vergara \(2022\)](#) at the micro level argues for San Juan Bautista (Loreto), there is a positive relationship between Trabaja Perú and the quality of population life, finding a coefficient of 0.744 with a (bilateral) significance of 0.000 *p*-value. In turn, it coincides with [Martínez \(2018\)](#), for the case of Amarilis (Huánuco), in which the author finds a 0.966 correlation and a zero *p*-value. This means that there is a favorable relationship between the Trabaja Perú and the quality of life. All of which confirms that this program has been favorable to fight against underemployment and unemployment at the macro and micro levels. On the other hand, when analyzing the first variable, namely unemployment and its relationship with poverty, the link between both has been a central concern in the field of economics, so this study aims to explain the dynamics between unemployment and poverty, or the lack of it.

2.2. Socioeconomic Variables

According to [Karnani \(2009\)](#), generating stable employment opportunities with reasonable wages is the best way to lift people out of poverty. This requires two major efforts: creating jobs and increasing employability. [Sánchez Torres \(2020\)](#), the relationship between poverty and the labor market in developing countries is closer when analyzing low labor incomes and the quality of employment. For Colombia, this author distinguishes that poverty is mainly associated with informal jobs; labor formalization policy would have significant effects on improving incomes and reducing poverty. Specifically, formalizing

workers would reduce the number of poor people about 40%. Therefore, improving labor market conditions (reducing informality) would have a significant effect on reducing poverty and would also contribute to better income redistribution. Finally, [Castillo and Huarancca \(2023\)](#) built a multidimensional poverty indicator to assess the Peruvian poverty trajectory (2007–2020) and indicate that eliminating precarious employment could decrease the incidence of multidimensional poverty by 10.4%.

Regarding human capital, its investment and development are also essential for poverty reduction because they enhance economic growth through their effect on total factor productivity, in addition to having positive effects on creating equal opportunities for citizens. Human capital is the skills and knowledge acquired by which people improve their economic productivity, includes not only formal education but also on-the-job training, work experience, self-learning, and any other type of investment that improve a person's ability to perform their job ([Becker 1975](#)). These investments are rationally taken by evaluating the cost–benefit relationship, so future gains obtained through higher wages and greater employment opportunities are weighed. Investment in human capital takes significant importance; it guarantees a real and significant reduction in poverty; therefore, it becomes a primary objective for developed and developing economies. In this sense, [Mincer \(1991\)](#) maintains that higher education has positive effects on maintaining people's incomes while simultaneously reducing unemployment risk.

[Olopade et al. \(2019\)](#) in a study for the 12 OPEC countries, where theoretically the resource curse hypothesis could be an obstacle to economic growth and have implications for poverty, determine that there is a positive interaction between human capital and poverty reduction. They recommend that investment should be made in improving the quality of human capital through education and health. In this regard, according to the same author, OPEC members that allocated significant percentages for education have achieved a reduction in the poverty rate (1.47%).

Regarding infrastructure, it is a main channel for agricultural, industrial, commercial, and service production, as infrastructure supports the development of the country's economic activities. Efficient public infrastructure boosts competitiveness in local and regional markets and, therefore, the national market, thereby promoting productivity and competitiveness. In this way, [Rozas and Sánchez \(2004\)](#) state that: "Transport networks (...) constitute a central integration element of the economic and territorial system, making transactions possible within a specific geographic/economic space, and with the outside" (p. 8). Therefore, these authors highlight the favorable relationship between infrastructure and poverty reduction, as the results show that at the regional (Latin American) level there is a negative relationship (-0.023071). Thus, investments in infrastructure improve the population's access to markets and enable coverage of services such as education, health, housing, transport, employment, etc. Currently, there is a significant gap in infrastructure. "Closing the infrastructure gap for the period 2016–2025 would imply an average annual investment of 8.27% of GDP (i.e., USD 15,955 million annually)" ([Bonifaz et al. 2015](#)).

2.3. The Peruvian Regional Poverty

[Ariza and Retajac \(2020\)](#) point out that poverty is a socioeconomic situation where there is vulnerability and a lack of necessary resources for subsistence, such as food, health, education, relationships, and productivity. Therefore, [Borga and D'Ambrosio \(2021\)](#) specify that in the face of the existence of chronic poverty and underemployment, it is necessary to implement public work programs with adequate remuneration and duration that would make it possible to accumulate economic capital. For this reason, regarding public expenditure, [Hlasny et al. \(2022\)](#) indicate that its amount and efficacy are important for achieving a reduction in inequality as part of the Sustainable Development Goals (SDGs). Therefore, poverty reduction requires effective management of public resources allocated to social programs that demonstrate their significant contribution to improving the well-being of the most vulnerable population segments in the short, medium, and long terms.

Poverty affects most of the world's population, experiencing a decline over the last 25 years. However, starting with the COVID-19 pandemic, the decreasing trend was interrupted ([Banco Mundial 2022](#)). Similarly, the behavior of the poverty rate in Peru has followed the same trend, with better results compared to other countries; since poverty in general as a percentage of the total population in 2001 rose to 54.8% ([INEI 2023](#)), it stood at 20.2% in 2019, rising again in 2022 to 27.5% due to COVID-19. It is important to highlight that the decreases in the poverty rate have taken place, thanks to the good performance of the country's macroeconomic variables, particularly highlighting the economic growth that began in 2002, until before the pandemic. "Countries that managed to reduce their poverty did so by increasing the average income associated with economic growth. Therefore, the decrease in the regional poverty rate occurred in the context of widespread economic growth" ([León Mendoza 2019](#), p. 4).

[Chapa et al. \(2022\)](#), in their studies on the impact of social programs on poverty levels, have developed a social matrix for Mexico in 2008, which is square and presents income and expenses, divided by economic sector, production factor, and institution. They work on a linear general equilibrium model based on three social programs: Oportunidades, Procampo, and Adulto Mayor. In this way, they find a favorable impact of social programs on reducing Mexican poverty, (as stated above) decreasing its level by 9% and generating direct and indirect effects that improve income distribution.

