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A Psychilogical Study in Determinants of Poverty in Peru: COVID-19 Context

Lindon Vela Meléndez[1], Ana Teresa Ferández Gill[2], Enaidy Reynosa Navarro[2*], Yefferson Llonto Caicedo[1], Juan Diego Dávila Cisneros[1], José Wilder Herrera Vargas[3]
[1]Universidad Nacional Pedro Ruiz Gallo, Lambayeque, Perú
[2]Universidad César Vallejo, Perú
[3]Universidad Nacional Pedro Ruiz Gallo,Perú

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Abstract
This research is based on identifying the factors of poverty in Peru in the COVID-19 scenario. The methodology considered is explanatory and based on the econometric estimation of a *logit model*, using the National Household Survey database with 34,473 observations corresponding to 2020. The measurement approach is monetary poverty, with a poverty threshold of S/.360 soles per month per capita (90.05 USD approx), according to the National Institute of Statistics and Informatics (2020), to be considered a poor household. The results found in the logit model show that the increase in the probability of moving to a condition of poverty would be explained by physical factors related to the household's access to public drainage, the geographical area in which they live; social factors such as experience, level of education attained at the primary level, level of education attained at the secondary level, level of education attained at the higher technical level, level of education attained at university, the origin of the school of study, number of children between 6 and 14 years and number of children under five years and economic factors such as monthly income per capita and the number of members who receive income in the household.

Keywords: Poverty; logit model; multidimensional approach; COVID-19.

Introduction

COVID-19 has been considered one of the challenges with the most significant socioeconomic impact on humanity, with a cost in terms of human lives that by July 2021 would reach 26,524.97 million confirmed cases of COVID-19 worldwide, as well as the deep economic crisis worldwide that has brought with it a sustained increase in poverty, unemployment of millions of workers and the growing gap in the heterogeneity of social indicators (S. Alkire & Santos, 2010; Boltvinik & Damián, 2020; Brum & De Rosa, 2020; Rendon et al., 2021)

The decline in gross domestic product per capita caused by COVID-19 has managed to reverse the gains made in two decades of poverty reduction since 1998 (World Bank Group, 2021). By 2020 the global poverty rate would reach 9.1%, and by 2022 9.4%, which translates into 88 million vulnerable people who have fallen into poverty, having the adverse scenario of extreme poverty where 115 million people would form by 2020, this group, failing to achieve the goals proposed in the Sustainable Development Goals, given that it is projected for the year 2030 that 6.7% of the world population would be below the poverty line.

COVID-19 affected the middle-income segments worldwide, leading to a 1% increase in the Gini index, triggering more significant cycles of inequality due to the destruction of micro and small businesses, effects unsustainable unemployment rate, loss of income of less skilled workers, and loss of human capital given the lower food intake that affects their productivity (Barraza et al., 2020). In Latin America and the Caribbean, close to 30 million people would fall into a state of poverty, the most significant economic cost being the social distancing measures, being the concern of the rulers about the very heterogeneity within the vulnerable families in terms of income generation capacity, working conditions, asset ownership, access to public services, which

implies an exquisite understanding of the vulnerability of households (De la Cruz et al., 2020; World Bank Group, 2021).

For the World Bank Group (2021), poverty is considered a complex and multidimensional phenomenon that is addressed by limitations in access to food, housing material, access to education, health, and working conditions, among others that gave way to the measurement of multidimensional poverty that reflects both monetary and non-monetary needs, in the Peruvian case the poverty rate measured by the income approach for the year 2019 would reach 2.2% while considering the multidimensional poverty index it would reach 3.9%, hence about a third of people who suffer from limitations of a multifaceted nature are not addressed by monetary poverty.

Peru is considered a case of economic and social success in Latin America due to its average growth of 4% since 1990 and the notable progress in the poverty rate, which went from 50% in 2000 to 24% in 2017, with a relative improvement in the Gini index from 0.50 to 0.43 in the said period, thus enlarging the middle-class socioeconomic segment. In this way (De la Cruz et al., 2020) consider that the reduction in poverty is explained by a 70% improvement in labor income and 30% by redistributive factors, with the greatest beneficiaries being the middle class, which increased from 50% in the year 2000 to 75% in the year 2017 (Manuel et al., 2000; Yamada et al., 2012)

However, after COVID-19, according to the National Institute of Statistics and Informatics 2020, monetary poverty reached 30.1% in Peru, which terms of the population reached 3 million Peruvians, increasing in the last five years 8.3% of the population was in poverty as result of the State of National Emergency approved by Supreme Decree No. 044-2020-PCM, which by July 2021 reaches 64,036.24 million confirmed cases, projecting towards the third wave of infections. According to Clausen Lizárraga (2019), monetary poverty affected 45.7% of the rural and 26% of the urban populations, with extreme poverty affecting 5.1% of the population. According to the National Institute of Statistics and Informatics 2020, the profile of poverty in a situation of poverty considers that 84.2% of poor households have access to basic services, 11% of households live in overcrowding, 91.9% have access to employment, 58.2% have women as heads of household, while only 14% have a computer. About 35% of households have a device. Hence De la Cruz et al. (2020) consider that the challenge for Peru is to consolidate the middle class where the empirical evidence shows that 40% of the population belonging to the middle class would be vulnerable to adverse *economic shocks such as* COVID-19.

This is a future problem since COVID-19 has not only demonstrated the vulnerability of the Peruvian health system but would also lead prospectively to worsening employment problems and other socioeconomic outcomes. But behind the reality of poverty, some factors or variables explain this condition, which (S. Alkire & Foster, 2011; Brum & De Rosa, 2020; Castillo & Brborich, 2007; Fernández-Sánchez et al., 2020; Giménez Mercado & Valente Adarme, 2016; Madueño Sayhua, 2020; Pacheco-López et al., 2021; Ramos Rollón, 2020) would describe as limitations in terms of housing space, precarious housing, access to basic services such as water, drainage, working conditions, access to technology, health conditions, and other factors aggravated.

