



## Research Article

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# Financial Development and Income Inequality: The Case of Ecuador

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## Abstract

Financial development, characterized by the growth and sophistication of the financial system, is crucial for the global economy, since it facilitates investment, savings and the efficient allocation of resources, in addition to contributing to the reduction of poverty and inequality by allowing, broader access to financial services. Ecuador has experienced significant changes in its financial system during recent decades, such as dollarization, liberalization, digitalization, diversification of services, and strengthening of regulation and supervision. The research focuses on establishing the influence of financial development on income inequality. The autoregressive distribution of lags (ARDL) methodology was used with the purpose of identifying short- and long-term relationships. The variables included are the Gini index, financial development, financial instability, public social spending, and final consumption spending by resident households, trade openness and gross fixed capital formation. After applying the ARDL model, the main results show that credit allocation to the private sector plays a significant role in reducing income inequality, and its effect intensifies over time.

**Keywords:** credit, inequality, wealth, monetary systems

## 1. Introduction

Among the primary objectives of economic policy is income distribution and economic growth. This has motivated states to implement and develop various instruments and mechanisms to achieve these objectives. In this context, Zhang & Naceur (2019) mention that greater economic growth and, consequently, adequate income distribution can be achieved through the development of the financial system. Under this argument, Levine (2005) defines financial development as a system capable of generate transactions, mobilize, and allocate resources, effectively manage risk, and facilitate access to the financial market.

Historically, several theoretical approaches have studied the relationship between financial

development and income inequality. On the one hand, models developed by Banerjee & Newman (1993) and Galor & Zeira (1993) on financial market imperfections argue that as the financial sector develops, barriers to access gradually recede, allowing low-income individuals to access this sector. This theoretical aspect has been supported by some empirical evidence (FitzGerald, 2007, Yonezawa & Azeez, 2010, Chiu & Lee, 2019, Hsieh, et al. 2019, Thornton & Di Tommaso, 2020), where the expansion of the financial structure promotes economic growth, and consequently, a better income distribution.

On the other hand, Rajan & Zingales (2003) They point out that a significant number of families and businesses are facing liquidity constraints that prevent them from accessing financial markets, leading to increased income inequality. This is because only individuals with a high per capita income have the necessary guarantees to access the markets.

De Haan et al. (2018) support this argument by mentioning that financial development promotes the deregulation of financial markets, leading to a significant reduction in government control, resulting in increased inequality. In this regard, Jalil & Feridun (2011) evaluate the case of China and observe that the economic liberalization process has led to increased inequality, with the Gini coefficient increasing from 0.21 in 1978 to 0.46 in 2006.

The approach developed by Greenwood & Jovanovic (1990) mention that the relationship between the variables takes the form of an inverted U; initially, greater inclusion in the financial system leads to higher income inequality, and as financial inclusion grows, inequality tends to decrease.

According to Cornia (2014), income inequality in Latin America has been reduced between 2002 and 2010, albeit in a heterogeneous manner across countries. However, during the 1990s, the Gini coefficient remained above 0.50, indicating high inequality, a period characterized by economic liberalization policies. In the case of Ecuador, the financial sector plays a fundamental role in the economic activity, evolving amidst political and economic instability. In the 1990s, the liberalization and deregulation of the financial system and macroeconomic instability led to an increase in income inequality, with an average value of 0.5.

Short-term relationships between the financial system and income inequality are apparent. However, a more comprehensive analysis is necessary. Therefore, the objective of this research is to determine both short and long-term relationships between financial development and income inequality, providing a more robust framework for implementing economic policies that promote financial development and reduce inequality.

In the case of Ecuador, the financial sector plays a fundamental role in economic activity, evolving in the midst of political and economic instability. During the 1990s, the liberalization and deregulation of the financial system, together with macroeconomic instability, led to an increase in income inequality, reaching an average value of 0.5 (Cornia, 2014).

In 1999, the Ecuadorian financial system faced a deep economic recession, resulting in the closure of credit lines, high interest rates, currency depreciation and political instability. According to Suarez & Mendieta (2019), this contributed to the inequality index increasing to 0.564 points by 2000.

During 2008-2009, the international financial crisis caused a 1.1% decrease in per capita income and an inequality index of 0.485 points in 2009. In 2019, the Ecuadorian economy showed poor performance, accompanied by social protests, and by the second quarter of 2020, the declaration of the Covid-19 pandemic. According to the World Bank database (2021), the Gini index in Ecuador reached 0.447 points in 2017, increasing by 2.24% for 2019, indicating an increase in the inequality of income distribution in the Ecuadorian population.

Therefore, the research question focuses on understanding what role has the development of the financial system played in income inequality in Ecuador in different scenarios in the short, medium and long term? This is crucial given the significant evolution of the financial system and the Ecuadorian economy in recent decades, which has influenced income distribution in the country. Understanding these relationships can provide valuable information for policy makers, academics and other actors interested in promoting economic and social equity in Ecuador.

Furthermore, this study is relevant at the global level, as income inequality is a widespread problem that affects many countries at different levels of development. By analyzing the Ecuadorian case, insights can be gained on how financial development can affect income inequality in emerging and developing economies. These findings may have important implications for the design of economic and social policies at both the national and international levels.

## 2. Literature Review

Financial development refers to the growth and efficiency of financial markets, including the availability of financial services, access to credit, capital market depth and efficiency in financial intermediation (Destek, Sinha & Sarkodie, 2020).