[Borga and D'Ambrosio \(2021\)](#) evaluate the impact of three social programs: The Productive Safety Net Program in Ethiopia (PSNP), National Rural Employment Guarantee Act in India, and Juntos Program in Peru. These authors use panel data provided by five surveys from 2002 to 2016. Different poverty thresholds are considered to analyze the distributive impact of the programs and their influence on poverty levels in three dimensions: living standards, health, and education. The program's impact is econometrically evaluated, estimating difference-in-differences (DID) models with propensity score matching (PSM) methods; after estimating the first-round logit model that considers household wealth, household members, rural or urban location, and mother's characteristics.

[Borga and D'Ambrosio \(2021\)](#) analyzed three or more indicators in the PSNP and Juntos Program, establishing that they do not present a statistically significant impact on reducing the poverty incidence, but their intensity is reduced. In this sense, participating in social programs is associated with a decrease in the indicators of poverty dimensions analyzed. In this way, the effect is greater for people with a higher level of poverty due to the multiple deprivations they face. And for the specific case of the Juntos Program, there is a higher reduction in poverty, where the multidimensional poverty index decreases from 0.57 (2006) to 0.17 (2016), with a decrease in the incidence of poverty of 54% and a decrease in the poverty intensity of 18% over a decade.

[Ariza and Retajac \(2020\)](#) evaluate the factors associated with urban poverty in Colombia (2002–2018), using indicators of incidence, gap, and severity, which are based on income, poverty threshold, and poverty situation. Furthermore, a logit model is estimated considering as dependent variables poverty and explanatory sociodemographic variables of size, composition, educational level, and characteristics within households, as well as unemployment, non-labor income, and external support.

[Stampini et al. \(2016\)](#) used synthetic panels, considering data from the Harmonized Database of Household Surveys of Latin America and the Caribbean (Sociometer-IDB), to evaluate the vulnerability of the poor and middle class from twelve countries, including Peru. They established that chronic poverty comprises 91% of extreme poverty and 50% of moderate poverty, finding that chronic poverty conditions have a very low level of human capital and few opportunities for employment due to their residence in rural areas. Therefore, it is difficult for strategies to improve the capacity to generate income in this population segment to be successful. The authors also find that 14% of the middle class has experienced a situation of poverty over a decade. They consider that to fight against chronic poverty, long-term social policies must be combined with those of the extremely rural poor.

Whereas, for transitory poverty, they point out that short-term policy measures are required with flexible entry and exit assistance from the social program for urban residents.

In this context, the country's rural sector needs to be prioritized in academic reflections, considering that these households are the most likely to suffer the impact of international variation in food prices. Paradoxically, a part of the peasant's food diet comes from imported supplies, affecting their food security. The support of social programs is necessary to reduce this effect, contribute to their resilience, and reduce their vulnerability (Osabohien et al. 2024). Social support encourages families to adopt better strategies to cope with periods of crisis, avoiding greater adverse effects on the rural population, such as decreased access to education and health (Abay et al. 2023). In addition, it is necessary to provide help to address demographic challenges such as the migration of young people and the population aging that affect agricultural activities in the different regions (Lindoso et al. 2018).

Therefore, in Peru, vigorous and comprehensive social programs are needed to support the poor rural population and marginal urban areas, who need access to opportunities to reach a better quality of life (Quispe-Mamani et al. 2022). It would be pertinent to incorporate digital technologies in favor of beneficiaries to overcome geographical limitations, improve access to information, broaden their employment prospects, and increase their personal development (Polo Escobar et al. 2023). Likewise, it is important to boost financial education through the Pilot Program for the Promotion of Savings in the Juntos Program (Daher et al. 2022), aimed at beneficiaries in rural areas, so that they have a savings account and access to financial services that allow them greater economic and social inclusion. Daher et al. (2022) point out that these types of programs have a significant impact on development, empowerment, and female entrepreneurship. Finally, Juntos aims to interrupt the intergenerational cycle of Peruvian rural poverty (Santos et al. 2021). It has been focusing on actions related to health and education, considering that economic vulnerability affects the conditions of well-being and economic and social development of rural areas in the regions.

3. Methods, Econometric Specification and Data

3.1. Methods

Our method is quantitative, non-experimental, and correlational, based on secondary data obtained from official sources, such as the Instituto Nacional de Estadística e Informática (INEI) and the user-friendly query of the Ministry of Economy and Finance (MEF), as well as data obtained from the Peruvian Institute of Economics (IPE). The information for the period 2013–2022 at the level of the 24 departments/regions was considered. We use the system generalized method of moments (SGMM) to estimate the econometric dynamic panel data models, in order to obtain information over a long period of time and across entities (regions).

We studied the four most representative social programs: The National Program of Direct Support to the Poorest Juntos, National Solidarity Assistance Program Pension 65, National School Nutrition Program Qali Warma, and Program for the Generation of Social Inclusive Employment “Trabaja Perú”. Additionally, socioeconomic variables, such as unemployment, gross Domestic Product per capita (income), human capital, physical infrastructure, and rotated expenditure were analyzed. Also, dummy variables on the occurrence of COVID-19 and the “El Niño” phenomenon (FEN2017) were included.

A dynamic panel data model was used, considering the various advantages over other econometric techniques; it corrects the problem of endogeneity, allows control of constant unobservable heterogeneity, temporal effect control, modeling of dynamic effects, and avoids aggregation bias, among others. This problem arising from the individual effect tends to be eliminated when working with series in first differences as instruments.

