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The Influence of Bank Loans and Deposits on Ecuador's Economic Growth: A Cointegration Analysis

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Abstract: This study examines the relationship between banking sector development (credit and deposits) and economic growth in Ecuador, using quarterly data for the period 2000–2022. An ARDL approach with Bound Test cointegration is employed, incorporating structural breaks using the Bai–Perron test and controlling for macroeconomic shocks. In addition, time transformation methodologies are applied to harmonize the frequency of the series: the monthlyization of GDP is performed using the Chow-Lin method, and the imputation of missing unemployment data using the Kalman filter. The results reveal a significant long-run elasticity between bank deposits and GDP (0.45%), while credits do not present a statistically significant effect, possibly due to high delinquency and institutional weakness. Granger causality tests confirm a unidirectional relationship between banking variables to economic growth. These findings highlight the importance of strengthening financial supervision and improving institutional quality to enhance the effect of bank intermediation. The study provides robust and contextualized empirical evidence relevant to resource-dependent economies with concentrated financial systems, contributing to the debate on the relationship between finance and growth in developing countries.

Keywords: banking development; economic growth; lending; deposits

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1. Introduction

Growth volatility is one of the most important issues for governments today, as it is influenced by the macroeconomic stability of countries. In this context, governments need to use policies that try to mitigate crises and maintain growth levels. Given that economic growth is influenced by banking development, crises in this sector would seriously affect growth (Zhang & Zhou, 2021). Therefore, it is important to analyze the relationship between the banking sector and the economy of the countries.

Several studies have highlighted the importance of the banking sector for economic growth, considering it key to the accumulation and efficient distribution of capital (King & Levine, 1993). This effect is explained through the mechanism of financial intermediation: banks, by attracting deposits, generate the necessary conditions for channeling resources toward productive investment, which boosts growth (Vrotslavskyy & Dropa, 2024). Furthermore, it has been shown that financial development not only favors economic growth per se, but is also linked to the promotion of innovation, human capital formation, and greater trade openness (Khan et al., 2020).

However, some studies question the theoretical soundness of this relationship in developing economies, pointing out that it is not always empirically verified (Ajakaiye & Tarp,

2012). They even warn that extrapolating results without rigorous econometric support can lead to erroneous conclusions. For example, when analyzing the credit portfolio, it may show a negative relationship with growth if it is dominated by non-performing loans (Mamatzakis et al., 2019; Tölö & Virén, 2021).

Thus, the link between bank deposits and economic growth has been extensively studied. In this regard, Gadisa and Tigre (2022) and Kalu et al. (2022), using time series analysis, found a positive and significant impact of deposits on GDP growth in Ethiopia and Nigeria, respectively. However, other studies reveal that this relationship may be non-significant or even negative, especially in contexts where there are deficiencies in political stability or institutional infrastructure (Akuien, 2023; Kan et al., 2024).

As for bank lending, analyses have shown a positive relationship with economic growth. However, this effect is intensified in contexts where the financial system has been deregulated, as in the case of the United States (Jayaratne & Strahan, 1996). Additionally, for low- and middle-income countries, Abbas et al. (2022) found a positive effect of financial development on economic growth, using panel data models. This result is consistent with the study of Mhadhbi et al. (2020), who employed Granger causality tests to reach similar conclusions.

On the other hand, recent literature also highlights the role of information and communication technologies (ICTs) as a moderating factor in the relationship between the banking sector and growth. Cheng et al. (2021), through dynamic GMM models, show that although the banking system can have negative effects on economic growth on its own, its interaction with the development of ICTs can reverse this impact. Finally, Zhang and Zhou (2021), by calibrating models with microeconomic foundations of utility maximization, argue that although there is a direct relationship between banking variables and economic growth, this effect tends to diminish in the very long run.