The contributions of Schumpeter (1912), McKinnon (1973), Shaw (1973), Saint-Paul (1992) and King & Levine (1993) are the most important theoretical contribution that has been generated around the effects of financial development on economic activity. Several studies (Rodríguez and Lopez, 2009; Ramirez & Reyes, 2010; Martinez, 2012; Zhang, Wang & Wang, 2012; Adu, Marbuah, and Mensah, 2013; Valickova, Havranek, & Horvath, 2015; and Durusu-Ciftci, Ispir, & Yetkiner, 2017) based on this literature have mentioned that financial development leads to improved returns to economic growth, and have been a guideline of empirical analysis to determine the relationships and transmission channels of the financial system towards economic growth.

Also, based on the theoretical review carried out, credit is used as a variable to represent financial development due to its crucial role in the economy and its relationship with financial activity. As highlighted by Demirgüç-Kunt & Levine (2001), access to credit is fundamental for the efficient functioning of the financial system and for sustainable economic growth. In addition, credit facilitates investment in productive projects, encourages entrepreneurship and promotes consumption, which contributes to a country's economic and social development (Beck, Demirgüç-Kunt & Levine, 2007).

Moreover, credit is a key measure of financial development because it reflects financial deepening and inclusion in an economy. As mentioned by Arcand, Berkes, & Panizza (2015), greater access to credit is associated with a more developed financial system, which in turn is linked to stronger economic growth and greater financial stability. Therefore, credit is considered a proxy variable for financial development due to its ability to influence various aspects of the economy and its importance for a country's economic and social progress.

On the other hand, income inequality refers to the disparity in the distribution of income among individuals in a society (Younsi, & Bechtini, 2020). In this context, Sen (2001) mentions that the concept of inequality presents a bias because it is constructed from different value judgments, however, he explains that inequality can be understood as the loss or gain of social welfare. Meanwhile Salcedo (1994) explains that the level of inequality depends on the relationship between income distribution and social welfare. According to Keeley (2018) the concept of inequality is broad, so it can be measured in different ways, however, the starting point is how economic resources are distributed in society.

Currently, there is a wide literature that tries to explain inequality and social gaps, which range from models that are built from ambiguous concepts based on personal income to more relevant models that study general economic inequalities.

Asymmetric variations in income among society can be explained by the following factors: i) Personal heterogeneities among individuals related to physical disabilities, illnesses and age that make it impossible for them to generate a certain level of wealth compared to a healthy person, thus generating a disparity in the level of income. ii) Environmental diversities such as climate changes, temperature variations, rainfall, floods, among others, can influence the level of income of groups of people who carry out primary activities (agriculture, livestock, fishing). iii) Public social conditions that refer to the lack of attention to public policies that generate social precariousness (deficiencies in public health, educational facilities, increases in violence and crime, etc.) that affect vulnerable

groups, deepening poverty levels. iv) Family structure where households with a large number of members and low income reduce welfare and therefore the inequality gap increases (Gaudin & Pareyón, 2020; Angarita, 2014).

Rogowski and MacRae (2004) deepen the theoretical plane and build a simple model of inequality, considering: i) that exogenous changes in demographics, investment and technology can profoundly affect economic inequality; and ii) the higher the level of economic inequality, the greater the loss of institutional quality.

### 3. Hypothesis of Inequality Expansion (Positive Relationship)

Rajan & Zingales (2003) argue that income inequality is affected by credit growth. This hypothesis arises from the consideration that only high-income individuals can provide collateral to access financing, unlike the poor, who are excluded from the market due to their lack of collateral to repay potential loans. Therefore, as the financial sector develops, it becomes more challenging for the poor to gain access.

Stiglitz (1989) argues that for many years, credit volume has grown, but it has not been directed toward wealth accumulation; instead, it has only boosted consumption, leading to rises in prices. He emphasizes that financial deregulation limits the creation of investment projects or access to capital goods to enhance productivity, and it is primarily used as a channel to increase consumption. Poor targeting of credit flow results in increased inequality.

Jauch & Watzka (2012) explain the connection between the growth of the financial system and income disparity developed and developing countries from 1960 to 2008. They use the private credit-to-GDP ratio as an indicator of financial development and the Gini index as a predictor of income inequality. Through generalized least squares with fixed effects estimation, their findings show that finance positively influences income disparity; a ten percent increase in credit provision leads to a 0.23 increase in the Gini coefficient in the short-term estimation.

De Haan et al. (2018) empirically determine the impact of financial development on income inequality for a large sample of countries spanning the period 1975–2005. They measure financial development by private credit divided by GDP and income inequality by the Gini coefficient. Their results show that financial development promotes financial liberalization practices, which lead to an increase in inequality.

Chiu & Lee (2019) analyze the nonlinear relationships between banking sector development and the impact on income distribution in 59 countries between 1985 and 2015. Using a panel data regression model, their results show an increase in income inequality in stable economic and financial environments. Thus, there is evidence of a direct relationship between the study variables in low-income countries.

Bolarinwa et al. (2020) emphasize that financial development, expressed as the ratio of private credit to GDP, increases income inequality in forty African countries categorized by income level. However, when using a combination of indicators such as financial branches per 100,000 adults (access), private credit % GDP (depth), and indices of the quality of financial institutions' assets (stability), their results suggest that financial development does not affect income inequality in low-income per capita countries.