3.2. Econometric Specification

Under the SGMM econometric methodology, our dynamic model was constructed and specified:

$$Y_{it} = c + \alpha Y_{i,t-1} + \beta X'_{it} + \varepsilon_{it}$$

$$\varepsilon_{it} = \mu_i + \vartheta_{it}$$

$$E(\mu_i) = E(\vartheta_{it}) = E(\mu_i \vartheta_{it}) = 0$$

The following general equation has been considered:

$$Y(t) = c + \alpha Y(t-1) + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7(t-1) + \beta_8 X_8(t-1) + \beta_9 X_9(t-1) + \beta_{10} X_{10} + \varepsilon(t)$$

Y: Poverty

X1: Income

X2: “El Niño” phenomenon

X3: Unemployment

X4: Human Capital

X5: Infrastructure

X6: COVID 19

X7: Juntos

X8: Pensión65

X9: Qaliwarma

X10: Trabaja Perú

The following general poverty equation is proposed:

$$Pobreza(t) = c + \alpha Pobreza(t-1) + \beta_1 Ingreso + \beta_2 FEN2017 + \beta_3 Desempleo + \beta_4 Capital Humano + \beta_5 Infraestructura + \beta_6 Covid19 + \beta_7 Juntos(t-1) + \beta_8 Pensin65(t-1) + \beta_9 Qaliwarma(t-1) + \beta_{10} Trabaja Per + \varepsilon(t)$$

In the next section, seven (07) SGMM econometric estimations are obtained from this equation, where the influence of socioeconomic variables and the impact of social programs implemented in Peru to reduce poverty are econometrically analyzed.

3.3. Data

Data for our empirical analysis has been obtained from different Peruvian official sources. Table 1 shows the variables name, following by definition and sources. They included social programs, socioeconomic variables and two dummy variables such as phenomenon El Niño and the pandemic of COVID-19.

Table 1. Socioeconomic variables.

Variable Name	Definition	Source
Poverty	% of population in poverty conditions	Peruvian Institute of Economics (IPE)
Poverty(−1)	% of population in poverty conditions, lagged by one period	Peruvian Institute of Economics (IPE)
Income	Real GDP per capita	Central Reserve Bank of Peru (BCRP 2022)
FEN2017	El Niño Phenomenon of 2017	Dummy Variable
Unemployment	Unemployment rate as a percentage of the economically active population	National Institute of Statistics and Informatics (INEI)
Human Capital	Average years of education achieved by the population aged 15 and over	National Institute of Statistics and Informatics (INEI)

Table 1. Cont.

Variable Name	Definition	Source
Infrastructure	Percentage of existing road infrastructure that is paved (national highway)	Ministry of Transport and Communications
COVID-19	COVID-19 pandemic in 2020	Dummy Variable
Juntos	Social program	Ministry of Economy and Finance
Pensión 65	Social program	Ministry of Economy and Finance
Qali Warma	Social program	Ministry of Economy and Finance
Trabaja Perú	Social program	Ministry of Economy and Finance

Own elaboration.

After correlations were obtained, Figure 1 shows a negative relationship between poverty levels and human capital, infrastructure, per capita income. On the other hand, Figure 2, shows a positive relationship between poverty rates and the different social programs spending, including Juntos, Pensión 65, Qali Warma, and Trabaja Peru.

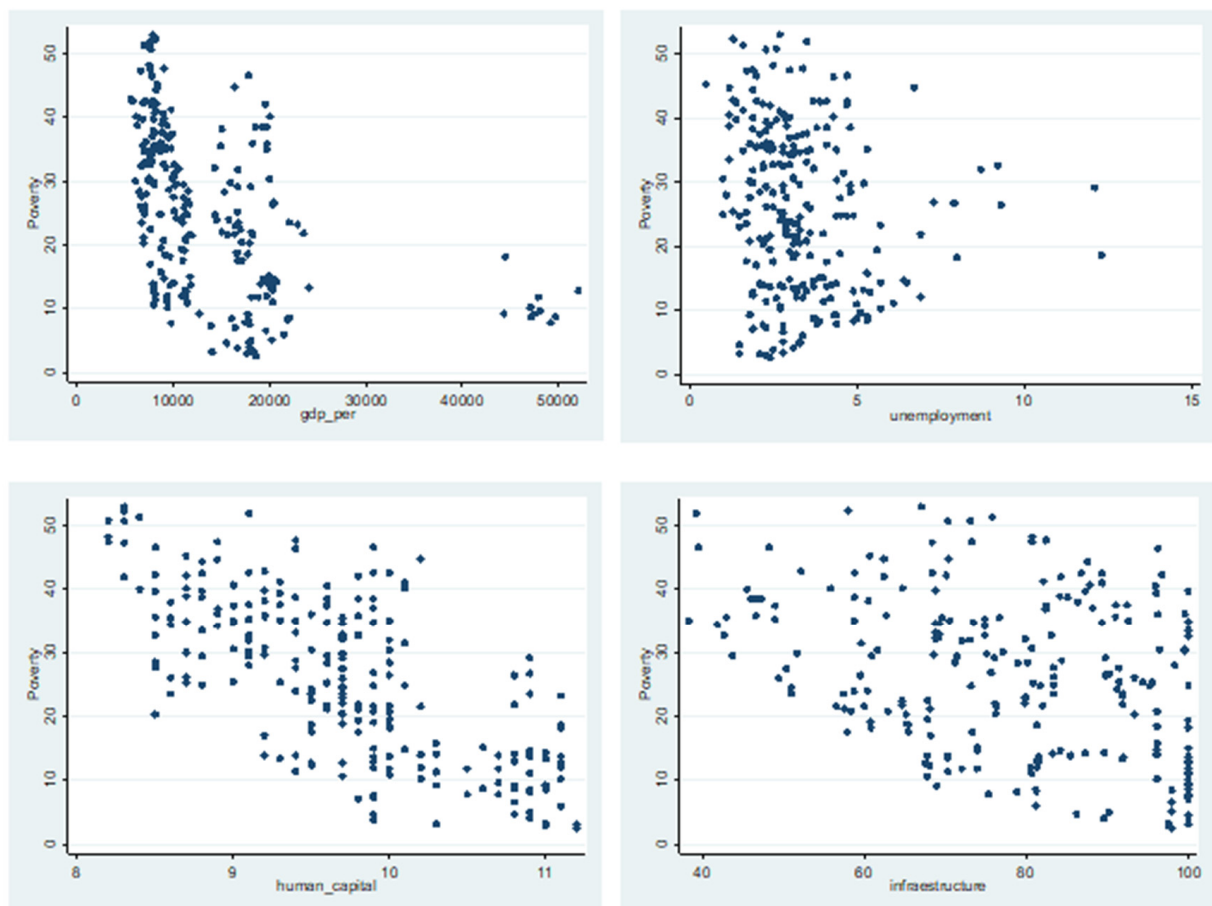


Figure 1. Relationship between poverty and per capita GDP, unemployment, human capital, infrastructure, and social programs.

