

Original Paper

Financial Inclusion and Poverty Reduction: An Analysis of Panel Data 2010-2019

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Abstract

The purpose of this research paper is to determine the contribution of financial inclusion on the reduction of poverty. Peru was used as a case study to analyze the policy process in reduction of poverty through financial inclusion using data for the period of 2010-2019. The general research hypothesis is that financial inclusion can contribute to the reduction of poverty. Panel data model was specified whose estimation was made through the fixed effects estimator.

Within the specified econometric model, the dependent variable was the poverty rate, while the explanatory variable of interest, in this case, financial inclusion, was measured through a multidimensional index of financial inclusion. Additionally, a set of control variables was incorporated: economic growth, income inequality, labor informality rate, and average number of years of education achieved.

The results of the research demonstrate evidence in favor of the general research hypothesis, confirming that financial inclusion presents a statistically significant contribution of 1% on the reduction of poverty in Peru during the period 2010-2019. Likewise, regarding the control variables, it is identified that the increase in the levels of economic growth and average years of education are also relevant for the reduction of poverty. Additionally, it is corroborated that the reduction of the levels of income inequality and labor informality lead to an improvement in reduction of the poverty rates.

Keywords

Financial inclusion, poverty, panel data, fixed effects, economic growth, inequality, labor informality, education

1. Introduction

Poverty has been widely studied and measured in order to understand and eradicate it, as it is a perennial social problem throughout the world. According to the World Bank report (2020a), in 2019, 10 percent of the world population lived in poverty (living on less than 1.9 dollars a day), in this sense, the eradication of Poverty continues to be the greatest challenge for many countries of the world, in particular for developing nations.

On the other hand, in 2015, the United Nations (UN) and the world's economies agreed to adopt a list of 17 goals in order to achieve sustainable development by 2030. Among the first goal of the group of Goals of Sustainable Development (SDG), was "the eradication of poverty in all its forms and dimensions" (UN, 2015, p. 5).

The study of poverty allows us to investigate what factors affecting the poverty level. The economic literature highlights the main factors that present a direct relationship with poverty: economic inequality (Ravallion, 1995; World Bank, 1990), informality (INEI, 2020; Rosenbluth, 1994), unemployment (Corcoran & Hill, 1980; Yamada & Montero, 2008), inflation (Easterly & Fischer, 2001), among other determinants.

While, among the factors that present an inverse relationship with poverty, the following stand out: economic growth (Ravallion, 1995; Mendoza & Garc ía, 2006; C éspedes, 2017a); education (Majumder & Chowdhury, 2017; Shack, 1999; Morrison, 2002); trade opening (Dollar & Kraay, 2004; Reina & Zuluaga, 2008), social spending and public transfers (C éspedes, 2017b; Del Pozo, 2015), access to information and communication technologies [ICT] (Yilmaz & Yalçinkaya, 2018; Bhavnani et al., 2008), among other factors.

Recently, financial inclusion has been highlighted as a factor that favors the achievement of 7 of the Sustainable Development Goals (SDGs) (World Bank, 2018), in addition, various authors and institutions at the international level highlight the role of financial inclusion in poverty alleviation. Specifically, access to financial services allows a credit or loan to be used to expand a business, start a business, have access to better education or health services, which improves the quality of life and, therefore, allows escape from poverty.

As a result, initiatives and organizations have emerged around the world to promote the development of financial inclusion as one of the public policy priorities. Thus, in the international arena, the G-20 Global Partnership for Financial Inclusion (GPFI) of the G-20 economic group, the Center for Financial Inclusion of Accion (CFI) of the global association CGAP and the Alliance for Financial Inclusion (AFI) of 90 developing countries, within which Peru participates as an associate member through the Superintendency of Banking, Insurance and AFP (AFI, 2021).

Additionally, at the national level (Peru) in 2015 the National Strategy for Financial Inclusion (NSFI) was established, and an initiative promoted by the Multisectoral Commission for Financial Inclusion (MCFI), whose members in charge came from the following institutions: the Ministry of Economy and Finance, the Ministry of Development and Social Inclusion, the Ministry of Education, the

Superintendence of Banking and Insurance, Alliance for Financial Inclusion, the Central Reserve Bank of Peru and the National Bank. Subsequently, in 2019, the National Financial Inclusion Policy (NFIP) was approved with the aim of promoting and facilitating the financial inclusion process through the execution of coordinated actions between the entities involved in the public and the private sectors (MEF, 2021).

According to the MEF (2021), the National Financial Inclusion Strategy [NFIS] served as the basis for the formulation of the NFIP, whose implementation was carried out based on five priority objectives (PO): PO#1. Generate greater confidence of all segments of the population in the financial system, PO#2. Have a supply of financial services sufficient and appropriate to the needs of the population, PO#3. Mitigate frictions in the functioning of the market, PO#4. Develop telecommunications infrastructure and digital platforms to increase the coverage of financial services for all segments of the population and PO#5. Strengthen the mechanisms for the articulation of institutional efforts.

So then, based on these objectives, as indicated by the SBS (2021), the NFIP seeks that financial services are offered efficiently, and are reliable, innovative, accessible, affordable and adequate to the needs of all segments of the population, in order to contribute to development and economic stability; and, on the other hand, have a positive impact on competitiveness, productivity, poverty reduction and inequality. It is important to highlight that such policy aims to obtain achievements in the three dimensions that financial inclusion comprises: Access, Use and Quality.

Considering the importance of financial inclusion for poverty reduction, which was mentioned in the previous paragraph, the study regarding the relationship between both variables is therefore relevant. Thus, in the international arena, authors such as Park and Mercado (2015), Céspedes et al. (2018), Zia and Prasetyo (2018), Agyemang-Badu et al. (2018), Erlando et al. (2020), Omar and Inaba (2020), Emara and Mohieldin (2020) and Ratnawati (2020) confirm that financial inclusion is a relevant factor for poverty reduction around the world.

Specifically, for the Peruvian case, the available empirical evidence mainly highlights the findings made by Schmied and Marr (2016) and ASBANC (2019). In particular, Schmied and Marr (2016) find that in Peru the effect of financial inclusion, measured through the dimension of access to financial services; on the reduction of poverty, is small and not significant for the period 2008 - 2010, while ASBANC (2019) finds that financial inclusion, measured through the use of financial services, has a statistically significant impact on the reduction of poverty for the period 2007-2015.

However, it should be noted that, although these studies address the contribution of financial inclusion on poverty reduction, in particular, both studies used a single indicator to measure financial inclusion. However, according to Sarma (2008) and Cámara and Tuesta (2014), the use of individual indicators would lead to an erroneous understanding of the scope of financial inclusion in a country, so its measurement requires a multidimensional perspective. Thus, in the case of this research, financial inclusion was measured through the multidimensional index of Sarma (2008), a methodology widely used in the world to measure financial inclusion.

In addition to the above studies, it should be noted that according to Figure 1, between 2010 and 2019, a declining poverty rates in different states in Peru is observed, while, with respect to financial inclusion, an increase is contemplated. In particular, in 2010 it is observed that the states with the highest poverty rates are Huancavelica (63%), Apurímac (62%), Cajamarca (55%) and Huánuco (55%) presenting low levels of financial inclusion.

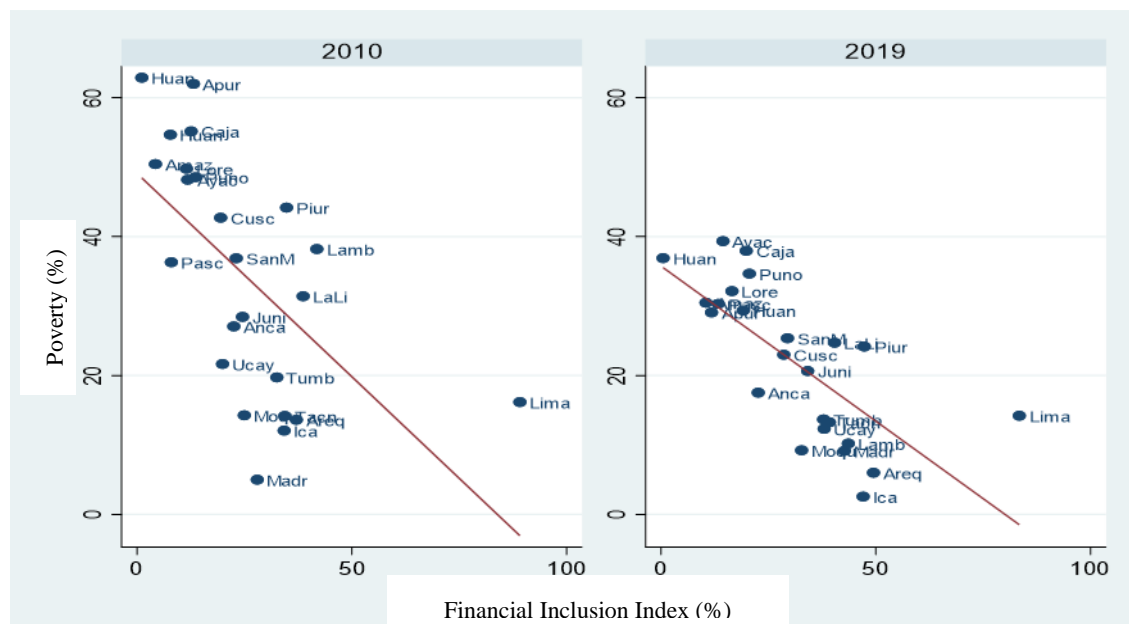


Figure 1. Dispersion between Poverty and Financial Inclusion in the Different States in Peru 2010 and 2019

Note. For purposes of a better visualization of the figure, the names of the departments are presented in a simplified way.