In the case of Ecuador, the literature points out that economic growth has historically been driven by the exploitation of natural resources, particularly oil. However, this strong dependence has exposed the country to vulnerabilities in the face of international price fluctuations. Internally, there are also marked economic inequalities between provinces, with territories that have had access to better conditions in terms of infrastructure, education, and institutional quality. In particular, cities such as Quito and Guayaquil have registered more dynamic growth due to their relatively more favorable economic environment (Correa-Quezada et al., 2023).

Therefore, the analysis of the Ecuadorian banking system is relevant not only for its structural configuration but also for its potential impact on economic development. In the country, large banks operate under conditions close to a monopoly, while medium and small banks compete in schemes that tend toward competition closer to the perfect model (Solano et al., 2020). This mixed structure, together with the macroeconomic environment, makes it particularly important to study its influence. In fact, some studies have found evidence that the development of the banking system in Ecuador generates positive effects on the national economy (Puente et al., 2023).

In line with the above, the literature on the relationship between bank development and economic growth is extensive and diverse in terms of methodologies, geographic contexts, and periods of analysis. One of the pioneering studies in empirically addressing this relationship is that of King and Levine (1993), who found that variables such as bank lending are positively related to economic growth, and using the GMM methodology shows that in the context of sub-Saharan Africa, financial sector development is directly linked to economic growth. Furthermore, this study underlines that institutional quality plays a crucial role in this relationship. In the same vein, Wen et al. (2022) recommend strengthening bank super-vision mechanisms, since, according to their results obtained using a GMM

model, the credit portfolio variable does not show a significant relationship with economic growth, suggesting latent risks if efficiency in credit allocation is not controlled.

However, economic growth does not depend exclusively on the financial system. The literature also identifies key macroeconomic variables that affect growth, such as the level of monetization, inflation, and unemployment. These variables reflect the overall health of the economy in different periods and are common components in the most fundamental theoretical models of economic growth (Berdyshev & Sopov, 2022; Li & Zhang, 2022; Girdzijauskas et al., 2022).

In this context, this study provides a novel contribution to the literature on banking development in resource-dependent economies through both methodological and empirical innovations. First, it implements an integrated econometric approach that combines the Bai–Perron test for the identification of structural breaks (corresponding to the years 2010 and 2014) with an ARDL error correction model. This combination allows the analysis to capture both the long-run dynamics and the effects of major historical shocks, such as the 2008 global financial crisis and the 2014 oil price collapse—factors often overlooked in empirical research on Ecuador. Second, it addresses data consistency challenges by applying time series transformation techniques, including the Chow-Lin method to interpolate quarterly GDP into monthly data and the Kalman filter to impute missing unemployment values.

Additionally, the study includes robustness checks using alternative data treatments to validate the reliability of the findings. Importantly, the results reveal a unidirectional causality running from banking variables to GDP, even when controlling for systemic shocks (e.g., the 2020 COVID-19 crisis) and latent institutional quality—challenging the bidirectional dynamics reported in other developing countries (Abbas et al., 2022). These methodological advances contribute to resolving longstanding theoretical debates about the finance–growth nexus in contexts of financial concentration and commodity dependence, offering policy-relevant evidence. In this framework, the main objective of the study is to examine the relationship between bank credit and deposits and Ecuador's economic growth and to evaluate the direction of causality between these variables through formal econometric testing.

Grounded in the financial intermediation theory and supported by empirical evidence from developing economies (King & Levine, 1993; Abbas et al., 2022; Gadisa & Tigre, 2022), this study formulates the following hypotheses: (1) there is a positive and statistically significant long-run relationship between bank deposits and economic growth in Ecuador, and (2) there is also a positive and statistically significant long-run relationship between bank credit and economic growth, as credit facilitates capital formation and investment in productive sectors.

2. Results

2.1. Descriptives

This section presents the results of the estimations. First, in order to see the behavior of the variables of interest over time, the series of the logarithm of GDP, the logarithm of total loans or bank portfolio, and the logarithm of total bank deposits are plotted, as shown in Figure 1.