In the scenario discussed above, the research problem is posed: What are the determining factors of poverty in Peru in the COVID-19 scenario? In this way, the objective of identifying the determining factors of poverty in Peru is raised. Peru in the COVID-19 scenario is based on the design of a Logit econometric model, allowing the identification of these microeconomic characteristics of households that are in poverty.

Literature review

Internationally, Correa-Quezada et al. (2021), in their article, show that the simulated scenarios impact revenue reduction between 5% and 20%. Concluding that COVID-19 has generated uncertain scenarios, causing a worldwide reduction in income. That poverty would increase by 34.7% in the most adverse scenario, returning to the values of a decade ago in Ecuador. Also, in their research, Boltvinik & Damián (2020) show that the

poverty rate as of April 2020 would be around 90.2%, translating into 15.5 million active people who became poor in Mexico. Concluding that COVID-19 has caused a fall in the gross domestic product and increased poverty in that country, becoming the most significant impact of the last decade. Similarly, Neves et al. (2021), in their investigation, show that in January-September 2020, it shows an increase in the unemployment rate by 3%, reaching an increase of 485 thousand households in conditions of extreme poverty. Since the COVID-19 pandemic, poverty and hunger have increased in Brazil, making it necessary to resume the fight against poverty and initiate Food Security programs. In the same way, Rendon et al. (2021), in their research article, explain that their vulnerability, marginalization, and inequity explain the socioeconomic dynamics of individuals in poverty, and social dynamics; concluding that COVID-19 has deepened social inequality in the modern world, threatening the existence of humanity. Additionally, Brum & De Rosa (2020), in their research article, show that in the central scenario of COVID-19, the incidence of poverty reached 11.6%, which implies 106,786 people who have increased towards the poverty line and negatively impacting the informal sector and the gross domestic product.

In the Peruvian national spectrum, Samamé Monje (2020) concludes that in the last decade, Peru has reduced its poverty rate from 42.4% in 2007 to 21.7% in 2017 and that, based on the logit model, the number of children increased the probability of being monetary poor by 5.56%; while access to electricity decreases the probability of being poor by 9.31%; while the education variable shows the probability of being poor monetary in 1.43% and access to hygienic services shows the probability of being poor decreases in 13.34%. Also, Guerrero Ojeda (2020), in his research called "Out-of-pocket spending on health and risk of poverty in Peruvian households, Peru-2017," show that spending on medicines amounts to 39.2% and out-of-pocket spending on health to 63%, with Gini index of 0.690. Concluding that out-of-pocket spending on health has meant three times what the World Health Organization stipulated, representing 40% of spending on medicines, dental services, and medical consultations. And Madueño Sayhua (2020) finds that the factors of migratory dynamics, socioeconomic reality, informality, level of education, infrastructure, and territorial ordering negatively influence poverty reduction, unlike social programs that positively influence and improve the living conditions of strata C and D of the population.

Poverty Measurement Approaches

Feres et al. (2001) part of the conceptualization of poverty as those limitations around a standard of quality of life-based on their scarce resources to satisfy the needs of consumption of goods or the necessary disposable income to achieve well-being indicators. In Latin America and the Caribbean, the most emphasized used the unsatisfied basic needs, starting from a need approach to achieve a life with quality standards. Coinciding with (B. C. Alkire et al., 2015; Kakwani & Silber, 2008; Mitra et al., 2013), poverty is understood as a limitation or a deprivation of well-being.

The human development approach of Osorio Caloca et al., (2017) raises the interaction between "being" and "doing," as well as the capacities required to achieve a quality standard, which from the traditional approach becomes a utility experienced by the individual from the consumption of goods. In this way, Sen (1985) considers poverty the perception of needs and deprivation for a long time. The inequality approach is related to economic growth and the distribution of wealth, which also depends on the characteristics of society. Poverty can be measured as a problem of inequality, but this approach leads to questioning other aspects beyond assets and to focus more on access to public services such as health and education; being services that must be available to the entire population. This approach questions the terms of poverty measurement as something absolute and proposes to include cultural conditions.

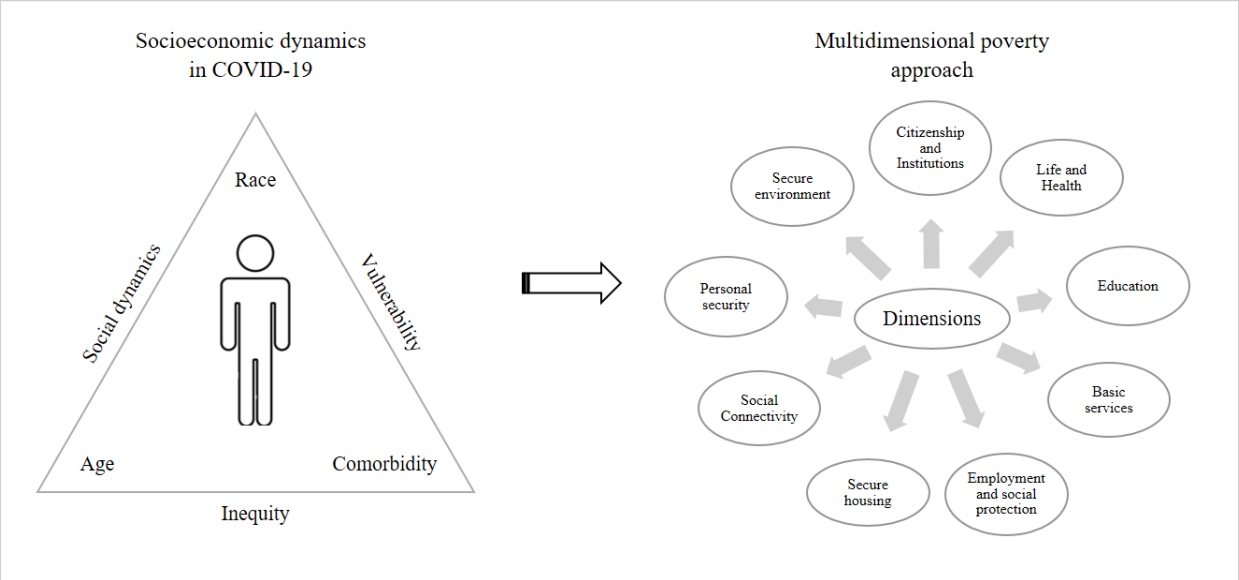
The absolute and relative approach is associated with social interpretations of needs; the first approach assumes that needs are independent of the wealth of others and that not satisfying them would generate a condition of poverty; while the second approach addresses that the condition of poverty considers the general level of wealth, that is, it perceives its improvement in the condition of well-being about the well-being of others. The monetary

poverty approach considers the limitations of income for the acquisition of a minimum basket, starting in this way from the per capita expenditure indicator of the household and the socially accepted parameters (total poverty lines for the case of total consumption and poverty line extreme in the case of food).