Source: National Household Survey (ENAHO) of the National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Subsequently, in 2019, in two states, Cajamarca and Huánuco, reduction of their poverty rates along with considerably increase in the financial inclusion rate was observed. Similarly, the states with the highest levels of financial inclusion (Lima, Arequipa, Ica and Lambayeque) present poverty rates of less than 15 percent. Thus, in a descriptive way, the existence of an inverse and favorable relationship between the poverty rate and Sarma's multidimensional indicator of financial inclusion can be evidenced. However, this association needs to be explored in greater detail through an econometric model in order to discover the contribution of financial inclusion on poverty reduction.

In this sense, considering the limitations of the measurement of financial inclusion carried out in the empirical studies for the Peruvian case like the data presented in Figure 1, the purpose of this research is to include new empirical evidence to the study of financial inclusion investigating the relationship

between financial inclusion and poverty in different states in Peru, using a multidimensional financial inclusion indicator. In order to achieve this purpose, the following question is posed as a research problem: Has financial inclusion contributed to the reduction of poverty in Peru during the period 2010 - 2019?

In response to this problem, a research hypothesis is established that financial inclusion has contributed to the reduction of poverty in different states in Peru during the period 2010-2019. So then, in order to contrast this hypothesis, this research is structured into eight sections: The first section addresses a brief introduction with emphasis on the problem and research hypothesis. In the second and third sections, the theoretical framework and review of the literature are presented. Subsequently, in the fourth section, a static panel data model is specified. Thus, in the fifth section, the main results of the investigation are presented, on which the conclusions are established in the sixth section. Finally, in the seventh and eighth sections, the references and annexes used in the development of this research are presented.

2. Theoretical Framework

This section presents the main transmission mechanisms that explain the link between financial inclusion and poverty. Likewise, a summary scheme is presented regarding the relationship of both variables under study.

2.1 The Nexus between Financial Inclusion and Poverty

Financial inclusion refers to the access and use of a series of financial products and services, including banking, savings, credit, insurance, payments, pensions, and remittances. According to the World Bank (2014), users who do not use formal financial services can be divided into two groups: those excluded voluntarily and those excluded involuntarily (See Figure 2). Within the involuntarily excluded population, the population with the following characteristics stands out: low income, low educated, high risk, discriminated against, informal, without access to information, among others; This social group being the ones with the greatest social vulnerability.

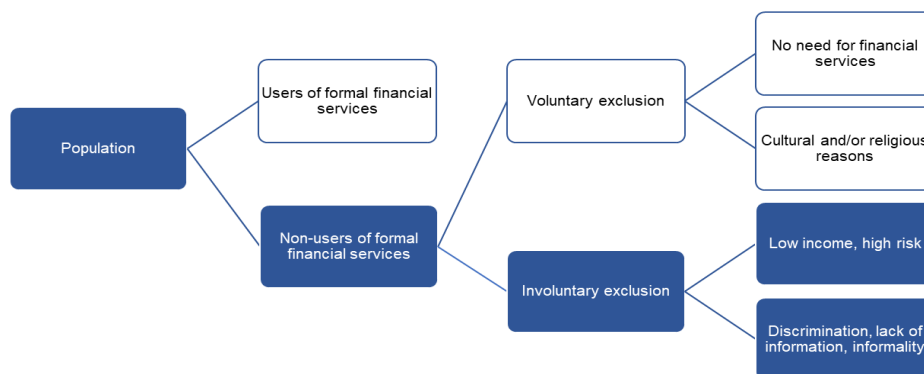


Figure 2. Use and Access to Financial Services

Source: World Bank (2014).

Elaboration: The authors.

Thus, in a context of financial exclusion, people must depend on their savings (which are limited) or finance themselves through informal means and could have difficult access to basic services such as getting a loan to finance education, health, food; to achieve their well-being. As for the corporate sphere, companies must depend on their profits for their growth and survival rather than having access to credits for further expansion of their business and job creation. As a result, both situations can contribute to aggravating poverty, in addition to having a negative impact on economic growth (World Bank, 2014).

It should be noted that in Peru it is common to see these forms of financing, mainly loans through relatives or acquaintances, boards and pawnshops. The characteristic of this group is the facilitate to grant credits, but most often it is in low amounts and high rates and since they are not regulated by the State, it allows situations of usury. This scenario negatively affects the segments excluded from the financial system, since, not being able to access a loan in a formal financial institution, they must go to informal means and pay the extra cost of the credit to finance any activity in mind.

Thus, the importance of financial inclusion in poverty reduction is manifested in the following transmission channels:

2.1.1 At the Population Level

An inclusive financial sector is characterized by the high proportion of inhabitants of an economy that use financial services, mainly from those sectors that are most vulnerable. In addition, it allows the efficient allocation of productive resources, therefore, it reduces the cost of access to capital.

Thus, individuals and households can have loans and credits, through a fair financing source, and with this, increase their level of consumption or invest in and have a greater access to quality services such as education, health and/or technology. For this reason, financial inclusion is a relevant element for the economic autonomy and empowerment of women, the poor and other excluded groups (Azar et al., 2018).

Additionally, people can use the capital for a venture or the acquisition of a business asset, thereby generating a source of employment and obtaining income. In this way, people can increase their level of well-being, having access to more opportunities, and therefore, get out of poverty and improving their standard of living.

On the other hand, access to the formal financial system provides the route to implement safe savings practices, allowing financial planning, which also has a positive impact on the well-being of the household and the community.

In this sense, financial inclusion plays a key role in reducing poverty and improving the living conditions of lower-income sectors, increasing prosperity and sustainable development (World Bank, 2018; Dev, 2006). For this reason, according to Canara and Tuesta (2014), access to formal financial services has the same relevance for the well-being of households, as well as income, health or housing.

In short, an inclusive economy is: (1) an economy that is designed to deliver inclusion and equity, (2) equitable distribution of the benefits from the economy (eg, assets, power, value), (3) equitable access

to the resources needed to participate in the economy (eg, health, education), and (4) the economy operates within global boundaries.

2.1.2 At the Business Level

Financial inclusion increases the productivity of companies and reduces informality, mainly in the most economically vulnerable sectors (SBS, 2015; World Bank, 2018). In Peru, most of the companies are small and informal, therefore, they are mostly excluded from the formal financial system. Among the disadvantages of this condition is the lack of access to credit at lower rates. In addition, these companies are not profitable enough to offer their employees any benefits such as a retirement plan or health insurance that allows them to live with dignity after their retirement.

In this sense, financial inclusion could change this paradigm. A greater participation of companies, particularly micro and small companies, in the formal financial sector could increase their access to credits and hence improve the productivity and also lower the risk through diversification of financing the business. Thus, a bank loan and/or a mortgage loan could be used for capital investment, improvement of the company's infrastructure and expansion of their business in new areas. This in turn could contribute to more job creation for the economy.

With this, the production of the firm and its competitiveness could increase, and in this way, the sustainability of the company is guaranteed over time. In addition, the workers of these companies can access better wage or salary, a pension plan for their retirement and health insurance, which is beneficial to improve their quality of life and alleviate poverty and lower income inequality gap in the long run. People will have a greater sense of belonging when they are empowered to participate in shaping public policies that affect them.

2.1.3 At the Government Level

In the last decade, financial inclusion has gained relevance around the world as a public policy instrument for closing pay gaps and productive insertion (Pérez & Titelman, 2018). In particular, through the opening of a savings account in a formal financial entity, governments can transfer subsidies and financial aid to the socially vulnerable population in a direct and more targeted manner. Thus, in Peru, social cash transfer programs such as JUNTOS, Pensi6n 65 or PRONABEC could increase their reach.

In addition, having a record of household data in the financial system can improve monitoring of the population's saving and spending practices, and with this, government can develop more targeted social assistance policies and improving efficiency in resource allocation. For its part, the government could direct credit programs at the business level, especially for micro and small businesses. Financial inclusion guarantees two important aspects; one is access to timely credit to stimulate production and investment and the second one is to ensure the repayment of the loans due to the greater transparency of information in a formal financial system. This in turn, guaranteeing the sustainability of the social programs.

2.2 Synthesis of the Transmission Mechanisms between Poverty and Financial Inclusion

Based on the previous discussion, it can be seen that financial inclusion is based on the following elements: use of financial services, ownership of financial services, access to credit and receipt of remittances.