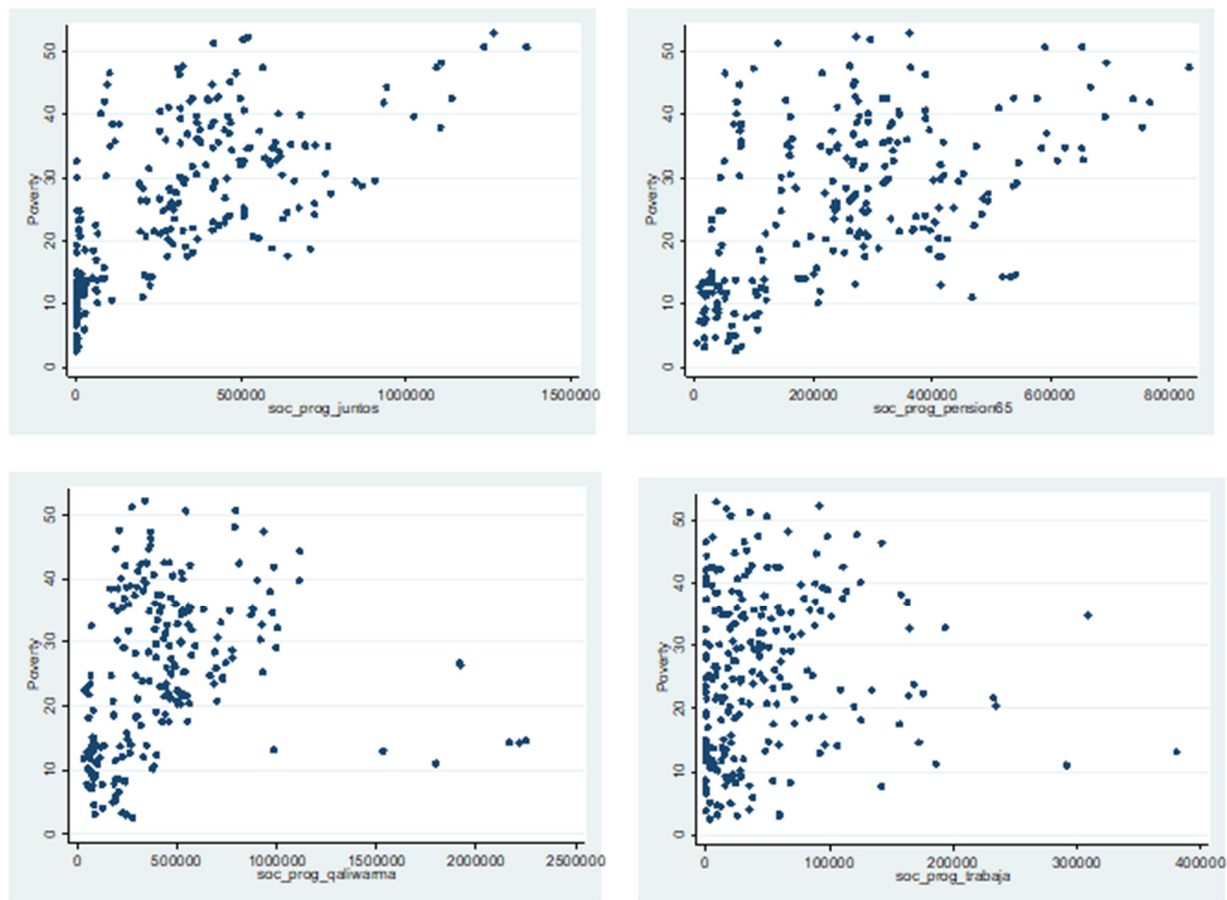


Figure 2. Relationship between poverty and social programs.

In the following Table 2, the matrix shows a negative correlation between poverty and per capita GDP, human capital, unemployment, and infrastructure. On the other hand, poverty has a positive correlation with Juntos, Pension 65, Qali Warma, and Trabaja Peru. There is a high correlation between human capital and income. Furthermore, there are high correlation indexes between social programs, such as Pension 65 and Juntos, Qali Warma, and Pension 65. These indicators should be tested in our econometric analysis in the next section.

Table 2. Correlation matrix.

	Poverty	GDP percap	Unemploy.	Human Capital	Infrastruc.	Juntos	Pension 65	Qali Warma	Trabaja Perú
Poverty	1								
GDP percap	−0.465	1							
Unemployment	−0.157	0.365	1						
Human Capital	−0.709	0.656	0.544	1					
Infrastruture	−0.350	0.222	0.101	0.306	1				
Juntos	0.665	−0.362	−0.247	−0.676	−0.332	1			
Pension 65	0.545	−0.362	−0.048	−0.418	−0.196	0.791	1		
Qali Warma	0.214	−0.177	0.193	−0.121	−0.134	0.467	0.644	1	
Trabaja Perú	0.096	−0.071	0.033	−0.068	−0.192	0.180	0.327	0.254	1

Own elaboration and estimation. Source: INEI, MEF, and IPE (2013–2022).

4. Results

In this section, all variables regarding regional poverty are tested through the System Generalized Method of Moments (SGMM), an estimation technique for dynamic panel data, to determine the variables that explain the evolution of regional poverty in Peru. Firstly, for the SGMM1 model, the evolution of the average income of the population—a proxy for real GDP per capita—which has contributed statistics significantly (p -value < 0.10) to reduce regional poverty levels, but marginally on average during the study period. S/ 1000 increases in real GDP per capita, poverty reduced on average by 0.5% (half a percentage point). Because GDP per capita is improving, the average income of the population increases, allowing the population to get different goods and services to improve living conditions. Moreover, in this first model, a dummy variable representing the 2017 “El Niño” phenomenon, which caused various geographical disasters, destroyed productive infrastructure, and caused the loss of production and jobs exogenously in various regions, was included as an explanatory variable.