Bolarinwa et al. (2020) note that financial development increases income inequality in forty African countries classified by income level. However, when using a combination of indicators such as financial branches per 100,000 adults (access), private credit % GDP (depth) and indices of the asset quality of financial institutions (stability), their results suggest that financial development does not influence the income structure in low per capita income countries.

Kavya & Shijin (2020) examine the interplay between economic development and financial development measured by private credit and its effects on income inequality measured by the Gini index. Using data from 85 countries between 1984 and 2014 and applying generalized least squares, their findings are not entirely conclusive, as they show that economic development combined with

financial development does not significantly impact income inequality.

Jung & Cha (2021) explore the relationship between financial development and income inequality in 29 administrative units in China between 1998 and 2014. Financial development is measured using three indicators: gross value added of the financial sector, deposit level (% GDP), and private credit (% GDP), while income inequality is measured using the Gini index. Their results show that financial development does not improve but rather worsens income inequality.

Sethi et al. (2021) study the combined effects of financial system growth and globalization on income distribution disparity in India during 1980-2014. They measure financial development using several indicators: credit to the private sector (% GDP), M2 money supply, stock market capitalization of financial institutions (% GDP), and stock market value of institutions. The Gini coefficient is used as a tool to assess the disparity in income distribution. Its results suggest that globalization and financial development aggravate inequality in emerging economies.

Perugini & Tekin (2022) analyze data from 48 middle- and high-income countries over the period 1996-2014 in order to study the connection between financial system advancement and income disparity. They use the Gini index as an indicator of income inequality and credit to the private sector as a robust variable of financial development. Through dynamic panel data, their results show that higher financial development leads to higher inequality, which is mitigated by better governance indicators.

Junk & Kim (2021) study the effects of financial market openness in the context of financial development on income inequality in 174 countries between 1995 and 2017. Using private credit (% GDP) and market capitalization as indicators of financial development, they employ the Gini coefficient to measure income inequality. Their results show that in economic environments with higher financial development, market openness has an ambiguous effect on income inequality.

For Latin America, studies specifically focusing on this topic are limited. However, among those worth noting is the research by Gómez and Ríos (2019), who, through a balanced panel data model, a positive association between financial progress and income disparity is corroborated. These results are supported by Ngangu (2020), who, using a fixed-effects panel model, confirms that financial sector development has increased income inequality in Latin America between 1995 and 2016.

#### 4. Hypothesis of Inequality Reduction (Inverse Relationship)

Banerjee & Newman (1993) and Galor & Zeira (1993) constructed arguments in favor of the hypothesis that greater financial system development leads to reduced income inequality. They emphasize that as the financial sector grows and develops, access restrictions to financial services are removed, enabling the poor, who had difficulties entering the market due to a lack of collateral, to access when the market develops.

Mookherjee & Ray (2003) support the hypothesis put forth by Banerjee & Newman (1993) and Galor & Zeira (1993), and suggest that financial development serves as a mechanism to reduce income inequality by creating more opportunities for individuals to create self-sustaining jobs. The precedent for this hypothesis can be found in the works of McKinnon (1973) and Shaw (1973), where they emphasize that financial development has positive impacts on the economy. Levine (1996) mentioned that financial development accelerates economic growth by increasing service provision, allowing a larger portion of the population to access financial services. An indirect outcome of this relationship leads to lower inequality indices.

Batabyal and Chowdhury (2015) study the interactive effects of corruption, inequality and financial progress using panel data from 30 nations. belonging to the Commonwealth of Nations over the period 1995 to 2008. Their results show that the implementation of policies that reduce corruption fosters financial development, which, in turn, leads to lower income inequality.

Kapingura (2017) uses two measures of financial development (private sector credit and the number of ATMs per 100,000 adults) to assess their effects on income inequality in Southern Africa between 1990 and 2012. The results show that financial development is a determining factor in

alleviating income inequality. Additionally, Zhang & Naceur (2018) provide evidence of the relationship between financial development, income inequality, and poverty for 143 developed and developing countries between 1961 and 2011. Their results show that dimensions of financial depth, access, efficiency, and stability can significantly reduce income inequality. However, aggressive financial liberalization processes tend to exacerbate inequality.

Selim & Gungor (2019) investigate the effect of financial development on income inequality in 11 countries in the MENA region between 1990 and 2015. They use the Gini index as the dependent variable and private sector credit as the variable related to financial development. The findings show a negative relationship, indicating that financial development reduces income inequality.

## 5. Hypothesis of a U-shaped Relationship

The model by Greenwood and Jovanovic (1990) focuses on economic growth, institutional development (financial sector), and income distribution. The developmental dynamics in this model resemble those of Kuznets, where in the initial stage of financial sector development, the financial markets in an economy are practically nonexistent and grow slowly, resulting in negligible income distribution. As the financial sector gradually develops, the economy enters an intermediate growth stage, and income distribution between the rich and the poor narrows. In the final stage, with a more developed financial sector, income distribution among agents tends to stabilize, leading to reduced income inequality.

Greenwood and Jovanovic's (1990) model focuses on economic growth, institutional development (financial sector) and income distribution. The development dynamics presented by this model resemble those of Kuznets, where in the first stage of development, the financial markets of an economy are practically non-existent and grow slowly, so that there is no income distribution. As the financial sector develops progressively, the economy enters an intermediate stage of growth and the income distribution between rich and poor narrows. In the final stage, where there is a higher rate of financial development, the distribution of income among agents tends to stabilize, resulting in less income inequality.