Thus, this generates the following results: income, entrepreneurship, personal independence, social inclusion and investment in technology, education and health; which, finally, leads to the reduction of poverty (See Figure 3).



Figure 3. Conceptual Link between Poverty and Financial Inclusion

Source: Koomson et al. (2020).

Elaboration: The authors.

3. Literature Review

In this section, the main empirical findings, both internationally and at the local levels, regarding the contribution of financial inclusion on poverty are presented.

3.1 Findings at the International Level

Park and Mercado (2015) examine the impact of financial inclusion on poverty levels and income inequality for 37 developing countries in Asia between 2004 and 2012. For research purposes the authors used a model of linear regression, considering as dependent variables the levels of poverty and income inequality, both measured through the poverty incidence rate and the Gini coefficient, respectively.

For its part, financial inclusion was measured through the multidimensional index of Sarma (2008). Likewise, it was incorporated as a set of control variables: GDP per capita, the rule of law, the dependency ratio, the size of the population, the literacy rate, and a dummy variable associated with low-income economies. Regarding the results obtained in the research, the work identifies that financial inclusion has a significant impact on the reduction of poverty and income inequality.

Agyemang-Badu et al. (2018) investigate the relationship between financial inclusion, poverty, and income inequality for 48 African countries over the period 2004-2015, using a fixed-effects panel data model. Likewise, they used as dependent variables: poverty and income inequality, while, within the explanatory variables, in the first place, is financial inclusion, which was measured through 4 indicators: the number of ATMs per 100,000 adults, the number of bank branches per 100,000 adults, the number

of borrowers per 1,000 adults, and the number of savers per 1,000 adults.

On the other hand, as control variables, the educational level, economic growth, the rule of law, credit to the private sector, the size of the population and the dependency ratio were incorporated. The research findings reveal that financial inclusion and economic growth contribute to poverty reduction at a significance level of 1 percent, however, in the case of income inequality, financial inclusion did not show statistical significance.

Cespedes et al. (2018) measure the effect of financial inclusion on the levels of poverty and extreme poverty in the departments of Bolivia for the period 2005-2015, for this, they used a static panel data model with fixed effects. The model considers the incidence of moderate and extreme poverty in each of the departments of Bolivia as an endogenous variable. Regarding financial inclusion, the authors used financial service points per hundred thousand inhabitants for its measurement.

Additionally, a set of control variables was incorporated: financial deepening (deposit/GDP ratio), intensity of use of financial services (number of deposit accounts per 100,000 inhabitants), income inequality (Gini coefficient) and economic growth. The results of the research reveal that financial inclusion is the second most important factor for the reduction of extreme poverty only after economic growth, while, in the case of moderate poverty, it is the third variable with the greatest contribution to the reduction of extreme poverty. mitigation of this social problem.

Zia and Prasetyo (2018) analysis of the influence of financial inclusion on poverty alleviation and income inequality conducted for 33 provinces in Indonesia, between the years 2014-2016, by estimating using a panel data model. The study considers two dependent variables: the incidence rate of poverty and inequality. The first is measured through the poverty line of people who live for less than \$1.9 a day, while the second through the Gini coefficient.

For its part, financial inclusion was measured through a multidimensional index prepared from Sarma (2008), whose dimensions are bank penetration, the availability of banking services and the use of banking services. It should be noted that a particular aspect of research is the non-inclusion of control variables. The research findings reveal that financial inclusion is negatively and statistically significantly associated with the poverty rate. On the other hand, the correlation registered with income inequality was positive, although not statistically significant.

Emara and Mohieldin (2020) examine the impact of financial inclusion on extreme poverty for 34 countries, 11 in the Middle East and North Africa (MENA) and 23 in the emerging economies, using a dynamic panel data model over the period 1990-2017. The research work considered the extreme poverty incidence rate as a dependent variable, while financial inclusion was measured through the multidimensional index of financial inclusion whose components were the following: the number of ATMs per 100,000 adults, the number of accounts bank branches per 1,000 adults and the number of bank branches per 100,000 adults.

Additionally, a set of control variables was incorporated: economic growth, inflation, the degree of commercial openness, the size of the population, and access to cell phones. The findings of the study

report that access to financial services has a significant impact on poverty reduction at the level of the entire sample under study, as well as in those countries belonging to the MENA region, but not in the case of the emerging economies. For its part, within the group of control variables, only growth had a significant impact on the reduction of poverty.

Erlando et al. (2020) analyze the contribution of financial inclusion on economic growth, poverty, and income inequality for 12 provinces of eastern Indonesia between the years 2010-2016, using a Toda Yamamoto bivariate causality model and a VAR panel model. The study uses poverty, inequality, economic growth and unemployment as endogenous variables. For its part, within the research, each of the three dimensions of financial inclusion was considered as explanatory variables, which were elaborated based on the work of Sarma (2008). Additionally, two control variables were incorporated: public spending on education and public spending on infrastructure.

Among the main results of the research, first of all, it is highlighted that financial inclusion is relevant to reduce both poverty and economic inequality, while its impact on economic growth is positive and significant. Secondly, the variables that most affect poverty alleviation are access to financial services, economic growth and public spending on education.

Omar and Inaba (2020) analyze the impact of financial inclusion on the reduction of poverty and income inequality, for 116 developing countries during the period 2004-2016, using a panel data model whose estimation was carried out through the fixed effects estimator. The study considers as dependent variables: poverty and income inequality, where the first is measured by the poverty incidence rate and the second by the Gini coefficient.

For its part, financial inclusion was measured through a three-dimensional indicator (penetration, accessibility and use), which considered the work of Sarma for its preparation, as well as other authors. On the other hand, within the set of control variables, explanatory factors were incorporated such as: economic growth, secondary school attendance rate, bank credit to the private sector, the rule of law, public spending, and free trade.

The results of the research highlight with a significance level of 1 percent the contribution of financial inclusion to reduce poverty and income inequality, this variable in particular has the greatest marginal impact compared to the other explanatory variables of the model. On the other hand, regarding the control variables, the secondary school attendance rate and economic growth significantly affected the reduction of poverty.

Ratnawati (2020) measures the effect of financial inclusion on economic growth, poverty, income inequality and financial stability for 10 developing countries in Asia during the period 2009-2018, for which he used a model of dynamic panel data. The research work incorporates financial inclusion variables as those associated with the dimensions of penetration, access and use of banking services. On the other hand, as endogenous variables of the model, poverty, economic growth, income inequality and financial stability were considered. The author used the inflation rate as the only control variable.

As the main results of the research, it is found that financial inclusion allows reducing poverty and

income inequality at a significance level of 1 percent. For its part, in relation to the variables of economic growth and financial stability, financial inclusion demonstrates a positive contribution on these with a similar level of significance of 1 percent.

3.2 Specific Research Associated with Peru

Schmied and Marr (2016) examine the impact of financial inclusion on poverty reduction in the several states of Peru between 2008 and 2010, using a static panel data model with fixed effects. The study considers monetary poverty measured through three indicators (incidence, gap and severity) as a dependent variable, while financial inclusion was measured through access to credit. Additionally, a set of control variables was included, such as: per capita income, internet access, population size, education level, access to health services, employment level, social assistance, and degree of rurality.

The research results show that financial inclusion is not a significant factor in reducing poverty in those states included in the study. On the other hand, it is corroborated that the variables with the greatest preponderance for poverty reduction in the period under study are: Internet access, access to health services, employment, and economic growth.

For its part, the Association of Banks of Peru - ASBANC (2019) examines the relationship between financial inclusion and poverty in different states in Peru, for the period 2007-2015, using a panel data model with fixed effects. The study considers the poverty incidence rate as the dependent variable, while financial inclusion, measured through the relationship between credits and GDP, is the explanatory variable.

For the control variables, they used the level of education (illiteracy rate), the level of work (employment rate), the level of income (income per capita), the access to health services (rate of access to health insurance), the penetration of technology (households that have internet) and social spending (public spending on social programs).

The results of the research highlight financial inclusion as the most relevant variable to reduce poverty in the different states in Peru during the study period. Likewise, within the group of control variables, per capita income and spending showed a significant effect on the reduction of poverty levels.

4. Methodology

In this section, the research methodology is developed, which is based on the theoretical and econometric model, for purposes of contrasting the research hypothesis. Additionally, the operationalization of each of the variables that intervene in the theoretical and econometric model is presented, corresponding to the relationship between financial inclusion and poverty in the 24 states in Peru during the period of 2010-2019.

4.1 Theoretical Model

Taking as reference Sarma (2008), Park and Mercado (2015), Céspedes et al. (2018), Zia & Prasetyo (2018), Agyemang-Badu et al. (2018), Erlando et al. (2020), Omar and Inaba (2020), Emara & Mohieldin (2020) and Ratnawati (2020), to assess the contribution of financial inclusion on poverty, the

following theoretical model is proposed:

$$Pobr_{it} = f(IncFinan_{it}, PBIPC_{it}, DesIng_{it}, Inform_{it}, Educa_{it})$$

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In particular, an inverse relationship between poverty and financial inclusion (IncFinan) is postulated since, according to Park and Mercado (2015), Céspedes et al. (2018), Erlando et al. (2020), Omar and Inaba (2020), and Agyemang-Badu et al. (2018), financial inclusion contributes to reducing poverty through access to financial services. Thus, a person can use a credit or loan to access better health, technology and/or education services, as well as to acquire a business asset, which would allow generating a source of income. Additionally, access to savings and/or pension programs facilitates financial planning in families. All of these contribute to improving people's quality of life and, therefore, to reducing poverty.