It should be remembered that these variables are not in levels but belong to the logarithms of the seasonally adjusted series. The visual analysis reveals a similar trend between the series, although in the GDP series, there are still volatilities, it is evident that the crises have common effects in the series, such as the decay of 2008, 2015, and 2020. It can be intuited that the series are related, but to give a final verdict on this, a cointegration analysis must be performed.

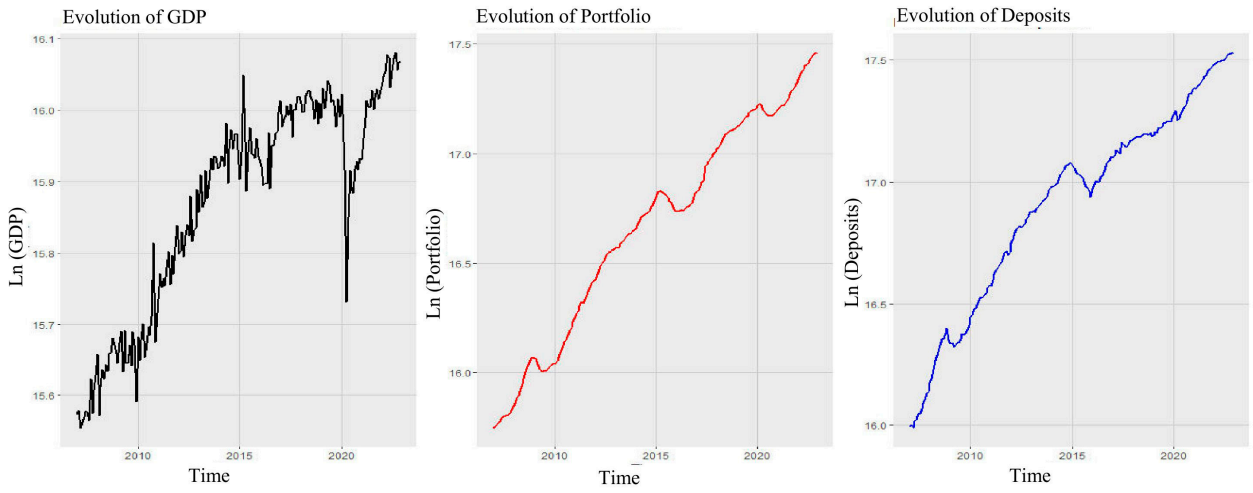


Figure 1. Evolution of GDP, Loans, and Deposits.

2.2. Unit Root Analysis

First, the results of the unit root tests are presented, which as mentioned in the methodology part, the augmented Dickey-Fuller unit root tests and the Zivot-Andrews test are used for this purpose.

The augmented Dickey–Fuller test, presented in Table 1, shows that there are variables that are $I(1)$ and $I(0)$, specifically, *GDP*, *Portfolio*, *Deposits*, and the level of monetization M2 are variables of order of integration 1. Inflation and unemployment are stationary variables.

Table 1. Augmented Dickey–Fuller Unit Root Test.

Variable	Model	Statistical	Critical Valor at 5%
$ln(GDP)$	*Drift and Trend*	−2.96	−3.43
$Ln(Portfolio)$	*Drift and Trend*	−2.04	−3.43
$ln(Deposits)$	*Drift and Trend*	−2.39	−3.43
$ln(Inflation)$	*Drift*	−5.22	−2.88
$ln(M2)$	*Drift and Trend*	−1.31	−3.43
$ln(Unemployment)$	*Drift*	−4.76	−2.88

Note: The test has as null hypothesis the existence of a unit root in the series.

Given the temporality of the data, it is highly probable that the variables have some structural break. To consider this, we proceeded to analyze the existence of a unit root using the Zivot–Andrews test. The results of this test are presented in Table 2.

Table 2. Zivot–Andrews Unit Root test.