Nikoloski (2012) uses private sector credit, Nguye et al. (2019) use variables related to domestic credit as a percentage of GDP, and Mbona (2022) uses the number of ATMs per 100,000 adults as an indicator of financial development. They also use the Gini coefficient as a proxy for income inequality. Their results consistently suggest that income disparity can increase in the early stages of financial development and decrease in subsequent phases.

Park & Shin (2017) delve deeper into the study of the relationship between financial development and inequality by using three measures to assess financial development: (i) liquid liabilities/GDP ratio; (ii) bank credit-to-deposit ratio as a percentage of GDP; (iii) stock market capitalization as a percentage of GDP. They employ the Gini coefficient as a dependent variable proxy for income inequality. Their results indicate that financial development can generate positive effects in the short term and negative effects in the long term, resulting in a U-shaped relationship.

## 6. Methodology

The data for the variables measuring financial development and income inequality, as well as the data for the control variables, were obtained from the World Bank and the Central Bank of Ecuador's databases on an annual basis, covering the period 1990 - 2020, which ensures a reliable database.

Regarding income inequality, according to the reviewed literature (Medina, 2001; Jalil & Feridum, 2011; Jauch & Watzka, 2012; Park & Shin, 2017; De Haan et al., 2018; Zhang & Naceur, 2018; Chiu & Lee, 2019; Gómez & Ríos, 2019; Nguye et al., 2019; Bolarinwa et al., 2020; Jung & Cha, 2021; Sethi et al., 2021), the Gini coefficient is considered the most useful variable for measuring income inequality. According to Perugini & Tekin (2022), this variable is more efficient compared to other measures because it (i) covers population density, geography, age, and employment status; (ii) is

widely used as a proxy for well-being; (iii) has greater availability of data. This indicator ranges between 0 and 1, where inequality increases as the index approaches 1. This variable was specifically obtained from the World Bank on an annual basis for the period 1990 – 2020.

Recent literature has used various indicators to measure financial development, aligning with dimensions such as depth, access, efficiency, and stability. According to the literature review, this research uses private sector credit as a percentage of gross domestic product (GDP) as a representative variable of financial development, essentially comprising credit granted to private companies and households by private financial institutions, excluding those in the public sector. King & Levine (1993) use this variable to avoid the problem of capital allocation. Nikoloski (2012) and De Haan et al. (2018) show that private sector credit covers two dimensions of financial development, namely depth and financial access. According to Ang & McKibbin (2007), using multiple variables to measure financial development simultaneously would increase the chances of multicollinearity problems, overparameterization, and potential loss of degrees of freedom. Based on this argument, Jalil & Feridum (2011) find a high correlation between different variables measuring financial development and conclude that private sector credit is the most representative variable.

To reduce the term of disturbance or error in the model, which captures all those unobservable factors that could influence the behavior of the dependent variable and are not included in the independent variable, it is necessary to include some control variables. The following variables are used as control variables: social public expenditure, expenditure on final consumption of resident households, trade openness, and gross fixed capital formation. Stiglitz (2000), Shahbaz & Islam (2011), Suanes (2016), Suárez & Mendieta (2019) mention that these factors influence the behavior of income inequality, as they are associated with how resources are distributed and utilized in an economy. For example, higher social public expenditure aims to reduce inequality and poverty rates. Private consumption is correlated with higher incomes, which could translate into a better income distribution. Ang (2010) and Jalil & Feridum (2011) mention that an increase in trade openness indices has a positive and significant impact on inequality.

#### *Autoregressive Distributed Lag (ARDL) Model:*

The ARDL (Autoregressive Distributed Lag) is used to represent the connections between variables in a time series context by means of a single equation. This model allows for cointegration between non-stationary variables, equivalent to an Error Correction Model (ECM). The work of Pesaran, Shin, and Smith (2001) initially utilizes this methodology, and its estimation process is based on two parts. First, the existence of cointegration (long-term equilibrium relationship) must be determined, and if confirmed, the respective long-term coefficients are estimated sequentially. Second, the adjustment speed must be estimated, and the long-term coefficients are obtained. The model, generally in terms of Error Correction Vectors (ARDL-ECM), according to Queiroz & Vieira (2019), takes the following form:"

$$\Delta y_t = \beta_0 + \beta_1 y_{t-n} + \beta_2 x_{t-1} + \sum_{i=0}^n \Delta x_{t-n} + \mu_t \quad (1)$$

"From equation (1), it can be mentioned that  $\Delta y_t$  represents the dependent variable,  $\beta_0$  is the model's constant,  $y_{t-n}$  represents the lagged dependent variable  $n$  times,  $\sum_{i=0}^n \Delta x_{t-n}$  represents the explanatory variables lagged  $n$  times and their cointegrating vector,  $\beta_{1..}$  represent the estimated coefficients of the explanatory variables, and  $y_t$  represents the stochastic disturbance of the model.

To determine cointegration between the series, the Johansen cointegration methodology is used, where the statistical probability should be less than 5% to demonstrate the existence of at least one cointegrating vector. As for the definition of equilibrium adjustment speed, ECM coefficients (-1) should be negative and statistically significant.