Regarding the control variables, in the first place, economic growth (PBIPC) helps to reduce poverty according to the empirical evidence provided by Ravallion (1995), Mendoza and García (2006) and Céspedes (2017a). The authors argue that greater growth in the economy contributes to improving the macroeconomic conditions of a region and/or country, that is, it increases production, investment and public spending, which leads to higher levels of employment, an increase in income and better social programs, thus poverty levels are reduced and families improve their economic well-being.

Secondly, income inequality (DesIng) has a positive impact on the increase in poverty according to Ravallion (1995) and the World Bank (1990), since, if there is an inequitable distribution of income, the access to basic quality services is difficult, thus, the productivity of people decreases due to the diminished capacity of human capital. Thus, that population does not have the necessary living conditions to develop their full capacity and they live in a precarious situation (malnutrition, informal and poorly paid work, low-quality education and health services, among others). In this way, the economic vulnerability of these people is further aggravated, therefore, it would lead to increase in poverty levels.

Third, labor informality (Inform) is a factor associated with the increase in poverty according to INEI (2020), Rosenbluth (1994) and Devicienti et al. (2009), since informality implies access to low-quality, precarious, poorly paid work and without social protection, with this, people do not have the capacity for financial planning (they do not have savings, insurance or pension), Furthermore, they are unable to meet their basic needs in a timely manner due to their low income.

Finally, regarding the contribution of education (Educa) to alleviating poverty, authors such as Shack (1999), Majumder and Chowdhury (2017) and Morrison (2002) stand out. These authors point out that access to a better education offers greater possibilities for the development of human capital capacities, thus, a person will be more productive and competitive, will have access to formal employment, as well as have a better salary, all of which It will help improve their quality of life and get out of poverty.

4.2 Econometric Model

For the purposes of this research, the econometric model of static panel data to be estimated was the

following:

$$Pobr_{it} = \beta_0 + \beta_1 IncFinan_{it} + \beta_2 Ln(PBIPC_{it}) + \beta_3 DesIng_{it} + \beta_4 Inform_{it} + \beta_5 Ln(Educa_{it}) + \mu_{it}$$

$$\text{With: } \beta_3, \beta_4 > 0 \text{ y } \beta_1, \beta_2, \beta_5 < 0$$

Where: $\forall i = 1, 2, 3, 4, 5 \dots 24$ are the cross-sectional identifiers, in this case the 24 states of Peru; and $\forall t = 1, 2, 3, 4, 5, 6, 7, 8 \text{ y } 10$ years, namely: 2010 to 2019. The study sample contains 240 observations, that is $(N \times T) = (24 \times 10) = 240$ observations. Being a microeconomic panel since $N > T$ and balanced in the sense that all cross-sectional and time series observations are available.

Where, μ_{it} the model error term, defined as:

$$\mu_{it} = \alpha_i + \varepsilon_{it}$$

Where:

α_i : Represents unobservable heterogeneity by department.

ε_{it} : Represents the random error (Note 1).

As established in various panel data econometrics texts such as: Wooldridge (2002), Hsiao (2003), Arellano (2004), Frees (2004), Cameron and Trivedi (2005), Baltagi (2005, 2006), Baum (2006), Maty s and Sevestre (2008) and Green (2012); In static panel models, as is the case, the main problem to address is the possible existence of a correlation between the unobservable heterogeneity (α_i) per individual (in this case the 24 states in Peru) and the regressors of the model, which would consequently generate a bias in the estimators obtained. In this sense, to determine the appropriate estimation method in this type of model (either constant effects, fixed effects or random effects) the *Redundancy* and *Hausman* tests are used.

Under **the first test**, the existence or non-existence of unobservable heterogeneity per individual in the model is determined. The fixed effects estimator is the one used if the existence of said heterogeneity is corroborated, while if the opposite is the case, the estimator to be used is the constant effects estimator (Pool OLS). The redundancy test poses as a general hypothesis and specifies those described below:

$$H_0 : \alpha_1 = \alpha_2 = \alpha_3 = \dots = \alpha_N$$

$$H_1 : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \dots \neq \alpha_N$$

Where:

The null hypothesis (H_0) indicates that there are no unobservable effects per individual while the alternative hypothesis (H_1) indicates the opposite, that is, the existence of unobservable effects per individual (state). The rejection or acceptance of the null hypothesis established in the test will depend on the result of the comparison between the test (F_p) and calculated (F_c) statistics:

$$F_p = F(0,95, N - 1, NxT - N - K + 1)$$

$$F_c = \frac{(SRR - SRS)/(N - 1)}{SRS/(NxT - N - K + 1)}$$

Specifically:

N: Number of individuals (districts), NxT: Total observations of the model, K: Number of regressors in the model, SRR (Restricted Residual Sum, in this case of the constant effects model) and SRS (Unrestricted Residual Sum, in this case of the fixed effects model).

If:

$F_c > F_p$, then the null hypothesis is rejected and the model to be estimated is the fixed effects model.

$F_c < F_p$, then the null hypothesis is accepted and the model to be estimated is that of constant effects.

Under **the second test**, given the existence of unobservable heterogeneity per individual, if this is correlated with the regressors of the model, then the estimator to use is the fixed effects estimator. If the opposite case occurs, then the estimator to use is the random effects estimator. In this sense, the Hausman test with its respective null and alternative hypotheses is as follows:

$$H_0 : E(X_{it}, \alpha_i) = 0 ; \widehat{B}_{EF} = \widehat{B}_{EA}$$

$$H_1 : E(X_{it}, \alpha_i) \neq 0 ; \widehat{B}_{EF} \neq \widehat{B}_{EA}$$

Where:

The null hypothesis (H_0) indicates that the unobservable effects per individual are not correlated with the regressors of the model, or what is equivalent to saying that in statistical terms there is no systematic difference between the estimators of fixed effects (\widehat{B}_{EF}) and random effects (\widehat{B}_{EA}). For its part, the alternative hypothesis (H_1) indicates the opposite, that is, that the unobservable effects per individual are correlated with the regressors of the model or what is equivalent to saying that in statistical terms there is a systematic difference between the estimators of fixed effects (\widehat{B}_{EF}) and random effects (\widehat{B}_{EA}). Likewise, the rejection or acceptance of the null hypothesis established in the test will depend on the result of the comparison between the test statistics (χ_p^2) and calculated (W_c):

$$\chi_p^2 = \chi_{(0.95, k)}^2$$

$$W_c = (\widehat{\beta}_{EF} - \widehat{\beta}_{EA}) / (Var(\widehat{\beta}_{EF}) - Var(\widehat{\beta}_{EA}))$$

Matrixly:

$$W_c = (\widehat{\beta}_{EF} - \widehat{\beta}_{EA})' [Var(\widehat{\beta}_{EF}) - Var(\widehat{\beta}_{EA})]^{-1} (\widehat{\beta}_{EF} - \widehat{\beta}_{EA})$$

Specifically:

K: Number of regressors in the model, $\widehat{\beta}_{EF}$: Vector of coefficients estimated by fixed effects,

$\widehat{\beta}_{EA}$: Vector of coefficients estimated by random effects, $Var(\widehat{\beta}_{EF})$: Matrix of variances and covariances of the coefficients of the model estimated by fixed effects, $Var(\widehat{\beta}_{EA})$: Matrix of variances and covariances of the coefficients of the model estimated by random effects.

If:

$W_c > \chi_p^2$, then the null hypothesis is rejected and the model to be estimated is the fixed effects model.

$W_c < \chi_p^2$, then the null hypothesis is accepted and the model to be estimated is the random effects model.

4.3 Operationalization of the Variables of the Econometric Model

The information required for the development of this research was compiled from secondary institutional sources, specifically from the statistical series of the Regional Information System for

Decision-making (SIRTOD) - National Institute of Statistics and Informatics (INEI); of the National Household Survey (ENAHO) - National Institute of Statistics and Informatics (INEI) and the Superintendency of Banking, Insurance and AFP (SBS), Likewise, the variables compiled from said sources of information for the purposes of this investigation They were listed below:

- Poverty (POBR).
- Gross Domestic Product Per Capita (PBIPC).
- Gini coefficient (DESING).
- Labor informality (INFORM).
- Average years of education per individual (EDUCA).
- Financial inclusion index (INCFINAN).

The following table shows the operationalization of each of the variables described above.