Being criticized the poverty measurement approach based on the minimum income threshold Baldwin & Wede di Mauro, (2020) argue that poverty goes much further than just the nature of income, moving towards a multidimensional analysis, generating a new look to the vulnerability of people and households under different risk factors, thus leading to a jump in the quantification of poverty concentrated not only in the monetary aspect but also considering social, labor and environmental indicators.

Clausen Lizárraga, (2019) recognizes the multidimensionality of poverty and considers the assumptions that highlight that of (S. Alkire, 2008), later readjusted in (S. Alkire et al., 2020) regarding assumptions based on theory, participatory processes of deliberation, consensus public reflected in official documents, statistical information on what people value, and availability of data that multidimensional poverty. Considering in this way, the poverty indicator from the multidimensionality nine dimensions referring to life and health, education, basic services (water, sanitation, energy), employment and social protection, safe housing, internet connection, security, environment, citizenship and institutions.

Figure 1: Socioeconomic dynamics of COVID-19 and multidimensional poverty



Source: Adapted from (Rendon et al., 2021) in their research paper called Marginalization, Vulnerability and Economic Dynamics in COVID-19.

Materials and methods

The research is approached from the positivist paradigm using statistical and mathematical tools to fulfill the stated objectives. The type of research is explanatory since it responds to explain the occurrence of the phenomenon under study and responds to the causes that generate said phenomenon (Hernández Sampieri et al., 2010). The research design is non-experimental and cross-sectional by making use of the information in a certain period of analysis of the variables corresponding to the year 2020, using for this the National Household Survey corresponding to the year 2020.

The method considered is the inductive one since it uses the Logit econometric model, which shows the probability that a household is poor or not, collecting the estimates of the coefficients of each explanatory variable and the relationship with the dependent variable. According to the National Household Survey, the population includes the group of private homes and their occupants in the urban and rural areas of the country, amounting to 10,102 849 homes according to the 2017 National Census: XII Population, VII Housing, and III Indigenous Communities. Being the criterion of exclusion to the armed forces and people who reside in collective housing.

The sample used in the National Household Survey is of a probabilistic, area, stratified, multi-stage type, with the size corresponding to that of private dwellings and their resident occupants in the urban and rural areas of Peru, which amounts to 34,490 private dwellings with a total of 32,969, 391 inhabitants.

The data obtained are from a secondary source from the 2020 National Household Survey of the National Institute of Statistics and Informatics, which allowed us to carry out the calculations at the national level.

The identified variables are operationalized as a dependent variable for monetary poverty and as explanatory variables for monthly per capita income, household access to water through the public network, household access to drainage through the public network, household access to electricity connection, the sex of the head of the family, the marital status of the head of the family, the number of years of experience, the number of years of experience squared, the classification of the school of study, the number of children in the range of 6 and 14 years, the number of children under five years of age, the level of education achieved, secondary occupation, occupation category, the size of the companies where they work, the number of members who receive income in the household and the geographic area in which they work that lives.

Below is a summary of the description of the variables considered in the research, identifying their influence and relationship with monetary poverty.

Table 1: Description of the variables

Variable	Dimension	Indicator	Abbreviation	variable type	Values	expected sign	Data source
Dependent Poverty	Economic	income level	*Poor*	dichotomous	1 = If the household is in a condition of monetary poverty 0 = Otherwise		National Household Survey- ENAHO 2020
Independent capita monthly income	Economic	capita monthly income	*ly*	discreet	Represents monthly per capita income	(-)	National Household Survey- ENAHO 2020
Availability of drinking water	Physical	Household access to water through the public network	*Water*	dichotomous	1 = If the household has drinking water inside the house 0 = otherwise	(-)	National Household Survey- ENAHO 2020
Availability of hygienic services	Physical	Household access to public sewage	*drain*	dichotomous	1 = If toilets are connected to an excreta disposal system 0 = Otherwise	(-)	National Household Survey- ENAHO 2020

Availability of electrical energy	Physical	Household access to electricity connection	*elect*	dichotomous	1 = If the household has electricity 0 = otherwise	(-)	National Household Survey-ENAHO 2020
Head of household's gender	Social	head of household sex	*men*	dichotomous	1 = If you are a man and 0 = If you are a woman.	(+)	National Household Survey-ENAHO 2020
Marital status of the head of the family	Social	Marital status of the head of the family	*married*	dichotomous	1= If you are married and 0 = if you have another condition.	(+)	National Household Survey-ENAHO 2021
Experience	Social	Number of years of experience	*expert*	discreet	Represents the number of years of experience.	(+)	National Household Survey-ENAHO 2021
School	Social	study college classification	*state*	dichotomous	1 = if it comes from a state school and 0 = from a private school.	(+)	National Household Survey-ENAHO 2021
Children in the range of 6 and 14 years	Social	Number of children in the range of 6 and 14 years	*Kids614*	discreet	represents the number of children between the ages of 6 and 14	(+)	National Household Survey-ENAHO 2021
Children under 5 years	Social	Number of children under 5 years	*kids0a*	discreet	represents the number of children under 5 years of age	(+)	National Household Survey-ENAHO 2021
years of education	Social	Level of education achieved	*neduc2*	dichotomous	1= if I reach the level of primary education and 0 = if I do not reach the mentioned level.	(-)	National Household Survey-ENAHO 2020
years of education	Social	Level of education achieved	*neduc2*	dichotomous	1= if I reach the level of secondary education and 0 = if I do not reach the mentioned level.	(-)	National Household Survey-ENAHO 2020
years of education	Social	Level of education achieved	*neduc2*	dichotomous	1= if I reach the level of non-university higher education and 0 = if I do not reach the mentioned level.	(-)	National Household Survey-ENAHO 2020
years of education	Social	Level of education achieved	*neduc2*	dichotomous	1= if I reach the university higher education level and 0 = if I do not reach the mentioned level.	(-)	National Household Survey-ENAHO 2020
Occupation of the head of the family	Social	secondary occupation	*Occupy*	dichotomous	1= if you have a secondary occupation and 0 = if you do not have a secondary occupation:	(-)	National Household Survey-ENAHO 2020