The approach developed by Pesaran and Shin (1999) of autoregressive distributed lag model (ARDL) cointegration has the advantage that the information regarding the order of integration of the variables is not unavoidable; therefore, preliminary unit root tests for other cointegration procedures can be omitted. The significance of the long-run relationship, unlike the other approaches, is evaluated using critical value bounds, which are determined by two extreme cases where all variables are I (0) and all variables are I (1). An additional advantage of the ARDL

methodology is that it estimates more robust results for determining long-term relationships when working with small samples (Pesaran and Shin, 1999; Panapoulou and Pittis, 2004).

In this context, the application of the ARDL model is fundamental in this research on financial development and income inequality due to its ability to analyze long-run relationships between economic variables. As Pesaran, Shin and Smith (2001) point out, ARDL allows modeling cointegration between non-stationary variables, which is crucial when investigating the relationship between financial development and income inequality, which are complex phenomena that evolve over time. Moreover, ARDL is particularly useful in this context because it allows estimating both the short-run and long-run relationship between variables, which provides a complete understanding of how financial development affects income inequality over time (Queiroz & Vieira, 2019).

On the other hand, Johansen's cointegration methodology, used in conjunction with the ARDL model, is essential to determine the existence of long-run equilibrium relationships between the variables of interest. As mentioned by Lütkepohl and Krätzig (2004), cointegration is crucial for identifying stable relationships between economic variables and establishing the presence of a long-run relationship between financial development and income inequality. This is important because it provides a solid basis for understanding how financial development affects income inequality in the long run, which is critical for designing effective public policies that promote economic equity (Nguye et al., 2019).

In addition to the ARDL model's ability to analyze long-term relationships and the presence of cointegration between variables, its methodological flexibility makes it an invaluable tool in research on financial development and income inequality. ARDL allows the inclusion of exogenous and endogenous variables, which facilitates the incorporation of relevant economic, social and political factors that may influence the relationship between financial development and income inequality. This dynamic modeling capability is essential to capture the complexity and multidimensionality of the phenomena studied, as Blundell & Bond (1998) point out. Moreover, the application of ARDL in this research provides a robust methodology to address potential endogeneity and autocorrelation problems, thus ensuring the validity of the results obtained and the reliability of the conclusions (Chudik, Pesaran, & Tosetti, 2016).

Another important aspect to consider is the ability of the ARDL model to analyze both linear and nonlinear relationships between variables. This allows us to explore the possibility of nonlinear effects of financial development on income inequality, as suggested by Kavinga & Shijin (2020). By examining the relationship between these variables in more detail, complex patterns and non-intuitive effects can be identified that might go unnoticed in a purely linear approach. Therefore, the application of ARDL in this research not only allows for a deeper understanding of the relationship between financial development and income inequality over time, but also captures the complexity of this relationship and its potential implications for economic and social policymaking.

## 7. Model Formulation

To represent the relationship between financial development and income inequality, we start with a Cobb-Douglas-type function, setting income inequality measured by the Gini index as the endogenous variable, represented as follows:

$$Gini = f(FD, CV) \quad (2)$$

Equation (2) can be represented as a simple linear function;

$$Gini = \beta_0 + \beta_1 FD_t + \beta_2 CV_t + u_t \quad (3)$$

From equation (3), it can be noted that the Gini index represents income inequality, FD represents financial development measured by the level of credit to the private sector as a percentage of GDP, VC represents the control variables, in this case, they are: financial instability (FI), social public spending (SPS), household final consumption expenditure (HFCE), trade openness (TO), and gross fixed capital formation (GFCF), and (t) represents the data frequency.

On the other hand, Shahbaz and Islam (2011) mention that financial instability is calculated



using the absolute value of the residuals of the financial development variable. This calculation is carried out through the application of the following regression:"

$$FD_{i,t} = FD_{-1} + trend_{it} + u_{it} \quad (4)$$

On the other hand, from equation (3), the ARDL model is established, in which a (t-1) lag is currently set. Thus, the model is expressed as follows:

$$\Delta Gini_t = \beta_0 + \beta_1 Gini_{t-1} + \beta_2 FD_{t-1} + \beta_3 FI_{t-1} + \beta_4 SPE_{t-1} + \beta_5 HFCE_{t-1} + \beta_6 TO + \beta_7 GFCE_{t-1} + \sum_{i=0}^n \delta_1 Gini_{t-1} + \sum_{i=0}^n \delta_2 FD_{t-1} + \sum_{i=0}^n \delta_3 FI_{t-1} + \sum_{i=0}^n \delta_4 SPE_{t-1} + \sum_{i=0}^n \delta_5 HFCE_{t-1} + \sum_{i=0}^n \delta_6 TO_{t-1} + \sum_{i=0}^n \delta_7 GFCE_{t-1} + u_t \quad (5)$$

Where:

$\Delta Gini_t$ : The Gini index represents income inequality, with values between 0 and 1.

$FD$ : Represents financial development, expressed as a percentage of GDP.

$FI$ : Represents financial instability, calculated as the variation in financial development.

$SPE$ : Represents social public expenditure, expressed as a percentage of GDP.

$HFCE$ : Represents household final consumption expenditure, expressed as a percentage of GDP.

$TO$ : Represents trade openness, expressed as a percentage of GDP.

$GFCE$ : Represents gross fixed capital formation, expressed as a percentage of GDP.

$\sum_{i=0}^n \delta_i$ : Represents the cointegration vectors of the ARDL model.