It should be noted that the seven models (SGMM1–SGMM7) show that the unemployment rate has a significant impact on increasing poverty. As the unemployment rate increases by one percentage point (1%), the proportion of the population in poverty conditions average increases by 0.4% (Table 3). Logically, if people lose their jobs or cannot find work, their income decreases or is eliminated, making it difficult to cover basic needs such as food, housing, healthcare, and education, remaining in poverty conditions, or deepening them. Furthermore, if people lose their jobs, they are falling into poverty.

Table 3. Social programs and socioeconomic variables: Their impact on regional poverty in Peru (2013–2022).

	System GMM1	System GMM2	System GMM3	System GMM4	System GMM5	System GMM6	System GMM7
Intercepto (p -value)	3.35738 (0.013)	19.66681 (0.002)	16.41553 (0.009)	18.85005 (0.002)	16.63751 (0.012)	19.68336 (0.002)	14.45205 0.009
Pobreza(-1) (p -value)	0.89429 (0.000)	0.843577 (0.000)	0.82982 (0.000)	0.82645 (0.000)	0.840224 (0.000)	0.84197 (0.000)	0.8210324 0.000
Ingreso (p -value)	−0.00005 (0.061)	−− −−	−− −−	−− −−	−− −−	−− −−	−− −−
FEN2017 (p -value)	1.19145 (0.048)	−− −−	−− −−	−− −−	−− −−	−− −−	−− −−
Desempleo (p -value)	0.244328 (0.073)	0.45638 (0.004)	0.42225 (0.008)	0.40934 (0.008)	0.36202 (0.028)	0.45693 (0.003)	0.392438 (0.025)
Capital Humano (p -value)	−− −−	−1.69907 (0.004)	−1.39186 (0.021)	−1.60884 (0.007)	−1.37729 (0.031)	−1.71884 (0.005)	−1.16682 (0.042)
Infraestructura (p -value)	−0.023071 (0.013)	−0.020791 0.052	−0.01863 (0.099)	−0.021971 (0.028)	−0.02459 (0.069)	−0.01971 (0.069)	−0.02399 (0.084)
COVID-19 (p -value)	8.74114 (0.000)	8.49489 (0.000)	8.54545 (0.000)	8.4992 (0.000)	8.68252 (0.000)	8.49666 (0.000)	8.61957 (0.000)
Juntos(-1) (p -value)	−− −−	−− −−	0.00174 (0.016)	−− −−	−− −−	−− −−	0.001441 (0.383)
Pensión65(-1) (p -value)	−− −−	−− −−	−− −−	0.00251 (0.097)	−− −−	−− −−	0.001367 (0.715)
Qaliwarma(-1) (p -value)	−− −−	−− −−	−− −−	−− −−	0.0012 (0.027)	−− −−	0.00035 (0.681)
Trabaja-Perú(-1) (p -value)	−− −−	−− −−	−− −−	−− −−	−− −−	0.00248 (0.353)	0.00059 (0.870)
Número obs.	213	213	240	213	189	213	189
Número grupos	24	24	24	24	24	24	24
Arell.-Bond AR(1) (p -value)	−3.26 (0.001)	−3.36 (0.001)	−3.36 (0.001)	−3.36 (0.001)	−3.16 (0.002)	−3.36 (0.001)	−3.15 (0.002)

Table 3. Cont.

	System GMM1	System GMM2	System GMM3	System GMM4	System GMM5	System GMM6	System GMM7
Arell.-Bond AR(2) (p-value)	0.65 (0.514)	0.54 (0.590)	0.57 (0.570)	0.57 (0.568)	0.27 (0.787)	0.54 (0.592)	0.28 (0.781)
Sargan Overd. (p-value)	167.36 (0.977)	170.18 (0.971)	170.54 (0.966)	170.38 (0.967)	149.59 (0.962)	170.12 (0.968)	149.62 (0.946)
Hansen Overd. (p-value)	4.14 (1.000)	3.51 (1.000)	3.02 (1.000)	3.55 (1.000)	5.31 (1.000)	3.09 (1.000)	3.82 (1.000)
Hansen test excluding group:	3.66 (1.000)	3.92 (1.000)	3.27 (1.000)	3.95 (1.000)	5.35 (1.000)	3.36 (1.000)	3.86 (1.000)
Difference (null H = exogenous):	0.47 (1.000)	−0.41 (1.000)	−0.25 (1.000)	−0.40 (1.000)	−0.04 (1.000)	−0.27 (1.000)	−0.04 (1.000)

Own elaboration and estimation. Source: Data taken from Instituto Nacional de Estadística e Informática (INEI), Ministerio de Economía y Finanzas (MEF) and Instituto Peruano de Economía (IPE).

Human capital (Becker and Chiswick 1966) is used to explain poverty. The number of average years of education accumulated by the Peruvian population over 15 years of age has been considered a proxy variable for human capital in this research. Evaluating the variables corresponding to the endowment of human capital, in SGMM2–SGMM7, the marginal effect of increasing one year of study in the population aged 15 and over statistically and significantly reduces poverty levels in all the econometric models estimated, in the range between 1.7% and 1.2% (Table 3). As expected, this variable negatively affects the ratio of the population to poverty conditions in the regions. Better human capital allows poor people to find jobs and improve their income. This virtuous cycle leads people to take off from poverty.

It should be clarified that in models SGMM2–SGMM7, per capita income was not considered, since it turned out to be, statistically, a non-significant variable in these new specifications, at the same time as human capital. Also, it is not advisable to include both variables (human capital and income) at the same time to avoid multicollinearity, given the high correlation between both variables (66%); see Table 3. As found by different authors, people with higher levels of education tend to have access to better-paying jobs, in addition to generating greater opportunities for personal growth. In this regard, education provides skills and knowledge that are valuable in the labor market. People with more years of education tend to be more competitive, allowing them to earn higher wages and, consequently, reducing the risk of living in poverty.