occupation category	Social	occupation category	*Independent*	dichotomous	1 = if independent and 0 = if dependent	(+)	National Household Survey-ENAHO 2021
Size of companies where you work	Social	Size of companies where you work	*bigemp*	dichotomous	1= if it is a large company and 0= if it is a micro company.	(-)	National Household Survey-ENAHO 2020
Number of recipients in the household	Social	Number of members receiving income in the household.	*percepho*	discreet	represents the number of members receiving income in the household.	(-)	National Household Survey-ENAHO 2020
geographic stratum	Social	geographic area in which you live	*urban*	dichotomous	1= if it is urban and 0 = if it is rural	(-)	National Household Survey-ENAHO 2020
Geographic area	Social	geographical area in which you reside	*Mountain range*	dichotomous	1 if it belongs to the sierra and 0 = if it does not belong.	(+)	National Household Survey-ENAHO 2021
Geographic area	Social	geographical area in which you reside	*jungle*	dichotomous	1 if it belongs to the sierra and 0 = if it does not belong.	(+)	National Household Survey-ENAHO 2021

Results

This article is based on the *logit econometric model*, which identifies the determining factors of poverty in Peru in 2020, where the country suffered from the COVID-19 pandemic. In this model, the database of the National Household Survey (Instituto Nacional de Estadística e Informática, 2020a), where the monetary poverty approach is used to create the *dummy variable* of 1 (poor) and 0 (not poor) having as a poverty threshold of S/.360 soles per month per capita (90.05 USD approx) according to the (Instituto Nacional de Estadística e Informática, 2020b) to be considered a poor household.

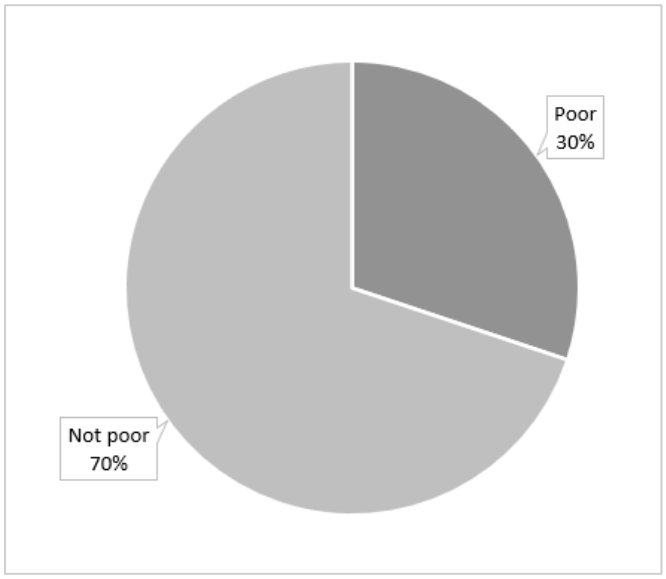
Considering the poverty above the threshold, we obtain a result that for 2020, in the scenario of the COVID-19 pandemic, the poverty rate reached 30.1%, which translates into 9.9 million Peruvians in a situation of poverty; increasing by 9.9% compared to 2019, that is, 3 million poor have increased (see table 2 and figure 2)

Table 2: Monetary poverty rate, 2020

Condition	Frequency	Percentage	Accumulated
Not poor	23034674	69.87	69.87
Poor	9,934,717	30.13	100.00
Total	**32,969,391**	**100.00**	

Source: (Instituto Nacional de Estadística e Informática, 2020a)

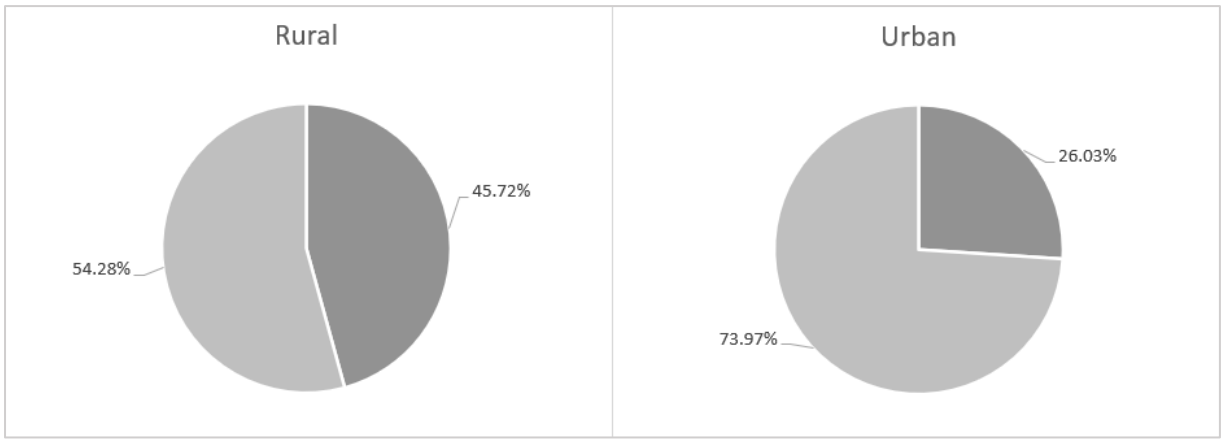
Figure 2: Monetary poverty rate, 2020



Source: (Instituto Nacional de Estadística e Informática, 2020a)

On the other hand, according to the geographical zone in the rural area, the poverty rate reached 45.7%; in the urban area, the poverty rate reached 26.03%.