Due to the model's structure, Gujarati and Porter (2010) suggest the use of variance-stabilized series to improve estimation specifications. Consistent with this approach, as mentioned by Box and Cox (1964), a logarithmic transformation is applied to all series to appropriately stabilize their variances. Additionally, it is expected that the model in logarithmic terms will be significantly better in both absolute and relative regression frameworks. Table 1 summarizes the expected signs of the control variables included in the development of the econometric model

**Table 1.** Description of Control Variables

Control variable	Definition	Expected sign	Justification
<b>Financial Instability</b>	Financial Instability Situation that arises when the structure of the financial system is affected by disturbances in the economic system (Vercelli, 2000)	(+)	Shahbaz and Islam (2011) point out that in the short term, financial instability can lead to an economic crisis, which would result in an increase in income inequality. However, they mention that this impact is minimal.
<b>Household Final Consumption</b>	Expenditures made by resident households on goods and services for consumption (Banco Central del Ecuador, 2017)	(-)	According to Suárez and Mendieta (2019), an increase in consumption is positively correlated with an improvement in income distribution.
<b>Social Public Expenditure</b>	Expenditures made by the State for public services to promote social well-being (Troya, 2013)	(-)	Stiglitz (2000) and Perugini and Tekin (2022) indicate that a better distribution of social public expenditure helps reduce inequality indicators.
<b>Trade Openness</b>	The ability of an economy to engage in commercial transactions with the rest of the world (Feal, 2008)	(+)	Ang (2010) and Jalil and Feridum (2011) mention that an increase in trade openness should be related to an increase in inequality.
<b>Gross Fixed Capital Formation</b>	Variation in non-financial assets generated in the public and private sectors (Banco Central del Ecuador, 2021)	(-)	According to Suanes (2016), there is a positive effect between investment and income inequality, as investments tend to be directed toward high-profit sectors.

## 8. Results

According to Gujarati and Porter (2010), when estimating a distributed lag model, it is necessary to determine the length of the lags (p) and try to establish a specification for these values based on the amount of available observations because an incorrect determination can lead to specification errors

or multicollinearity due to a high correlation between successive lag values. In a prior analysis of model estimation, using the Akaike Information Criterion, Schwarz Information Criterion, and Hannan-Quinn Information Criterion, it was determined that optimal estimation requires only one lag. Therefore, the specification of the ARDL model would be  $p = 1$  (Table 2)

**Table 2.** Determination of Optimal Lags

N. lags	LogL	LR	FPE	AIC	SC	HQ
0	123,03	NA	7.90e-13	-8.001.786	-7.671.749	-7.898.422
1	257,68	195.0129*	2.38e-15*	-13.90881*	-11.26851*	-13.08190*

Note: LR: Sequential Test at 5%; FPE: Final Prediction Error; AIC: Akaike Information Criterion; SC: Schwarz Criterion; HQ: Hannan-Quinn Information Criterion

Now, as this model establishes long-term relationships, it is necessary to determine if there is evidence of cointegration among the variables. Rodríguez and Venegas (2011) describe the Johansen cointegration test as reliable and easy to analyze; where the null hypothesis ( $H_0$ : there are no cointegration vectors) is rejected when the p-value of the test is less than 0.05.

**Table 3.** Johansen Cointegration Test

Null Hypothesis	Trace Statistic	Max-Eigen Statistic	Diagnostic
No cointegrating vectors	161,45***	56,8**	1 vector
At least 1 cointegrating vector	104,64**	36,20	
At least 2 cointegrating vectors	68,43*	27,01	
At least 3 cointegrating vectors	41,42	19,19	
At least 4 cointegrating vectors	22,23	10,94	
At least 5 cointegrating vectors	12,28	9,66	
At least 6 cointegrating vectors	1,62	1,63	

Note: \*\*\* $\text{prob} < 0.01$ ; \*\*  $\text{prob} < 0.05$ ; \*  $\text{prob} < 0.1$

As seen in Table 3, the Johansen test under the Trace and Max - Eigen statistics presents a p-value less than 0.05, which is evidence against the null hypothesis; therefore, there is a long-term equilibrium relationship between the variables. Once cointegration has been confirmed.

For the purpose of a rigorous analysis, a trending section has been implemented to capture the evolution and relationship of the variables over time given the presence of cointegration. Regarding the model summary (Table 4), it is observed that it conforms to a normal distribution, shows no serial autocorrelation, and exhibits equal variance in its residuals. The adjusted R-squared value is adequate, indicating that 92% of the time, financial development, financial instability, household final consumption, government social expenditure, trade openness, and investment explain the behavior of the Gini index.

According to Gujarati and Porter (2010), in a distributed lag structure, contemporaneous variables represent short-term effects. Financial development (LNDF) has a negative and significant short-term effect on the Gini index, with each percentage point increase in financial development leading to a 0.106% decrease in the Gini index, interpreted under the ceteris paribus principle. As for financial instability (LNIF), it has a positive and significant short-term effect on income inequality, with a 0.0196% increase in income inequality for each percentage point increase in financial instability. Estimations also show that each percentage point increase in investment (LNFBKF) leads to a 0.74% decrease in income inequality in the country, which is a significant effect.

On the other hand, trade openness has a positive and significant effect on the Gini index, meaning that a 1% increase in trade openness increases income inequality by 0.35%. Finally, it is observed that in the short term, private final consumption and government social expenditure have negative and nonsignificant effects on income inequality. However, their lagged variables are

significant, so it is expected that their effects will be greater in the long term.