Given that productive infrastructure is an indispensable condition to fight against poverty, we considered as a proxy variable the endowment of transport infrastructure, the proportion of national paved roads in each of the seven econometric models. This variable has a negative and significant influence on the poverty ratio in our country; the coefficients are negative and statistically significant in all econometric models. Increasing the condition of national roads in a paved state proportion by 10% reduces poverty levels between 1.9% and 2.4% since paving roads facilitates connectivity between cities and poor rural areas. This enables producers in the country access to local, regional, national, and international markets, improving personal income, trade opportunities, and employment.

Regarding the COVID-19 pandemic, it has positively and significantly affected the poverty rate in the regions. This not only coincides with what is expected by economic theory but also with the observed country's daily life. We considered a dummy for the pandemic variable, taking one (1) only for the 2020 year and zero for the rest of the last nine (9) years evaluated. The 2021 year is not considered after the application of the vaccine and the restoration of economic activities. Being poor is the dependent variable. The pandemic contributed to an increase in poverty of about 9% in Peru, according to the estimated econometric results. The point is that by 2023, it would have been very difficult for Peruvians to return to pre-pandemic poverty levels that had reached around 20%.

Regarding the evaluation of social programs implemented with the aim of contributing to poverty reduction in Peru. Firstly, Juntos Program is econometrically analyzed in SGMM3, where counterintuitive results are shown by displaying a positive coefficient (0.00174) and statistically significant (p -value = 0.016). This can be interpreted as indicating that higher levels of spending by the central government on this social program increase poverty levels. The results show that social spending through the Juntos Program has evolved positively according to the poverty rate in various regions of the country. The first lag of this social program was used precisely to contribute to solving problems of endogeneity, given the dual implications of the studied dependent variable, poverty, and this social program.

Subsequently, in the SGMM4 model, the social program Pensión 65 is included as an explanatory variable. The first lag of this explanatory variable turns out to be positive and significant at 10% to explain poverty in Peru (0.0025). In other words, an increase in the budget allocated to this social program would contribute to reproducing poverty in different regions of the country. This result reinforces what was found in the case of the conditional cash transfer program Juntos (see Table 3). In the SGMM5 model, the national school feeding social program *Qali Warma*, which lagged by one period, is included as an explanatory variable of poverty. The coefficient turned out to be positive (0.0012) and statistically significant, with a p -value of 0.027, less than 5%. This social program also does not have a direct impact on reducing poverty.

As for the *Trabaja Perú* program, which aims to generate temporary employment for the working-age population from 18 years old, who are in a situation of poverty, extreme poverty, or partially or fully affected by natural disasters or emergencies, according to the SGMM6 model, the estimated coefficient of this explanatory variable (0.00248) turned out to be not significant with a p -value of 0.353. It should be clarified that these results could be due to the low productivity generated by this social program. Likewise, the jobs generated by this social program contribute to marginally reducing structural poverty in different regions.

In the SGMM7, the public spending of the four social programs analyzed previously, Juntos, Pensión 65, Qali Warma, and Trabaja Perú, was simultaneously included. Thus, their simultaneous impact turned out to be not significant, with p -values of 0.383, 0.715, 0.681, and 0.870, respectively. The interpretation is that these social programs collectively (at the same time) would not have a significant direct impact on reducing regional poverty. Or perhaps the type of econometric technique used in this study for evaluating the impact of social programs to reduce poverty is questionable, requiring the application of other impact evaluation techniques.

If the social programs goals are to reduce poverty and improve the living conditions of the most vulnerable population, however, the fact that they show opposite results would denote that higher government spending on social programs could be leading the vulnerable population into a “poverty trap”, in which people would become dependent on government assistance. The consequence of this effect would be reflected in the loss of motivation to seek employment or improve their qualifications through education or training (learning by doing). Likewise, it is possible that some farmers have been reducing their economic activities, waiting for government transfers and other social programs. Indeed, it should be highlighted that poverty and extreme poverty are essentially resolved with the economic activity boost, via the improvement of private investment, national or international, greater and better training of human capital, and substantial improvement of the nation’s physical infrastructure, among others.

Therefore, as expected, in accordance with econometric technique, we rejected the null hypothesis (H_0) of the absence of first-order serial autocorrelation among the residuals, given that the p -values are very small (below 0.05). However, the null hypothesis (H_0) of the absence of second-order serial autocorrelation among the residuals is not rejected due to the high p -value (above 0.51). Regarding the Sargan test (or Hansen’s J statistic), the null

hypothesis (H_0) that the instruments are not jointly correlated with the error term, meaning they meet the exogeneity condition, is not rejected given the high p -value of this test.

5. Discussion

This research fulfills the objective of estimating the influence of social programs and socioeconomic variables on poverty reduction, using the generalized method of moments system (SGMM) and the dynamic data panel technique. In relation to the variable average income of the population, considering real GDP per capita, it is statistically significant at 10%, with a minimal negative impact on poverty reduction. It is empirically corroborated that an increase in income reduces the risk of being in a situation of economic vulnerability and poverty due to the impossibility of covering their basic expenses and food, because a higher income improves the level of familiar consumption.

Regarding the average income, we considered the real GDP per capita as independent variable. This turns out to be statistically significant at 10%, with a minimal negative impact on poverty reduction. This indicator coincides with the result of [Brychka et al. \(2023\)](#), where GDP per capita is one of the most significant factors to explain the level of poverty (R^2 of 0.50), with a negative Pearson correlation coefficient of -0.71 , Kendall's -0.48 , Spearman's -0.63 , and Fechner's -0.40 . It also coincides with [Villarruel-Meythaler et al. \(2020\)](#), where the poverty-income elasticity is negative, finding that 1% increases in the logarithm of family per capita income are expected to result in a 0.90% decrease in the poverty logarithm. Highlighting that increasing per capita income decreases inequality and poverty. However, despite the positive relationship of GDP per capita with family income, the structural gaps present in extreme poverty would not be closed, nor would their living conditions be improved ([Gomero Gonzales and Barrantes Martínez 2023](#)).