Figure 3: Monetary poverty rate by geographic area, 2020



Source: (Instituto Nacional de Estadística e Informática, 2020a)

The estimation of the *logit model* considers the following variables in the estimation presented below in the functional form.

$$P(poor) = 1/\ [\![1 + e]\!]\ \hat{}((Bo + B1ly + B2water + B3sewage + B4elect + B5man + B6\ married + B7\ exper + B8\ exper2 + B9\ estate + B10\ nedu2 + B11neduc3 + B12neduc4 + B13neduc5 + B14\ ocusec\ + B15\ independent + B16granemp + B17percepho + B18kids14 + B19kids0a5 + B20urban + B21sierra + B22jungle))$$

Where:

- *Poor*: represents the poverty condition, taking the value 1 if it is poor and 0 if it does not have the poverty condition.
- *ly: represents the per* capita monthly income, expressed as a logarithm.
- *water*: represents the household's access to water through the public network, taking the value 1 if it has drinking water and 0 if it does not.
- *sewage:* represents the home's access to the sewage through the public network, taking the value 1 if it has a sewage connection and 0 if it does not have a sewage connection.
- *elect:* represents the household's access to electricity connection, taking the value 1 if it has electricity and 0 if it does not have electricity.
- *man: represents* the gender of the head of the family, taking the value 1 if he is a man and 0 if he is a woman.
- *married:* represents the marital status of the head of the family, taking the value 1 if he is married and 0 if he has another condition.
- *exper:* represents the number of years of experience.
- *exper2:* represents the number of years of experience squared
- *state:* represents the classification of the school of study, taking the value 1 if it comes from a state school and 0 if it comes from a private school.
- *Kids614:* represents the number of children in the range of 6 and 14 years
- *Kids0a5:* represents the number of children under 5 years old
- *neduc2:* represents the level of education achieved, taking the value 1 if I reach the level of primary education and 0 if I do not reach the mentioned level.
- *neduc3:* represents the level of education achieved, taking the value 1 if I reach the level of secondary education and 0 if I do not reach the mentioned level.
- *nedu4:* represents the level of education achieved, taking the value 1 if I reach the level of non-university higher education and 0 if I do not reach the mentioned level.
- *nedu5:* represents the level of education achieved, taking the value 1 if I reach the university higher education level and 0 if I do not reach the mentioned level.
- *ocusec:* represents if it has a secondary occupation, taking the value 1 if it has a secondary occupation and 0 if it does not have a secondary occupation:
- *independent:* represents the category of occupation, taking the value of 1 if it is independent and 0 if it is dependent
- *granemp:* represents the size of the companies where you work, taking the value of 1 if it is a large company and 0 if it is a micro-company.
- *percepho:* represents the number of members receiving income in the household.
- *urban:* represents the geographical area in which you live, taking the value 1 if it is urban and 0 if it is rural
- *sierra:* represents the geographical area in which you reside, taking the value 1 if it belongs to the sierra and 0 if it does not.
- *jungle:* represents the geographical area where you reside, taking the value 1 if it belongs to the jungle and 0 if it does not.

Considering the variables described above, three estimation models of the *logit model were elaborated,* being significant in model 1 the physical factors (desag, elect, urban, sierra, jungle), social factors (married, exper, exper2, neduc2, neduc3, neduc4, neduc5, state, kids614, kids0a5) and economic factors (ocusec, granempr) at a significance level of 5%, while the variables man and percepho are not significant. While in model 2 physical factors (desag, urban), social factors (exper, exper2, neduc2, neduc3, neduc4, neduc5, state, kids614, kids0a5) and economic factors (ly, percepho) are statistically significant, and in model 3 physical factors (desag, elect,

urban, sierra, jungle), social factors (married, exper, exper2, neduc2, neduc3, neduc4, neduc5, kids614, kids0a5) and economic factors (ocusec, granempr) are statistically significant at a significance level of 5%.

To choose the best-estimated model we consider the information criteria aic (akaike info criterion) and bic (schwarz criterion) with the lowest value corresponding to model 2 (aic: 23379.113 and bic: 23497.384) with a goodness of fit of 36.31%.

Table 3: Comparisons of estimated models

explanatory variable	Model 1	Model 2	Model 3
ly		-2.160503	
drain	-0.5307548	-0.3254875	-0.5299259
elect	-0.296447		-0.2938951
men	-0.0367692		
married	0.6285849		0.6094891
expert	0.0142919	-0.0164662	0.0144815
expert2	-0.0003613	0.0002192	-0.0003649
neduc2	-0.356124	-0.6256073	-0.3638083
neduc3	-0.8430842	-0.8941408	-0.8535947
neduc4	-1.617857	-1.253493	-1.628529
neduc5	-2.330022	-1.650469	-2.342566
state		0.2828368	
ocusec	-0.4888299		-0.4892696
bigemp	-1.211129		-1.212445
percepho	0.0043468	-0.336283	
kids614	0.6347933	0.302162	0.6355791
kids0a5	0.7085658	0.378632	0.7103937
urban	-0.0867987	0.2051061	-0.0838852
Mountain range	0.5687599		0.5684808
jungle	-0.4863322		-0.4869658
_ cons	-0.9033778	11.48288	-0.9054021
Pseudo-R2	0.2091	0.3631	0.2091
aic	29035.446	23379.113	29032.248
bike	29195.956	23497.384	29175,863

Source: (Instituto Nacional de Estadística e Informática, 2020a)

Considering model 2, we note that there is a positive relationship between the variables state, exper2, kids614, kids0a5, urban with the probability of being poor, while the variables ly, desag, exper, neduc2, neduc3, neduc4, neduc5, percepho have a negative relationship.