Table 1. Operationalization of the Variables of the Econometric Model

VARIABLE	CONCEPT DEFINITION	OPERATIONAL DEFINITION	DIMENSIONS	INDICATORS	SCALE OF MEASUREMENT/ SOURCE OF INFORMATION
Dependent variable					
Poverty (POBR)	The World Bank (1990) defines poverty as the inability of a person to achieve a minimum standard of living, while Sen (1992) refers to it as the lack of basic capabilities for an individual to achieve their well-being and that does not depend of income or wealth.	Consumption or spending of a person below the total poverty line, which is equivalent to the cost of a basic family or consumption basket.	Monetary poverty	- Incidence (rate) of poverty (%)	Reason scale (%) / National Household Survey (ENAHO) - National Institute of Statistics and Informatics (INEI)
Independent variables					
Financial Inclusion (INCFINAN)	Sarma (2012) defines financial inclusion as the process that facilitates access, availability and use of quality financial services to all members of a society or country.	Financial inclusion index based on three dimensions commonly used in the world: access, use and availability.	- Financial or banking penetration - Use of financial services - Availability of financial services	Penetration: - Number of debtors in the financial system Use: - Credit/GDP ratio - Deposit/GDP ratio Availability: - Number of ATMs	Reason scale (%) / Superintendency of Banking, Insurance and AFP (SBS)

				per 100 000 adults	
				- Number of offices	
				per 100 000 adults	
Economic growth (PBIPC)	Kuznets (1973) defines economic growth as the increase in the capacity of a country or region to provide economic goods and services to its population, and this must be based on the advancement of technology, institutionality, and adjustments in ideology and culture society structure.	Economic growth refers to the percentage variation of the Gross Domestic Product Per Capita of the regions of Peru.	Gross Domestic Product Per Capita	Natural logarithm of real GDP per capita (S/ de 2007)	Reason scale (%) / Regional Information System for Decision Making (SIRTOD) - National Institute of Statistics and Informatics (INEI)
Income inequality (DESING)	The UN (2015) defines income inequality as the differentiated distribution of assets, income or wealth between a community, a country or region, and that this affects their consumption and/or well-being.	Income inequality is defined as the dispersion of income at the household level among the states of Peru.	Income inequality	Gini coefficient	Reason scale (%) / National Household Survey (ENAHO) - National Institute of Statistics and Informatics (INEI)
Labor informality (INFORM)	The ILO (1999) defines labor informality as that regime where its participants are underemployed in small-scale economic activities or who work in unincorporated companies, are poorly paid and do not have access to social protection.	Labor informality refers to the Employed Economically Active Population that: - It is salaried without social security by the employer. - It owns or works in an unincorporated company. - They are family workers and are not paid.	Economically Active Population	Labor informality rate	Reason scale (%) / Regional Information System for Decision Making (SIRTOD) - National Institute of Statistics and Informatics (INEI)
Education (EDUCA)	According to the World Bank (2020b), education is a human right and also an effective instrument to fight poverty, guarantee equality and promote development in a region.	Average years of education per individual of the population of each state of Peru	Educational achievement	Natural logarithm of the average years of education per individual by the population aged 15 and over	Reason scale (%) / Regional Information System for Decision Making (SIRTOD) - National Institute of Statistics and Informatics (INEI)

Elaboration: The authors.

5. Results and the Policy Instruments

As indicated in the previous section, for the purposes of estimating the panel data econometric model, the redundancy and Hausman tests were used. In particular, as seen in the Appendix 1, the statistical probability associated with the F statistic of the redundancy test presents a value below 5%, which leads to the conclusion that there is evidence of unobservable effects by states, which is why OLS is not the indicated method for the specified econometric model.

Thus, using the Hausman test (Appendix 2) the fixed effects estimators (Appendix 3) and random effects (Appendix 4) were evaluated, the resulting estimator being the fixed effects estimator according to the results presented in the test (Appendix 2). However, when evaluating the presence of heteroskedasticity (Appendix 5) and autocorrelation (Appendix 6) in the fixed effects model, using the Wald and Wooldridge tests, the presence of the econometric problems was confirmed, which affect the efficiency property of the estimators obtained.

Thus, using the specific panel method, these econometric problems were corrected, with the final estimate for analysis being the one shown in Appendix 7. This estimate is also characterized by the presence of low multicollinearity (Appendix 8) since all the correlations of the explanatory variables are below the multiple correlation coefficient of the econometric model corrected by the specific panel method (0.8890).

Additionally, the Jarque-Bera, Shapiro Wilk and Shapiro France tests (Appendix 9) confirm evidence in favor of the hypothesis of normality of the residuals of the estimated model. Therefore, the statistical inference of the model is valid. In this sense, the results obtained for the fixed effects estimator corrected for heteroscedasticity and autocorrelation through the specific panel method allow obtaining unbiased, consistent and efficient estimators, on which the research hypothesis is then contrasted.

So then, Table 2 consolidates the results of the static panel data model. In particular, column (5) corresponds to the fixed effects model, while column (6) to the fixed effects model corrected for heteroscedasticity and autocorrelation using the specific panel method. On the results reported in this column, the corresponding analysis of results is carried out below as a contrast to the research hypothesis.

Thus, the present investigation postulated as a hypothesis that financial inclusion has contributed to the reduction of poverty in different states in Peru during the period 2010-2019. In this regard, the hypothesis presents evidence is favorable, since the results reported in Table 2 allow us to appreciate that, for each 1 percentage point increase in the financial inclusion index, the poverty rate is reduced by 0.16 percentage points which indicates the marginal impact in turn is statistically significant at 1%. Likewise, the reported result for the contribution of financial inclusion in poverty level in Peru during the period 2010-2019, show correspondence with the studies reported internationally, specifically, Park and Mercado (2015), Agyemang-Badu et al. (2018), Céspedes et al. (2018), Zia and Prasetyo (2018), Erlando et al. (2020), Emara and Mohieldin (2020), Omar and Inaba (2020), Ratnawati (2020). Additionally, in this case, the reported result for financial inclusion shows correspondence with the empirical work carried out by ASBANC (2019).

Table 2. Results of the Panel Data Econometric Model

Variables	Dependent variable: Incidence (rate) of monetary poverty					
	(1)	(2)	(3)	(4)	(5)	(6)
Multidimensional Financial Inclusion Index	-0.702*** (0.117)	-0.586*** (0.088)	-0.383*** (0.084)	-0.292*** (0.080)	-0.246*** (0.079)	-0.161*** (0.057)
Natural logarithm of GDP per capita in 2007 soles		-0.214*** (0.017)	-0.161*** (0.017)	-0.139*** (0.016)	-0.129*** (0.016)	-0.0613*** (0.019)
Coeficiente de Gini			0.890*** (0.126)	0.825*** (0.117)	0.669*** (0.125)	0.635*** (0.106)
Tasa de informalidad laboral				0.761*** (0.128)	0.600*** (0.135)	0.307** (0.126)
Natural logarithm of average years of education					-0.511*** (0.160)	-0.388*** (0.135)
$\hat{\beta}_0$	0.467*** (0.033)	2.431*** (0.154)	1.506*** (0.191)	0.702*** (0.222)	1.938*** (0.445)	1.258*** (0.375)
Observations	240	240	240	240	240	240
Probability>F Statistic	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.144	0.520	0.611	0.667	0.682	0.790
Numbers of states	24	24	24	24	24	24

Note. *** p<0,01 ** p<0,5 * p<0,1

Fuente: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

However, although the econometric results obtained show that financial inclusion has contributed to the reduction of poverty in Peru during the period 2010-2019, it should be noted that, according to the order of importance, with respect to the control variables, financial inclusion is the fourth explanatory factor for poverty reduction. In particular, this result is based on comparing the marginal impacts associated with each of the explanatory variables. Thus, given a 1 percentage point increase in financial inclusion, a 1 percentage increase in GDP per capita, and a 1 percentage increase in average years of education per individual, the poverty rate is reduced by 0.16, 0.06 and 0.38 percentage points, respectively. For its part, given a reduction of 1 percentage point in both income inequality and the informality rate, the poverty rate is reduced by 0.64 and 0.31 percentage points, respectively.

Thus, in terms of reducing poverty rates in terms of percentage points, the marginal impact associated with reductions in income inequality and the labor informality rate is greater than the impact associated with increasing financial inclusion, economic growth and education, respectively. However, this does not diminish the importance of economic growth, education and financial inclusion in the fight against

poverty. In this sense, the contribution associated with financial inclusion in the reduction of poverty, whose level of statistical significance is 1%; It allows us to establish that financial inclusion is highly relevant for the fight against poverty in Peru. Thus, given the inverse and statistically significant relationship between financial inclusion and poverty, for the poor to be included into the financial system constitutes a greater range of opportunities for income generation and, therefore, a reduction in poverty.

Additionally, the contribution obtained for financial inclusion on poverty in Peru during the period 2010-2019 shows that for Peru it has been very relevant to promote the implementation of policy instruments such as the National Strategy for Financial Inclusion (NSFI) and the National Financial Inclusion Policy (NFIP). In particular, the National Strategy for Financial Inclusion implemented in Peru, was structured under the pillars of Access, Use and Quality and seven lines of action: Savings, Payments, Financing, Insurance, Consumer Protection, Financial Education and Vulnerable Groups (CMIF, 2015). Each of these pillars as lines of action have made it possible to boost access to the financial sector system, one of its main results being the reduction of poverty.