Regarding unemployment, it is statistically significant, and one percentage point increases the unemployment rate, increasing the country's regional poverty between 0.2% and 0.5%. It demonstrates the importance of reducing the unemployment rate, increasing the percentage of the economically active population that is employed, and generating income to cover their basic expenses and food, moving away from a possible condition of monetary poverty. Unemployment implies that people do not perceive income; if this situation continues, it will affect their consumption level and their economic situation, which will lead them to a situation of vulnerability and poverty. For this reason, job creation is very important because of its social impact on individual and family well-being.

The unemployment rate is statistically significant at 10% in GMM1 and 5% in all other equations (GMM2 to GMM7); one percentage point increases the unemployment rate and increases regional poverty between 0.2% and 0.5%. Similarly, [Brychka et al. \(2023\)](#) concluded that the unemployment rate is one of the most significant factors of poverty. Also, it is consistent with [Arellano Rojas et al. \(2022\)](#) results, where the unemployment rate has a direct effect on Ecuadorian poverty, regarding other variables studied. Additionally, [Ariza and Retajac \(2020\)](#) find that in Colombia, a 1% increase within the household of unemployed family members raises the probability of poverty, more than 48%.

Regarding human capital, skills, and knowledge acquired by people to improve their productivity, it has a favorable impact on reducing regional poverty, it is a statistically significant indirect relationship. One-year increases in education contribute to reducing poverty by 1.2% to 1.7%. A higher level of education provides cognitive, practical, and behavioral tools that improve the competence, aptitude, and attitude of the future worker to access a job. The labor market increasingly demands greater qualifications and productivity, offering better remuneration, which allows the basic expenses of the worker and his or her family to be covered, ceasing to be economically vulnerable or in poverty. These results are confirmed by [Phan et al. \(2017\)](#) for the period 2002–2010 and for a set of provinces in Vietnam, in which they obtain in a model using the generalized method of moments (SGMM) system with dynamic panel data that a one-year increase in education attained by the population aged 15 and over reduces the poverty rate by 2.1%.

Likewise, [Ariza and Retajac \(2020\)](#) find that an increase of one year of average schooling within the household decreases the probability of poverty from 8% to 10%. Similarly, [Olopade et al. \(2019\)](#) establish that, in the long term, human capital development contributes to reducing poverty. It is found to be statistically significant at 5% and has an inverse relationship because the estimated coefficient presents a negative sign. As previously stated, the increase of one year of study in the population aged 15 and over contributes to reducing poverty from 1.7% to 1.2%.

Regarding infrastructure at the regional level, there is a negative and statistically significant relationship. Thus, in the seven econometric models, particularly in three of them, it is significant with a negative coefficient sign of 0.026 to 0.032. The role of asphalt road infrastructure as a means of connectivity between markets and the transport of production and its inputs is highlighted, which contributes to improving the productivity and competitiveness of economic agents. Transport infrastructure facilitates domestic and international trade and supports the creation and survival of enterprises. The higher the level of economic activity, the greater the job creation, with a positive impact on average income and poverty reduction.

These results of the infrastructure coincide with those indicated by [Chotia and Rao \(2017\)](#) for the case of India in the period 1991–2015. They find that infrastructure development played a preponderant role in the reduction of poverty levels, with a unidirectional causal relationship. Similarly, [Alvarado Tolentino \(2018\)](#) for the Peruvian case maintains that investment and management of public spending on infrastructure contributed to the reduction of poverty levels in the period 1994–2015. One percent increases in public investment spending in economic sectors, such as transport and other sectors, produce a decrease in the level of poverty by 0.0018%. This is due to a greater articulation of national investment policies and territorial policies, as well as public accountability with greater citizen participation.

In the case of COVID-19, the result is a highly significant direct relationship at 1%, generating in all cases an impact greater than 8%. The increase in poverty occurred as a result of the forced isolation measures that were adopted to prevent its spread. The restriction of mobility, suspension of activities, and quarantine states decreased the level of production, causing the closure of businesses, perfect suspension of work, and layoffs. This affected the income level of families, increasing their economic vulnerability, which coincides with [Davies et al. \(2023\)](#) indicating a 15% increase in poverty in Pakistan due to the pandemic. The high impact of this variable is due to the economic situation generated by a generalized recession and food security problems ([Vos et al. 2022](#)), as well as a decrease in income due to the long lockdown that occurs in Peru and harms its highly informal economy.

On the other hand, the Juntos Program does not have a significant impact on poverty reduction; the coefficient is 0.00174 according to the SGMM3 model of our econometric study. These results are comparable with [Banegas-González and Mora-Salas \(2012\)](#), who conducted an evaluation of the Oportunidades Program in Mexico, similar to the Peruvian Juntos Program. In the Mexican case, the authors determined that there is no evidence to show that this conditional cash transfer program fosters overcoming poverty because it would not constitute an efficient alternative to reduce the structural vulnerability of poor households and reduce poverty in the short and medium terms. Since they maintain that the vast majority of households (8 out of 10) did not manage to overcome the eligibility condition after a decade, they did not manage to surpass the minimum poverty threshold.

Regarding the Pension 65 program, no effects on poverty reduction are evident, showing non-significant coefficients (p -value of 0.715 in the SGMM7 model) or, as also observed in the SGMM4 model, showing an almost null coefficient of 0.00251. This result aligns with the evaluation conducted by [Chapa et al. \(2022\)](#) for a set of social programs in Mexico such as Oportunidades, Procampo, and Adulto Mayor, highlighting in this latter case its similarity to the Pension 65 program in Peru.