In what corresponds to the correlation matrix, we observe that the highest correlation is observed between income and urban (0.3569), income and level of university higher education (0.3549); as well as a negative relationship between income and the number of children in a household between 6 and 14 years old (-0.3272)

Table 4: Correlation matrix of the variables of model 2

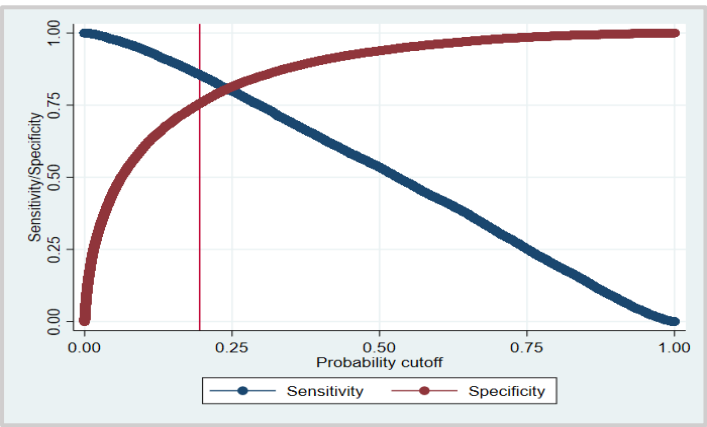
	ly	**expert**	**expert2**	**neduc2**	**neduc3**	**neduc4**	**neduc5**	**state**	**kids614**	**kids0a5**	**urban**
ly	one										
expert	0.0713	one									

expert2	0.0666	0.9765	one								
neduc2	-0.2304	0.3411	*0.346*	one							
neduc3	-0.092	-0.1976	-0.224	-0.5423	one						
neduc4	0.1484	-0.2107	-0.2093	-0.2583	-0.2848	one					
neduc5	*0.3549*	-0.1762	-0.1773	-0.2648	-0.292	-0.1391	one				
state	-0.1767	0.0268	-0.0138	0.3024	0.2933	-0.2656	-0.249	one			
kids614	-*0.3272*	-0.3271	-0.3467	-0.0051	0.0979	-0.0045	-0.0729	0.0768	one		
kids0a5	-0.2383	-0.3196	-0.2982	-0.0457	0.0902	0.0225	-0.0436	0.0309	0.2533	one	
urban	*0.3569*	-0.0932	-0.1038	-0.304	0.09	0.1763	0.2254	-0.0924	-0.0951	-0.032	one
drain	0.3302	-0.0098	-0.0242	-0.2574	0.058	0.1604	0.2095	-0.0763	-0.1298	-0.0857	0.598
percepho	0.0295	0.0734	0.0319	0.0543	0.0119	-0.0189	-0.0345	0.0679	0.131	0.1569	0.0057

Source: (Instituto Nacional de Estadística e Informática, 2020a)

Considering the best estimate at the cut-off point of 0.25, in sensitivity, the result is that 79.8% can be classified as poor, while specificity indicates that 81.42% can be classified as not poor; the best prediction is the non-poor, classifying correctly globally in 81%.

Figure 4: Sensitivity and specificity of model 2



Source: (Instituto Nacional de Estadística e Informática, 2020a)

Table 5: Leaderboard

Classified + if predicted Pr(D)	>=.5	
True D defined as poor! = 0		
sensitivity	Pr(+ D)	79.88%
Specificity	Pr(- ~D)	81.42%
Positive predictive value	Pr(D +)	55.36%
Negative predictive value	Pr(~D -)	93.35%
False + rate for true ~D	Pr(+ ~D)	18.58%
False- rate for true D	Pr(- D)	20.12%
False + rate for classified +	Pr(~D +)	44.64%
False- rate for classified- _	Pr(D -)	6.65%
correctly classified		81.08%

Source: (Instituto Nacional de Estadística e Informática, 2020a)

Table 6: Marginal effects of the logit model

variable	**dy / dx**	**Std. err.**	**z**	**P>z**	**[95% CI]**		**X**
ly	-0.193967	0.00316	61.35	0.000	-0.200	-0.188	6,313
expert	-0.001478	0.00054	-2.73	0.006	-0.003	0.000	34,825
expert2	0.0000197	0.00001	2.59	0.009	0.000	0.000	1412.180
neduc2*	-0.051945	0.00892	-5.82	0.000	-0.069	-0.034	0.330
neduc3*	-0.074505	0.0094	-7.93	0.000	-0.093	-0.056	0.374
neduc4*	-0.078566	0.00493	15.94	0.000	-0.088	-0.069	0.119
neduc5*	-0.094338	0.00457	20.64	0.000	-0.103	-0.085	0.125
state*	0.0235468	0.0072	3.27	0.001	0.009	0.038	0.837
kids614	0.0271277	0.00195	13.91	0.000	0.023	0.031	0.542
kids0a5	0.0339931	0.00263	12.95	0.000	0.029	0.039	0.291
urban*	0.0180274	0.00356	5.07	0.000	0.011	0.025	0.634
drain *	-0.030371	0.00392	-7.75	0.000	-0.038	-0.023	0.641
percepho	-0.030191	0.00158	19.11	0.000	0.027	0.033	2,035
(*) dy / dx is for discrete change of dummy variable from 0 to 1							

Source: (Instituto Nacional de Estadística e Informática, 2020a)

Table 7: Average marginal effects of the logit model

variable	**dy / dx**	**Std. err.**	**z**	**P>z**	**[95% CI]**	
ly	-0.231082	0.0024169	-95.61	0.000	-0.236	-0.226
expert	-0.001761	0.0006472	-2.72	0.007	-0.003	0.000
expert2	0.0000234	9.07E-06	2.59	0.010	0.000	0.000
neduc2*	-0.064778	0.0109726	-5.9	0.000	-0.086	-0.043
neduc3*	-0.092697	0.0108558	-8.54	0.000	-0.114	-0.071
neduc4*	-0.11532	0.0082547	-13.97	0.000	-0.131	-0.099
neduc5*	-0.140454	0.0078784	-17.83	0.000	-0.156	-0.125
state*	0.0294332	0.0101322	2.9	0.004	0.010	0.049
kids614	0.0322881	0.0022298	14.48	0.000	0.028	0.037
kids0a5	0.0404377	0.0030106	13.43	0.000	0.035	0.046

urban*	0.0216897	0.0044916	4.83	0.000	0.013	0.030
drain *	-0.035441	0.0041697	-8.5	0.000	-0.044	-0.027
percepho	-0.035926	0.0018411	19.51	0.000	0.032	0.040