On the other hand, the National Financial Inclusion Policy (NFIP) was established in Peru based on the following five priority objectives (MEF, 2019):

- **Priority Objective 1 (PO1):** Generate greater confidence of all segments of the population in the financial system. This means improving the financial skills and capacities of all segments of the population; generate communication strategies aimed at all segments of the population, with linguistic relevance, gender and intercultural focus, disability perspective, by age group, among others; implement mechanisms that promote access and use of formal financial services, with special attention to the population with less access.
- **Priority Objective 2 (PO2):** Have a supply of financial services that is sufficient and appropriate to the needs of the population. For this, it is necessary to increase the coverage of convenient and accessible channels; encourage the development of innovative, affordable, convenient and accessible channels; encourage the offer of simple, innovative, safe, efficient and appropriate services.
- **Priority Objective 3 (PO3):** Mitigate the frictions in the functioning of the market. This requires promoting the reduction of information costs, strengthening risk centres and promoting the use of alternative sources and services for information analysis; strengthen population protection systems and proper management of market behaviour of financial service providers; promote a regulatory framework appropriate to the evolution of innovation trends in the financial field, preserving the stability of the financial system; and promote the development of financial services in a context of free competition.
- **Priority Objective 4 (PO4):** Develop telecommunications infrastructure and digital platforms to increase the coverage of financial services, which is based on developing telecommunications infrastructure to make financial services available to all segments of the population, as well as developing digital platforms in order to promote collaboration, interoperability, authentication, digital security and optimized use of digital technologies.

- **Priority Objective 5 (PO5):** Strengthen the mechanisms for the articulation of institutional efforts. For this, it is necessary to generate sustainable mechanisms (institutional arrangements) of articulation between the institutions, establish the adequate role of public financial institutions in government policies for financial inclusion, specify the functions of the actors for a better efficiency of public management and develop management instruments and mechanisms for articulation between public and private institutions and civil society.

Each of these objectives leads to greater vitality of financial inclusion in the country, which in turn translates into better results in fighting against poverty. In this sense, the promotion, development and implementation of policy instruments aimed at the promotion and dynamism of financial inclusion in the country, constitutes a tool for the fight against poverty, which in turn can complement its impact with the other explanatory factors of poverty considered for the purposes of this research: economic growth, income inequality, labor informality and education, variables on which, below, a brief reflection is made on the results shown in Table 2.

Now we are going to discuss the impacts of other factors on reduction of poverty including economic growth, income inequality, access to employment and education. With respect to the economic growth in Peru, with a significance level of 1%, it is identified that for each 1 percent increase in GDP per capita, the poverty rate is reduced by 0.06 percentage points. These results show correspondence with what was indicated by Ravallion (1995), Mendoza and Garc ía (2006) and Céspedes (2017a), authors who maintain that economic growth is favourable for poverty reduction. In this sense, in different states in Peru it is feasible to continue with the revitalization of economic activity, which allows individuals to enter the labor market, obtaining income that allows them to access a basic consumption basket, thus reducing poverty levels existing between them.

Regarding income inequality, this variable presents a direct and statistically significant relationship at 1% with the poverty rate. According to the results of the econometric estimation, it can be seen that for each percentage point increase in the Gini coefficient (income inequality), poverty increases by 0.64 percentage points. The results obtained show correspondence with the arguments raised by Ravallion (1995) and the World Bank (1990), authors who specify that the higher the income inequality, the economic vulnerability of people is further aggravated, therefore, it would allow an increase in poverty levels.

Regarding labor informality, with a significance level of 5%, a direct relationship with poverty is confirmed, which reflects that, for each increase of one percentage point in the labor informality rate, the poverty rate increases by 0.31 percentage points. This result shows evidence in favour of the arguments indicated by INEI (2020), Rosenbluth (1994) and Devicienti et al. (2009), authors who establish that informality increases poverty since access to low-quality, precarious, low-paid work and without social protection means that individuals cannot satisfy their basic needs in a timely manner due to his low income.

In addition to the above discussion, Tenjo (2001) indicates that the income of the poor is low due to the limited employment opportunities they face in the labor market given their low endowment of human

capital. Likewise, the author points out that the difference in income between the poor and the rich is not due to quantitative aspects, but that there are also unobservable aspects and a functioning of the labor market that discriminates against the poor, with its predominance being a particular characteristic of poverty. Among the families of workers in the informal sector, which would also be confirmed for the Peruvian case given the positive relationship between poverty and labor informality resulting from the static panel data model estimated for the purposes of this research.

Finally, in relation to education, the results obtained show that with a significance level of 1%, said variable is inversely related to poverty. Likewise, it is evident that for each 1 percent increase in the average number of years of education, the poverty incidence rate is reduced by 0.39 percentage points. Therefore, the result associated with the education variable shows correspondence with what was indicated by Shack (1999), Majumder and Chowdhury (2017) and Morrison (2002), authors who emphasize that access to a better education offers greater possibilities for the development of human capital capabilities for the individual. This in turn allows the individual to access a high pay job, which will lead to a better quality of life and, therefore, to get out of poverty.

Having carried out the contrast of the research hypothesis as well as the analysis of the results of the control variables: economic growth, income inequality, labor informality and education, the main conclusions of the research are presented below.

6. Conclusion Remarks

The purpose of this research was to determine the contribution of financial inclusion on the reduction of poverty in Peru during the period 2010 -2019, the general research hypothesis was that financial inclusion has contributed to the reduction of poverty in Peru during the period 2010-2019.

Based on the results obtained, the following conclusions can be drawn mainly:

1. During the period 2010-2019, the existence of evidence in favour of the research hypothesis is confirmed, since the results obtained show that financial inclusion has contributed favourably to the reduction of poverty in Peru during the period under study. In this sense, financial inclusion can be constituted as a relevant factor of public policy to continue making progress in terms of the first objective of sustainable development by the year 2030: The end of poverty.
2. The control variables that present an inverse relationship with poverty are economic growth and education, whose significance level is 1%. In particular, the estimated impacts reveal that for every 1 percent increase in GDP per capita and years of education, the poverty rate is reduced by 0.06 and 0.39 percentage points, respectively.
3. Finally, the control variables that present a direct relationship with poverty are income inequality and labor informality. In particular, it is evident that for each 1 percentage point increase in the Gini coefficient and labor informality rate, poverty increases by 0.64 and 0.31 percentage points, respectively.

References

- Agyemang-Badu, A. A., Agyei, K., & Kwaku, E. (2018). Financial Inclusion, Poverty and Income Inequality: Evidence from Africa. *Spirit International Journal of Poverty Studies*, 2(2). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3167200#:~:text=The%20study%20found%20that%20financial,in%20the%20selected%20African%20countries.
- Alliance for Financial Inclusion [AFI]. (2021). *Members Institutions*. Retrieved from https://www.afi-global.org/sites/default/files/inline-files/AFI%20Official%20Members_09%20Feb%202021.pdf
- Arellano, M. (2004). *Panel Data Econometrics*. United States: Oxford University Press Inc., New York.
- Association of Banks of Peru [ASBANC]. (2019). *Financial inclusion as a determinant of poverty reduction in Peru: an analysis at the departmental level*. ASBANC Publications. Retrieved from <https://www.asbanc.com.pe/Publicaciones/INCLUSION%20FINANCIERA%20Y%20POBREZA.pdf>
- Azar, K., Lara, E., & Mejía, D. (2018). *Financial Inclusion of Women in Latin America: current situation and policy recommendations*. CAF: Public Policies and Productive Transformation Series No. 30. <https://scioteca.caf.com/handle/123456789/1162>
- Baltagi, B. (2005). *Econometric Analysis of Panel Data* (3rd ed.). John Wiley & Sons Ltd: England.
- Baltagi, B. (2006). *Panel Data Econometrics*. Theoretical Contributions and Empirical Applications. United States: Elsevier, Department of Economics and Center for Policy Research Syracuse University.
- Baum, C. (2006). *An Introduction to Modern Econometrics Using Stata*. Texas: StataCorp LP.
- Bhavnani, A., Won-Wai, R., Janakiram, S., & Silarszky, P. (2008). *The role of mobile phones in sustainable rural poverty reduction*. World Bank: ICT policy division. Retrieved from <http://documents1.worldbank.org/curated/en/644271468315541419/pdf/446780WP0Box321bile1Phones01PUBLIC1.pdf>
- Cánara, N., & Tuesta, D. (2014). *Measuring Financial Inclusion: A Multidimensional Index*. BBVA Research: Working Paper No. 14/26. Retrieved from https://www.bbvarsearch.com/wp-content/uploads/2014/09/WP14-26_Financial-Inclusion2.pdf
- Cameron, C., & Trivedi, P. (2005). *Microeconometrics*. Methods and Applications. United States: Cambridge University Press.
- Céspedes, A., Cossio, J., & Calle, A. (2018). Financial inclusion and poverty in Bolivia. Bolivian Central Bank. *Analysis Magazine*, 29, 83-126. https://www.bcb.gob.bo/webdocs/publicacionesbcb/revista_analisis/ra_vol29/articulo_3_v29.pdf
- Céspedes, N. (2017a). *Economic growth and poverty in the regions and in the economic sectors of Peru*. Peruvian Economic Association: Working Document No. 109. Retrieved from <http://perueconomics.org/wp-content/uploads/2014/01/WP-109.pdf>