**Table 4.** ARDL Model Estimation: Income Inequality and Financial Development in Ecuador, 1990-2020

Dependent Variable (Logarithms)	Gini Index
Independent Variables Coefficient	Coefficient
LNGINI(-1)	-0,052 (0,16)
LNDF	-0,106** (0,05)
LNDF(-1)	-0,091** (0,04)
LNIF	0,0196*** (0,01)
LNIF(-1)	0,018*** (0,01)
LNCP	-0,172 (0,29)
LNCP(-1)	-0,504 (0,35)
LNGS	-0,006 (0,04)
LNGS(-1)	-0,12*** (0,04)
LNAP	0,35*** (0,07)
LNFNKF	-0,74*** (0,12)
LNFNKF(-1)	0,16 (0,12)
C	-1,85*** (0,25)
@TREND	0,013*** (0,002)
R-squared	0,96
Adjusted R-squared	0,92
Durbin-Watson stat	2,38
Normality (Jarque Bera)	p-valor>0,05
Serial Correlation(Breusch-Godfrey)	p-valor>0,05
Heteroscedasticity(Breusch-Pagan-Godfrey)	p-valor>0,05

Note: \*\*\*prob<0.01; \*\* prob<0.05; \*prob<0.1 (standard error in parentheses)

Under the parameters of the previous estimation, the calculated long-term coefficients are presented below.

**Table 5.** Long-term Relationships. ARDL Mode

Variables	Coefficient
LNDF	-0,187468*** (0,04)
LNIF	0,036204*** (0,01)
LNCP	-0,642610** (0,26)
LNGS	-0,118258*** (0,04)
LNAP	0,335091*** (0,05)
LNFNKF	-0,549239*** (0,07)

Note: \*\*\*prob<0.01; \*\* prob<0.05; \*prob<0.1 (standard error in parentheses)

Table 5 displays the calculated long-term coefficients, where all included variables are significant at the 5% level. The effects of each variable on income inequality are in line with economic theory and are relatively greater than in the short term. Thus, the persistent positive trend of financial development leads to a 0.187% reduction in income inequality for each percentage point increase per year. Financial instability, as analyzed in previous sections with its volatile trend, leads to a 0.0362% increase in income inequality, highlighting how stability in this sector affects the country's economic and social environment.

Within the analysis, household final consumption (LNCP) is the variable that has the greatest impact in the long term, as a 1% increase results in a roughly 0.64% reduction in income inequality. It is followed by investment (LNFBKF), where a cumulative temporary increase leads to a 0.55%

reduction in the inequality gap. Regarding the effects of social expenditure, they are indeed mostly significant in the long term, although their impact is smaller than that of other macroeconomic variables, reducing income inequality by approximately 0.12%. Finally, trade openness in the long term maintains a positive effect on income inequality, implying an unequal distribution of benefits generated from economic activities related to trade.

## 9. Discussion

This research has yielded results in favor of an inverse relationship between financial development and income inequality, indicating that one of the factors contributing to income inequality reduction in Ecuador is financial development. These findings align with the hypotheses proposed by Banerjee & Newman (1993) and Galor & Zeira (1993), where the elimination of barriers to accessing financial services facilitated by a more developed financial sector, reduces income inequality by expanding economic opportunities for low-income individuals, despite their lack of collateral or credit history.

The conceptual descriptions of Mookherjee & Ray (2003) regarding the distributive effects of financial development align with the results obtained, as a higher pace of financial sector growth, characterized by expanded credit access, not only covers more beneficiaries but also increases the efficiency of instruments that are effectively captured by economic agents, thereby stimulating the economy and reducing income inequality. In reference to the theory of Greenwood & Jovanovic (1990), no evidence of an inverted U-shaped relationship was found, as short-term effects of financial development tend to reduce income inequality.

Regarding the empirical results, the research obtained a short-term coefficient of  $-0.106$  and a long-term coefficient of  $-0.187$  associated with financial development measured by private sector credit as a percentage of GDP. These results are similar to the work of Mbona (2022), who estimated a financial depth coefficient (domestic credit % GDP) of  $-0.02$  for a set of 120 countries between 2004 and 2019, showing that financial development reduces income inequality. Similarly, the study conducted by Jalil and Feridun (2011) estimated a negative and significant impact of private credit (financial development) of  $-0.306$  in the short term and  $-0.08$  in the long term for the Chinese economy. It is evident that the impact of financial development in Ecuador tends to be greater in the long term, while the results estimated by Jalil and Feridun (2011) for China are the opposite.

The research results differ from the findings of Rodriguez et al. (2019), who analyzed the connection between financial progress and income disparity. For 13 Latin American countries. The estimated coefficient of domestic credit as a percentage of GDP in Rodriguez et al. (2019) is  $0.04$ , implying a positive impact on income inequality. However, this research has methodological limitations, as their estimations were conducted using generalized least squares and introduced control variables such as inflation and government expenditure, which turned out to be non-significant, reducing the overall robustness of the model.

Additionally, it is evident that the benefits derived from financial development tend to change depending on economic structures and conditions, as suggested by McKinnon (1973), Shaw (1973), and Seven & Coskun (2016). In certain situations, financial development that generates positive economic effects can also result in a reduction of social inequality. Therefore, in the context of the results obtained and the incorporation of control variables related to the country's economic dynamics (social public expenditure, household final consumption, gross fixed capital formation, and trade openness), it is observed that greater economic activity, mainly driven by investment, reduces social inequality, and its long-term impact is highly significant. However, it is essential to be cautious when discussing the financial sector as a whole, as financial instability has positive effects on income inequality, leading to direct relationships between income inequality and financial development under conditions of instability, as found in the studies of Chiu & Lee (2019), Gómez & Ríos (2019), Ngangu (2020), Rodríguez, Ríos, & Zambrano (2021).