Source: (Instituto Nacional de Estadística e Informática, 2020a)

From table 5 and 6, where we consider the marginal effects of the significant variables at 5% of the chosen model, we obtain a result:

- Regarding monthly per capita income, a change of one unit in the average monthly per capita income is associated with a 19% change in decreasing the probability of being poor. While if we consider the average marginal effect, the change increases to 23%, reducing the probability of being poor.
- Regarding the number of years of experience, a change of one unit in the average number of years of experience is associated with a change of 0.14% in decreasing the probability of being poor, having a quadratic effect. While if we consider the average marginal effect, it is associated with a 0.17% change in decreasing the probability of being poor.
- Regarding the level of primary education, a change of 1% from preschool to primary education reduces the probability of being poor by 5.19%. While if we consider the average marginal effect, the probability of being poor decreases by 6.48%.
- Regarding the level of secondary education, a change of 1% from primary to secondary education reduces the probability of being poor by 7.45%. While if we consider the average marginal effect, the probability of being poor decreases by 9.27%.
- Regarding the level of higher technical education, a 1% change from secondary to higher technical education reduces the probability of being poor by 7.85%. While if we consider the average marginal effect, the probability of being poor decreases by 11.5%
- Regarding the level of higher education, a change of 1% from moving from higher technical education to university education decreases the probability of being poor by 9.43%. While if we consider the average marginal effect, the probability of being poor decreases by 14.04%
- Regarding the origin of the school, a change of 1% in the origin of the state school is associated with a change of 2.35% in increasing the probability of being poor. While if we consider the average marginal effect increases the probability of 2.94% of being poor
- Regarding the number of children between 6 and 14, a change of one unit in the average number of children between 6 and 14 years of age is associated with a 2.71% change in the probability of being poor. While if we consider the average marginal effect increases the probability of 3.23% of being poor
- Regarding the number of children under five years, a change of one unit in the average number of children under five years is associated with a 3.4% increase in the probability of being poor. While if we consider the average marginal effect, the probability of being poor increases by 4.04%.
- Regarding the geographic area in which you live, a 1% change from urban to rural increases the probability of being poor by 1.8%. While if we consider the average marginal effect, the probability of being poor increases by 2.17%.
- Regarding household access to public sewage, a change of 1% from access to sewage reduces the probability of being poor by 3.04%. While if we consider the average marginal effect, the probability of being poor decreases by 3.54%.
- Regarding the number of members who receive household income, a change of one unit in the number of members who receive household income is associated with a 3.02% change in decreasing the probability of being poor. While if we consider the average marginal effect, the probability of being poor decreases by 3.59%.

From table 7, where we consider the *odds ratios* of the significant variables at 5% of the chosen model, in figure 5, we observe the parametric COR curve that shows the global performance of a test (area under the curve), generating a global performance of 88.5%. In this way, the centered estimates concerning sensitivity, specificity,

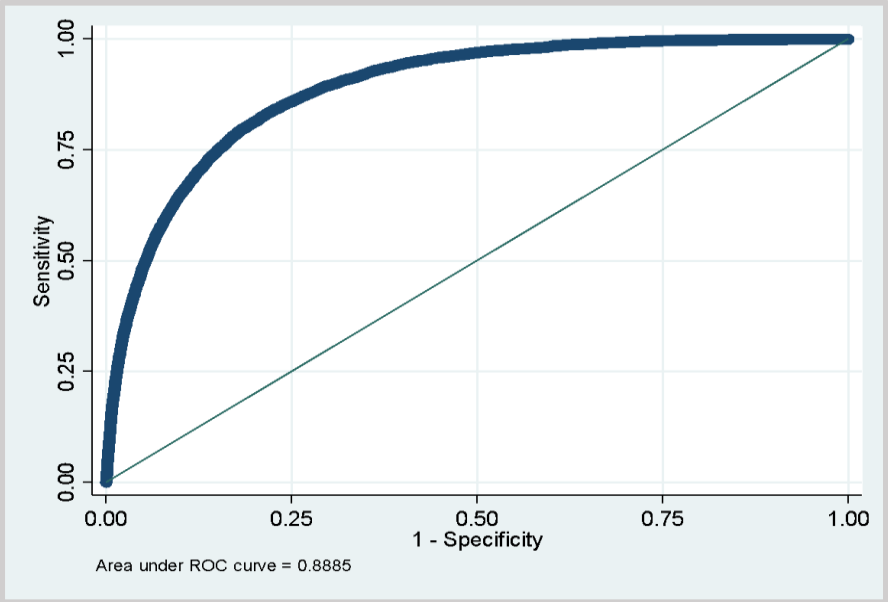
and the area under the curve, that for each point, the best estimators are the parametric ones; translating into the differential between being poor and not poor, it generates the ability to classify correctly is 88.5%.

Table 7: Odds ratio of the logit model

poor	odds ratio	Std. err.	z	P>z	Statistical Significance
ly	0.1152671	0.0036615	-68.01	0.000	The relative probability that the poverty condition will decrease if household heads improve their income is 0.11 times
expert	0.9836686	0.0059526	-2.72	0.007	The relative probability that the poverty condition decreases if the household heads increase their years of experience is 0.98 times
expert2	1,000219	0.0000848	2.58	0.010	
neduc2	0.5349364	0.0619559	-5.4	0.000	The relative probability that the poverty condition will decrease if the household heads obtain a primary level of education is 0.5 times
neduc3	0.4089588	0.049062	-7.45	0.000	The relative probability that the poverty condition will decrease if household heads obtain a secondary education level is 0.5 times
neduc4	0.2855057	0.0329964	-10.85	0.000	The relative probability that the poverty condition decreases if the household heads obtain a level of higher technical education is 0.3 times
neduc5	0.1919599	0.0259976	-12.19	0.000	The relative probability that the poverty condition decreases if the household heads obtain a university higher education level is 0.2 times
state	1.326889	0.1242859	3.02	0.003	The relative probability that the condition of poverty increases if the household heads go from studying in a state school to a private one is 1.32 times
kids614	1.35278	0.0286447	14.27	0.000	The relative probability that the poverty condition increases if the head of household has a child between 6 and 14 years of age is 1.35 times
kids0a5	1.460286	0.0417359	13.25	0.000	The relative probability that the poverty condition increases if the head of household has a child under 5 years of age is 1.35 times
urban	1.227655	0.0507929	4.96	0.000	The relative probability that the condition of poverty increases if the household heads move from living in an urban to a rural area is 1.22 times
drain	0.7221752	0.0290391	-8.09	0.000	The relative probability that the condition of poverty will decrease if the population gains access to drainage is 0.72 times
percepho	1.399735	0.0246523	19.09	0.000	The poverty condition's relative probability decreases if the number of members who receive income increases is 1.4 times.
_ cons	97040.23	20599.79	54.09	0.000	