- Céspedes, N. (2017b). Public and private transfers and their importance in poverty. *Economic Studies Magazine*, 34, 77-96.
<https://www.bcrp.gob.pe/docs/Publicaciones/Revista-Estudios-Economicos/34/ree-34-cespedes.pdf>
- Corcoran, M., & Hill, M. S. (1980). Unemployment and poverty. *Social Service Review*, 54(3), 407-413.
<https://doi.org/10.1086/643847>
- Del Pozo, C. (2015). Transfers, credit and agricultural assets in Peru. *Economic and Social Research Consortium [CIES]: Economía & Sociedad*, 86.
https://www.cies.org.pe/sites/default/files/files/articulos/economiaysociedad/02-del_pozo.pdf
- Dev, S. M. (2006). Financial Inclusion: Issues and Challenges. *Economic and Political Weekly*, 41(41), 4310-4313. <https://www.jstor.org/stable/4418799?seq=1>
- Devicienti, F., Groisman, F., & Poggi, A. (2009). *Informality and poverty: Are these processes dynamically interrelated? Evidence from Argentina*. Working Papers 146, ECINEQ, Society for the Study of Economic Inequality. <http://www.ecineq.org/milano/WP/ECINEQ2009-146.PDF>
- Dollar, D., & Kraay, A. (2004). Trade, Growth and Poverty. *The Economic Journal*, 493, F22-F49.
<https://doi.org/10.1111/j.0013-0133.2004.00186.x>
- Easterly, W., & Fischer, S. (2001). Inflation and the Poor. *Journal of Money, Credit and Banking*, 33(2), 160-178. <https://doi.org/10.2307/2673879>
- Emara, N., & Mohieldin, M. (2020). Financial inclusion and extreme poverty in the MENA region: a gap analysis approach. *Review of Economics and Political Science*, 5(3).
<https://doi.org/10.1108/REPS-03-2020-0041>
- Erlando, A., Riyanto, F., & Masakazu, S. (2020). Financial inclusion, economic growth, and poverty alleviation: evidence from eastern Indonesia. *Heliyon*, 6(10), e05235.
<https://doi.org/10.1016/j.heliyon.2020.e05235>
- Frees, E. (2004). *Longitudinal and Panel Data. Analysis and Applications in the Social Sciences*. United States: Cambridge University Press.
- Greene, W. (2012). *Econometric Analysis*. United States: New York University. Prentice Hall.
- Hsiao, C. (2003). *Analysis of Panel Data*. United States: Cambridge University Press.
- International Labor Organization [OIT]. (1999). *International Labor Conference: Report of the Director General*. International Labor Office Geneva. Retrieved from <https://www.ilo.org/public/spanish/standards/relm/ilc/ilc87/rep-i.htm>
- Koomson, I., Villano, R. A., & Hadley, D. (2020). *Effect of Financial Inclusion on Poverty and Vulnerability to Poverty: Evidence Using a Multidimensional Measure of Financial Inclusion*. Social Indicators Research. <https://doi.org/10.1007/s11205-019-02263-0>
- Kuznets, S. (1973). Modern Economic Growth: Findings and Reflections. *The American Economic Review*, 63(3), 247-258. <https://www.jstor.org/stable/1914358?seq=1>

- Majumder, S., & Chowdhury, S. (2017). The role of education in poverty alleviation: evidence from Bangladesh. *Journal of Economics and Sustainable Development*, 8(20).
<https://core.ac.uk/download/pdf/234648043.pdf>
- Matyas, L., & Sevestre, P. (2008). *The Econometrics of Panel Data*. Fundamentals and Recent Developments in Theory and Practice. Third Edition. Busapest and Paris: Springer.
- Mendoza, W., & Garc ía, J. (2006). *Peru, 2001 – 2005: Economic growth and poverty*. Pontifical Catholic University of Peru: Working document 250. Retrieved from
<http://files.pucp.edu.pe/departamento/economia/DDD250.pdf>
- Ministry of Economy and Finance [MEF]. (2019). *The National Financial Inclusion Policy is approved and Supreme Decree No. 029-2014-EF, which creates the Multisectoral Commission for Financial Inclusion, is modified*. Retrieved from
<https://www.gob.pe/institucion/mef/campa%C3%B1as/242-politica-nacional-de-inclusion-financiera>
- Ministry of Economy and Finance [MEF]. (2021). *National Financial Inclusion Policy*.
<https://www.gob.pe/institucion/mef/campa%C3%B1as/242-politica-nacional-de-inclusion-financiera>
- Morrison, C. (2002). *Health, Education and Poverty Reduction*. OECD Development Centre: Policy brief No. 19. <http://www.oecd.org/countries/tanzania/1851366.pdf>
- Multisectoral Commission for Financial Inclusion [CMIF]. (2015). *National Strategy for Financial Inclusion: Peru*. <https://www.mef.gob.pe/contenidos/archivos-descarga/ENIF.pdf>
- National Institute of Statistics and Informatics [INEI]. (2020). *Informal production and employment in Peru: satellite account of the informal economy 2007-2019*. INEI: digital publications.
https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1764/libro.pdf
- Omar, M. A., & Inaba, K. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data an álysis. *Journal of Economic Structures*, 9(37).
<https://doi.org/10.1186/s40008-020-00214-4>
- Park, C., & Mercado, R. (2015). *Financial inclusion, poverty, and income inequality in developing Asia*. ADB Economics Working Paper Series No 426. <https://doi.org/10.2139/ssrn.2558936>
- P érez, E., & Titelman, D. (2018). *Financial inclusion for productive insertion and the role of development banks*. ECLAC: Publications. Retrieved from
https://repositorio.cepal.org/bitstream/handle/11362/44213/1/S1800568_es.pdf
- Ratnawati, K. (2020). The impact of financial inclusion on economic growth, poverty, income inequality and financial stability in Asia. *The Journal of Asian Finance, Economics and Business*, 7(10), 73-85.
<https://doi.org/10.13106/jafeb.2020.vol7.no10.073>
- Ravallion, M. (1995). Growth and poverty: Evidence for developing countries in the 1980s. *Economics Letters*, 48, 411-417. [https://doi.org/10.1016/0165-1765\(94\)00620-H](https://doi.org/10.1016/0165-1765(94)00620-H)
- Reina, M., & Zuluaga, S. (2008). *Trade and poverty: comparative analysis of the evidence for Latin America*. ECLAC: international trade series No. 87. Retrieved from
https://repositorio.cepal.org/bitstream/handle/11362/4431/1/S0800389_es.pdf

- Rosenbluth, G. (1994). *Informality and poverty in Latin America*. ECLAC Magazine No. 54, 157-178.
https://repositorio.cepal.org/bitstream/handle/11362/11941/1/052157177_es.pdf
- Sarma, M. (2008). *Index of Financial Inclusion*. Indian Council for Research on International Economic Relations: Working Paper No. 215. http://www.icrier.org/pdf/Working_Paper_215.pdf
- Sarma, M. (2012). *Index of Financial Inclusion – A measure of financial sector inclusiveness*. Money, Finance, Trade and Development: Working Paper No. 07. Retrieved from https://finance-and-trade.htw-berlin.de/fileadmin/HTW/Forschung/Money_Finance_Trade_Development/working_paper_series/wp_07_2012_Sarma_Index-of-Financial-Inclusion.pdf
- Schmied, J., & Marr, A. (2016). Financial inclusion and poverty: the case of Peru. *Regional and Sectorial Economic Studies*, 16(2), 29-43.
- Sen, A. (1992). *Inequality Reexamined*. Oxford University Press. Retrieved from <https://oxford.universitypressscholarship.com/view/10.1093/0198289286.001.0001/acprof-9780198289289>
- Shack, N. (1999). *Poverty, inequality and education in Peru today: a quantitative approach*. Master's Thesis. University of Chile, Department of Industrial Engineering. Retrieved from <http://www.mgpp.cl/wp-content/uploads/2017/04/CASO32.pdf>
- Superintendency of Banking, Insurance and AFP [SBS]. (2015). *Estrategia Nacional*. SBS: Portal de Inclusión Financiera. Retrieved from <https://www.sbs.gob.pe/inclusion-financiera/Politica-Nacional/Estrategia-Nacional>
- Superintendency of Banking, Insurance and AFP [SBS]. (2021). *Summary of the National Financial Inclusion Policy (PNIF)*. Retrieved from https://www.sbs.gob.pe/Portals/4/jer/EST-MONITOREO-ENIF/Documento%20Resumen_PNIF.PDF
- Tenjo, J. (2001). *Poverty and Labor Markets*. CEDE Documents No. 2001-10, Center for Studies on Economic Development (CEDE). University of Los Andes, Bogota-Colombia.
- United Nations [UN]. (2015). *Concepts of inequality*. Development Issues Series No. 1. <https://www.un.org/development/desa/dpad/publication/no-1-concepts-of-inequality/>
- Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. United States of America: Massachusetts Institute of Technology.
- World Bank. (1990). *World Development Report 1990: Poverty*. Oxford University Press. <https://openknowledge.worldbank.org/handle/10986/5973>
- World Bank. (2014). *Global Financial Development Report 2014: Financial Inclusion*. Washington, DC: World Bank. Retrieved from <https://openknowledge.worldbank.org/bitstream/handle/10986/16238/9780821399859.pdf?sequence=4&isAllowed=y>
- World Bank. (2018). *Financial Inclusion*. Retrieved from <https://www.bancomundial.org/es/topic/financialinclusion/overview>
- World Bank. (2020a). *Understanding Poverty*. <https://www.worldbank.org/en/understanding-poverty>