On the other hand, the Qali Warma school feeding program also does not have a significant effect on poverty levels, with its effect being marginal (coefficient of 0.0012 and p -value of 0.027) in the SGMM 5 model, while in the SGMM7 model, where all social programs are considered, a non-significant value with a p -value of 0.681 is observed. The results are in accordance with what was found in Mexico, where the School Breakfast Program of Mexico City, according to the study by [Sánchez Vargas et al. \(2019\)](#), determined that the results of the estimates suggest that the school feeding program does not lead to significant changes in grades, observing that participation in the School Breakfast Program shows a positive, but not significant relationship with academic score. Thus, being a participant in the program would raise the score only by 2.3% in fourth-grade primary students; however, this coefficient lacks statistical significance since its p -value is 0.321, meaning the program would not have collateral effects on reducing poverty in the long term. These results are aligned with what [Francke and Acosta \(2021\)](#) find when studying the impact of the Qali Warma program on anemia and malnutrition in children aged 3 to 5 years, determining that the program would not have effects on anemia or chronic malnutrition, at least in the age range studied. Because, according to them, the probability that children do not have anemia if they benefit from the program is just 1.8%.

Regarding the employment assistance program Trabaja Perú, evaluated in the SGMM6 and SGMM7 regressions, it is observed that it is also not significant to explain the reduction in poverty in the country since the p -value is greater than 0.10. These results coincide with those of [Abramo et al. \(2019\)](#), in a study of social programs for Latin America, in which they indicate that while the poor or extremely poor population may manage to be employed, they do so in low-productivity jobs. Since 74.4% of men and women in 2016 were employed in low-productivity sectors for the first income quintile, and for a second quintile, 60.8% of this same type of population were also employed in low-productivity sectors. In this sense, the beneficiary population of this program focuses on low-skilled jobs, which limits the program's impact, besides being designed as a temporary solution and not addressing the structural factors that contribute to reducing poverty in the long term.

The limited capacity of social programs to alleviate poverty is in line with [Phan et al. \(2017\)](#), where they do not find a statistically significant relationship between poverty reduction and spending on programs that are designed to benefit people living in poverty or economic vulnerability. In this regard, the p -value of the coefficients found in the estimation exceeds the threshold of 5%. This result would reflect the complexity of the management of these social programs, adding that the implementation of the program can present filtering problems, so that the benefits of these programs are captured by non-poor groups, thus damaging the effectiveness of the program. In addition, another element of inefficiency could be due to corruption. [Olken \(2006\)](#) points out that redistributive programs, especially in developing countries, can promote corruption and consequently generate economic losses that exceed the benefits received by recipients.

6. Conclusions, Recommendations and Limitations

There is a negative impact/indirect relationship between income, human capital, and infrastructure on poverty levels, while a direct relationship is observed between poverty and spending on social programs such as Juntos, Pensión 65, Qali Warma, and Trabaja Perú. These results were obtained using the System Generalized Method of Moments, which established solid and reliable foundations. Thus we are contributing to the body of knowledge existing in the economic literature to improve the quality of social spending and public budget management.

Social programs implemented by Peruvian governments in recent decades aimed at reducing poverty paradoxically have not been having a significant impact on reducing poverty at the regional and national levels. They would be weak public policy instruments to generate a structural change in the inequality levels present in Peruvian society. Therefore, their main objectives would only be aimed at mitigating the effects of inequality on poverty levels.

On the other hand, socioeconomic variables such as per capita income, employment, human capital, and productive infrastructure have a significant impact on reducing regional poverty in Peru. It is recommendable for governments to increase investment in infrastructure, such as tunnels, more roads, ports, trains, bridges, telecommunications, the Internet, etc., in regions to allow rural and poor inhabitants to connect with national and international markets, get productive jobs, and increase their income.

Unfortunately, social programs have not had favorable results in the recent decade, even with increasing public financing. However, the best way to escape poverty is through better training/qualification of human capital, substantial improvement of physical infrastructure, and income generation through well-paid formal employment, where the worker deploys all their productive capacities, obtains social benefits, and contributes effectively to their personal development, regional development, and the country in general.

The system generalized method of moments was demonstrated as being a good instrument to analyze regional poverty in Peru. The results are consistent with others previously obtained by different authors. Social programs implemented in Peru in the last few decades have not had clear results in reducing poverty. It is also fair to point out that COVID-19 has increased the poverty rate in the last few years. However, we can be sure that human capital, infrastructure, employment, and income can help significantly reduce poverty rates.

To reduce poverty sustainably in the long term, a comprehensive policy should be implemented, focusing on addressing the structural causes of poverty, which should combine the promotion of economic growth, the strengthening of human capital, and the development of infrastructure. Incentives for investment and job creation should be established through a favorable environment for private and foreign investment through tax incentives, simplification of public bureaucracy, and proper management of social conflicts. It should also seek to improve education and job training by investing in quality education accessible to all and developing job training programs to improve the employability and productivity of the workforce. Finally, develop basic infrastructure and modernize transport infrastructure to facilitate access and connectivity to national and international markets.

Among the limits of our research is the System Generalized Method of Moments (SGMM), which constitutes a contribution to the explanation of regional poverty in Peru. However, it can be mentioned that socioeconomic and geographical differences between regions can introduce unobserved heterogeneity, that the SGMM does not capture adequately, and that it could lead to biased estimates. Likewise, there may be unobserved, region-specific effects, such as cultural or public policy factors, that cannot be measured with the variables included in the model.

Our theoretical-mathematical explanation can be improved by employing techniques that incorporate the analysis of multidimensional poverty, capturing more completely the shortcomings that people face beyond monetary poverty. It is recognized that monetary poverty may not capture all dimensions of poverty, some deficiencies in health or education are not necessarily reflected in the monetary poverty measure. Therefore, impact evaluations with experimental methods could help identify the effects of social programs, by comparing treatment and control groups.

As for socioeconomic variables, such as unemployment, human capital, and physical infrastructure, it can be pointed out that their measurement does not internalize the quality of employment or underemployment, which also affects poverty. The average years of education considered as human capital only reflect the number of years that people have spent in the formal education system; it does not capture its quality or the skills acquired. The physical infrastructure variable, measured as a percentage of asphalted road infrastructure, could be improved by building an indicator that includes railways, airports, and ports, which would provide a more complete idea of the connectivity and accessibility of the region.

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