Source: (Instituto Nacional de Estadística e Informática, 2020a)

Figure 5: Sensitivity and specificity of model 2



Source: (Instituto Nacional de Estadística e Informática, 2020a)

Discussion

This scientific article aims to identify the determining factors of poverty in Peru in the COVID-19 scenario based on the estimation of a *logit econometric model* using the National Household Survey, 2020.

The COVID-19 pandemic has been considered one of the challenges with the greatest socioeconomic impact on humanity, causing in Peru according to the National Household Survey, 2020, poverty has increased in Peru, reaching a rate of 30.1%, which translates to 9.9 million Peruvians living in poverty, whose highest incidence is in rural areas, which reached 45.7%; while in the urban area it reached 26.03%. Hence De la Cruz et al., (2020) consider that the challenge for Peru is to consolidate the middle class where the empirical evidence shows that 40% of the population belonging to the middle class would be vulnerable to adverse *economic shocks such as* COVID-19. The findings are related to (Boltvinik & Damián, 2020; Brum & De Rosa, 2020; Correa-Quezada et al., 2021; Fernández-Sánchez et al., 2020; Neves et al., 2021; Rendon et al., 2021) indicating that COVID-19 has had repercussions not only in the health dimension but also in the economic aspect from the decrease in household income and increased social gaps, impacting the vulnerability of households poorest which has led to increased hunger and poverty.

On the other hand, the statistically significant factors at 5% that explain poverty in the year 2020 are the physical factors related to the household's access to public drainage, the geographical area in which they live; social factors such as experience, level of education attained at the primary level, level of education attained at the secondary level, level of education attained at the higher technical level, level of education attained at university, the origin of the school of study, number of children between 6 and 14 years old and number of children under five years old; while economic factors would be the monthly income per capita and the number of members who receive income in the household. Likewise, the economic theory was fulfilled with the expected sign concerning the independent variables included in the model. The variables with the greatest impact are those of the average monthly income per capita, which is associated with a 19% change in reducing the probability of being poor, as well as a 1% change in going from higher technical education to university education, decreases the probability of 9.43% in being poor, while a change of 1% from going from secondary to higher technical education, decreases the probability of 7.85% in being poor; On the other hand, a change of 1% from going from primary to secondary education reduces the probability of being poor by 7.45%; Likewise, a change of 1% from going from initial to primary education reduces the probability of being poor by 5.19%, on

the other hand, a change of one unit in the average number of children between 6 and 14 years old is associated with a change in 2.71% in increasing the probability of being poor; a change of one unit in the average number of children under 5 is associated with a 3.4% change in increasing the probability of being poor, and a change of one unit in the number of members receiving household income is associated with a 3.02% change in decreasing the probability of being poor. These findings are related to the research by (Samamé Monje, 2020) called "Microeconomic Determinants of Poverty in Peru: Elaboration of the Econometric Model-ENAHO 2017," where he finds that the number of children increases the probability of being monetary poor by 5.56%. ; while access to electricity decreases the probability of being poor by 9.31%; while the education variable shows the probability of being poor monetary by 1.43%, and access to hygienic services shows the probability of being poor decreases by 13.34%. Likewise, it coincides with the research of (Madueño Sayhua, 2020) in his research called "Factors that influence urban poverty in the Arequipa region in the 2019 period," where he points out that the factors of migratory dynamics, socioeconomic reality, informality, level of education, infrastructure, and land use have a negative influence on poverty reduction, unlike social programs that have a positive influence and improve the living conditions of strata C and D. In this way, COVID-19 has caused a multidimensional impact on the most vulnerable households, pushing them to increase their limitations that affect their quality of life and increase social gaps at the global and regional levels, being the concern of the rulers for the heterogeneity itself within the vulnerable families in terms of income-generating capacity, working conditions, asset ownership, access to services, public, which implies exquisiteness in understanding the vulnerability of households.

Conclusions

In the COVID-19 scenario, it has not only had negative effects in terms of deaths; Well, according to ENAHO 2020, poverty has increased in Peru, reaching 30.1%, which translates into 9.9 million Peruvians in a situation of poverty, whose highest incidence is in rural areas, which reached 45.7%; while in the urban area it reached 26.03%; In this way, 40% of the population belonging to the middle class is vulnerable to adverse economic *shocks* such as COVID-19.

The new theoretical approach to poverty measurement addresses a multidimensional approach considering dimensions related to life and health, education, basic services (water, sanitation, energy), employment and social protection, safe housing, internet connection, security, environment, citizenship, and institutions.

According to the results of the *logit econometric model*, the statistically significant factors that explain poverty in the year 2020 are the physical factors related to the household's access to public drainage, the geographical area in which they live; social factors such as experience, level of education attained at the primary level, level of education attained at the secondary level, level of education attained at the higher technical level, level of education attained at university, the origin of the school of study, number of children between 6 and 14 years old and number of children under five years old; while economic factors would be the monthly income per capita and the number of members who receive income in the household.

In the year 2020, the increase in the probability of moving to a condition of monetary poverty with greater emphasis would be explained by the level of monthly per capita income; the educational level achieved access to basic services, and family burden; being essential to guide public policies to the development of human capital that allows impact in terms of developing capacities to obtain income by increasing their labor productivity.

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