- World Bank. (2020b). *Education*. World Bank: Understanding poverty. Retrieved from <https://www.bancomundial.org/es/topic/education/overview>
- Yamada, G., & Montero, R. (2008). *Unemployment, poverty and social protection strategies*. Research Center of the University of the Pacific. Retrieved from <https://repositorio.up.edu.pe/bitstream/handle/11354/337/DD0803.pdf?sequence=1>
- Yilmaz, R., & Yalçinkaya, J. (2018). The contribution of ICT to poverty reduction: a panel data evidence. *Social Sciences Research Journal*, 7(4), 63-75. <https://dergipark.org.tr/tr/download/article-file/580921>
- Zia, I. Z., & Prasetyo, P. E. (2018). Analysis of Financial Inclusion Toward Poverty and Income Inequality. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, 19(1), 114-125. <https://doi.org/10.23917/jep.v19i1.5879>

Note 1. The subscripts represent the region “I” and the time “t” (year) respectively.

Appendix

Appendix 1. Static Panel Data Model Redundancy Test

Fixed-effects (within) regression	Number of obs	=	240
Group variable: id	Number of groups	=	24
R-sq:	Obs per group:		
within = 0.6823	min =		10
between = 0.7510	avg =		10.0
overall = 0.7285	max =		10
corr(u_i, Xb) = -0.7445	F(5, 211)	=	90.64
	Prob > F	=	0.0000

Pobr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Incfinan	-.2456839	.0794365	-3.09	0.002	-.4022747	-.0890931
Ln_PBIPC	-.1291402	.0158861	-8.13	0.000	-.1604561	-.0978244
DesIng	.6685655	.12481	5.36	0.000	.4225313	.9145997
Inform	.5998249	.1348399	4.45	0.000	.3340189	.8656308
Ln_Educa	-.5101944	.1601099	-3.19	0.002	-.8258144	-.1945744
_cons	1.938462	.4450563	4.36	0.000	1.061135	2.815788
sigma_u	.10827065					
sigma_e	.03176387					
rho	.92075206	(fraction of variance due to u_i)				

F test that all u_i=0: F(23, 211) = **43.70** Prob > F = **0.0000**

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 2. Hausman's Test

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) mef	(B) mea		
Incfinan	-.2456839	-.1430055	-.1026784	.0418854
Ln_PBIPC	-.1291402	-.1139976	-.0151426	.0036952
DesIng	.6685655	.8228713	-.1543058	.038724
Inform	.5998249	.4739242	.1259006	.0316402
Ln_Educa	-.5101944	-.3792697	-.1309247	.0432191

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
 = 20.39
 Prob>chi2 = 0.0011
 (V_b-V_B is not positive definite)

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 3. Fixed Effects Model

Fixed-effects (within) regression
 Group variable: id

Number of obs = 240
 Number of groups = 24

R-sq:
 within = 0.6823
 between = 0.7510
 overall = 0.7285

Obs per group:
 min = 10
 avg = 10.0
 max = 10

corr(u_i, Xb) = -0.7445

F(5, 211) = 90.64
 Prob > F = 0.0000

Pobr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
Incfinan	-.2456839	.0794365	-3.09	0.002	-.4022747 - .0890931
Ln_PBIPC	-.1291402	.0158861	-8.13	0.000	-.1604561 - .0978244
DesIng	.6685655	.12481	5.36	0.000	.4225313 .9145997
Inform	.5998249	.1348399	4.45	0.000	.3340189 .8656308
Ln_Educa	-.5101944	.1601099	-3.19	0.002	-.8258144 - .1945744
_cons	1.938462	.4450563	4.36	0.000	1.061135 2.815788
sigma_u	.10827065				
sigma_e	.03176387				
rho	.92075206	(fraction of variance due to u_i)			

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 4. Random Effects Model

Random-effects GLS regression
 Group variable: **id**

Number of obs = **240**
 Number of groups = **24**

R-sq:
 within = **0.6751**
 between = **0.7638**
 overall = **0.7438**

Obs per group:
 min = **10**
 avg = **10.0**
 max = **10**

corr(u_i, X) = **0** (assumed)

Wald chi2(5) = **475.08**
 Prob > chi2 = **0.0000**

Pobr	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Incfinan	-.1430055	.0674964	-2.12	0.034	-.275296	-.0107149
Ln_PBIPC	-.1139976	.0154504	-7.38	0.000	-.1442798	-.0837154
DesIng	.8228713	.1186507	6.94	0.000	.5903202	1.055422
Inform	.4739242	.1310751	3.62	0.000	.2170217	.7308268
Ln_Educa	-.3792697	.1541665	-2.46	0.014	-.6814304	-.0771089
_cons	1.507495	.4277084	3.52	0.000	.6692014	2.345788
sigma_u	.07245414					
sigma_e	.03176387					
rho	.8387895	(fraction of variance due to u_i)				

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 5. Fixed Effects Model Heteroskedasticity Analysis: Wald Test

Modified Wald test for groupwise heteroskedasticity
 in fixed effect regression model

H0: $\sigma(i)^2 = \sigma^2$ for all i

chi2 (24) = **235.69**
 Prob>chi2 = **0.0000**

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 6. Fixed Effects Model Autocorrelation Analysis: Wooldridge Test

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 23) = **43.458**
 Prob > F = **0.0000**

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 7. Correction of Heteroskedasticity and Autocorrelation - Specific Panel Method

Prais-Winsten regression, heteroskedastic panels corrected standard errors

```

Group variable:    id                Number of obs   =    240
Time variable:    Año                Number of groups =    24
Panels:           heteroskedastic (balanced)  Obs per group:
Autocorrelation: common AR(1)                min =    10
                                                avg =    10
                                                max =    10

Estimated covariances =    24      R-squared      =    0.7904
Estimated autocorrelations =    1      Wald chi2(5)    =    449.17
Estimated coefficients =    6      Prob > chi2     =    0.0000
  
```

Pobr	Het-corrected		z	P> z	[95% Conf. Interval]	
	Coef.	Std. Err.				
Incfinan	-.1613086	.0567753	-2.84	0.004	-.2725861	-.0500312
Ln_PBIPC	-.0613038	.0194386	-3.15	0.002	-.0994029	-.0232048
DesIng	.6350546	.1055134	6.02	0.000	.428252	.8418571
Inform	.3070046	.125687	2.44	0.015	.0606626	.5533465
Ln_Educa	-.3881348	.1351032	-2.87	0.004	-.6529321	-.1233375
_cons	1.258465	.3752387	3.35	0.001	.5230111	1.99392
rho	.7699394					

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendencia of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 8. Simple Correlations Matrix

	Pobr	Incfinan	Ln_PBIPC	DesIng	Inform	Ln_Educa
Pobr	1.0000					
Incfinan	-0.6759 0.0000	1.0000				
Ln_PBIPC	-0.6537 0.0000	0.4198 0.0000	1.0000			
DesIng	0.7034 0.0000	-0.4806 0.0000	-0.3410 0.0000	1.0000		
Inform	0.7819 0.0000	-0.8073 0.0000	-0.7580 0.0000	0.5038 0.0000	1.0000	
Ln_Educa	-0.8098 0.0000	0.7203 0.0000	0.7637 0.0000	-0.6486 0.0000	-0.8657 0.0000	1.0000

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendencia of Banking, Insurance and AFP (SBS).

Elaboration: The authors.

Appendix 9. Evaluation of the Normality of the Residuals of the Fixed Effects Model Corrected for Heteroscedasticity and Autocorrelation - Specific Panel Method

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Joint test	
				Adj chi2(2)	Prob>chi2
epobr	240	0.9177	0.4685	0.54	0.7629

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
epobr	240	0.99225	1.356	0.708	0.23951

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
epobr	240	0.99373	1.193	0.370	0.35580

Note. *** p<0.01 ** p<0.5 * p<0.1

Source: National Institute of Statistics and Informatics (INEI) - Superintendence of Banking, Insurance and AFP (SBS).

Elaboration: The authors.