Financial development plays a crucial role in the distribution of income in an economy, affecting factors such as access to credit, financial inclusion and the impact of financial policies on

income equity. Access to credit is essential, as those with limited access to credit, such as low-income individuals or microenterprises, may find it difficult to invest in key areas such as education, entrepreneurship or housing, thus perpetuating income inequality (Hodula, 2023). On the other hand, when access to credit is facilitated for these groups, economic opportunities open up that can help reduce the income gap.

In research by Beck, Demirgüç-Kunt, & Levine (2007) and Kling, Pesqué-Cela, Tian, & Luo (2022) found that greater access to credit is linked to a more equitable income distribution. This is because access to credit allows low-income individuals and firms to invest in human and productive capital, which increases their income and reduces inequality.

Financial inclusion, which seeks to ensure that all segments of the population have access to financial services, also plays an important role in income distribution. Promoting financial inclusion reduces the exclusion of groups such as rural communities or low-income individuals, giving them the opportunity to participate in the formal economy. Demirgüç-Kunt & Klapper (2012) found an association between financial inclusion and a more equitable income distribution, highlighting how access to basic financial services empowers individuals and improves their economic conditions.

In addition, financial policies can influence income distribution. Claessens and Perotti (2007) showed that policies that promote financial stability and inclusion are associated with a more equitable income distribution.

Finally, limitations and areas for future research are identified. The possibility of endogeneity problems is highlighted, suggesting more robust identification methods. In addition, the quality of cointegration and long-run coefficient estimates depends on data availability, arguing for more complete and updated sets. Finally, it highlights the limitation of the generalization of the analysis to other contexts by focusing only on Ecuador, suggesting comparison with other countries or international analyses for a broader understanding.

## 10. Conclusion

Regarding financial development and its contributions to the economy, they have been described by Goldsmith (1969), McKinnon (1973), and Shaw (1973), who refer to this activity as promoting stable and sustainable economic growth, with evidence that a robust financial system incentivizes investment and capital efficiency. Among the theoretical framework of financial development, credit is the most relevant variable studied due to its dynamic effects on the market.

The literature reviewed offers three perspectives on the relationship between financial development and income inequality. On the one hand, studies such as Jauch & Watzka (2012) and De Haan et al. (2018) support the idea of a direct relationship, where the growth of the financial sector leads to an increase in the availability of credit and other financial services, which may intensify inequality by favoring the more privileged strata of society. On the other hand, authors such as Banerjee & Newman (1993) and Galor & Zeira (1993) suggest a possible inverse relationship, arguing that greater financial development could reduce inequality by removing barriers to access to financial services for low-income individuals. In addition, the inverted U-shaped relationship theory, proposed by Greenwood & Jovanovic (1990), posits a more complex dynamic. In its early stages, financial development may exacerbate inequality by concentrating benefits in the wealthier strata of society. However, as the financial sector consolidates and stabilizes, inequality is expected to decrease as more low-income individuals gain access to financial services.

Financial development channels, such as access to credit, financial inclusion and the distributional impact of financial policies, play a fundamental role in the distribution of income in an economy. Facilitating access to credit and promoting financial inclusion can help reduce income inequality by allowing previously excluded segments to participate in the formal economy and improve their economic conditions. In addition, financial policies that promote financial stability and financial inclusion can contribute to a more equitable distribution of income.

Through the application of the ARDL model, it was identified that financial development has a

negative and significant impact on income inequality, both in the short (-0.106) and long term (-0.187). In this sense, the effects of financial development tend to be greater in the long term, indicating that the conditions of access to financial services improve people's welfare over time. Within this model, control variables were implemented to improve the efficiency of the estimates, revealing that private consumption, public social spending and gross fixed capital formation reduce income inequality in the long run.

On the other hand, trade openness generates a positive and significant effect on the Gini index, so that a 1% increase in trade openness increases the income inequality gap by 0.35%. Finally, it is observed that in the short term, private final consumption and government social spending generate negative and non-significant effects on income inequality; however, their lagged variables are significant, so a priori it is expected that their effects will be greater in the long term. Financial instability, as analyzed in previous sections, whose volatile trend resorts to constant peaks, causes an increase of 0.0362% in income inequality, which determines that the stability of this sector affects the economic and social environment in the country.

## 11. Recommendations

It is recommended that the government promote continuous improvement in the quality of public services, especially in education, healthcare, and basic services, to improve income distribution and, consequently, reduce social inequality. In addition, mechanisms should be implemented to incentivize job creation and a more stable economic environment, which will create opportunities for people to improve their quality of life.

Based on the theoretical and empirical review, it is recommended that authorities implement and strengthen financial inclusion policies and improve control over the financial sector to reduce the sector's risks and uncertainties. Furthermore, mechanisms should be promoted to encourage investment in the country, thereby improving social conditions and ultimately leading to a fairer society.

Finally, it is recommended to expand research on income inequality and how it may be influenced by other economic and social aggregates, allowing public authorities to make more efficient decisions.

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