Variable	Model	Statistical	Critical Valor at 5%
$ln(GDP)$	*Drift and Trend*	*−5.05*	−5.08
$Ln(Portfolio)$	*Drift and Trend*	*−3.39*	−5.08
$ln(Deposits)$	*Drift and Trend*	*−4.10*	−5.08
$ln(Inflation)$	*Drift*	*−7.06*	−4.80
$ln(M2)$	*Drift and Trend*	*−3.81*	−5.08
$ln(Unemployment)$	*Drift*	*−5.40*	−4.80

Note: The test has as null hypothesis the existence of a unit root in the series.

The results are robust regardless of the test, since with the Zivot–Andrews test again GDP, Portfolio, Deposits, and M2 have a unit root, but unemployment and inflation variables are stationary.

2.3. Cointegration Test and Long-Run Relationships

To analyze structural breaks, as mentioned in the methodology, the Bai–Perron test is used. This test requires the specification of a model, in this case, a model with a trend, and that considers the 2020 crisis as a dichotomous variable. Additionally, it must be specified what the minimum fraction of data in each segment is before and after a possible break, to avoid errors in the choice of this parameter, the test has been performed with different values, as detailed in the Appendices A and B of this document.

For this case, it has been decided to place as break points the dates of August 2010 and March 2014, this as suggested by the Bai–Perron test and historical coincidences such as the effect of the international crisis 2008–2009 (Wong, 2012) and the fall in the oil price in 2014 (Baumeister & Kilian, 2016).

Given the structural breaks, the model considers dummy variables that mark 1 in the different periods of breaks, from now on these variables will be named Q1 and Q2.

Given the different orders of integration of the variables, we proceeded to estimate the respective ARDL model (Appendix A), from which the following error correction model is obtained, see Table 3.

Table 3. Representation of the Error Correction Model.

Variable	Estimate	Std. Error	t-Value	Pr (>|t|)	Significance
$Intercept$	4.295214	1.102451	3.896	0.000145	***
$ln(GDP_{t-1})$	−0.385804	0.092573	−4.168	5.10×10^{-5}	***
$ln(Portfolio_{t-1})$	−0.016934	0.057589	−0.294	0.769115	
$ln(Deposits_{t-1})$	0.175444	0.071405	2.457	0.015112	**
$Inflation_{t-1}$	−2.372.578	0.920473	−2.578	0.010882	**
$ln(M2_{t-1})$	−0.047758	0.07865	−0.607	0.54459	
$Unemployment_{t-1}$	−0.804971	0.438735	−1.835	0.068459	*
$Q1_{t-1}$	0.018149	0.011553	1.571	0.118216	
$Q2_{t-1}$	0.035252	0.018643	1.891	0.060498	*
$Dummy\ 2020_{t-1}$	−0.021394	0.022404	−0.955	0.341097	
$\Delta ln(GDP_{t-1})$	−0.464859	0.094975	−4.895	2.45×10^{-6}	***
$\Delta ln(GDP_{t-2})$	−0.440327	0.088055	−5.001	1.53×10^{-6}	***
$\Delta ln(GDP_{t-3})$	−0.268425	0.078179	−3.433	0.000765	***
$\Delta ln(GDP_{t-4})$	−0.133105	0.061987	−2.147	0.033322	**
$\Delta Inflation_t$	−0.721552	0.821547	−0.878	0.381148	
$\Delta ln(M2_t)$	0.53212	0.284255	1.872	0.063093	*
$\Delta ln(M2_{t-1})$	−0.521032	0.278473	−1.871	0.063225	*
$\Delta Unemployment_t$	−0.237076	0.51281	−0.462	0.644508	
$\Delta Unemployment_{t-1}$	0.070468	0.519346	0.136	0.892245	
$\Delta Unemployment_{t-2}$	−0.725843	0.51591	−1.407	0.161454	
$\Delta Unemployment_{t-3}$	−0.419929	0.535018	−0.785	0.433718	
$\Delta Unemployment_{t-4}$	0.926339	0.528241	1.754	0.081471	*
$\Delta Q1_t$	0.012487	0.025798	0.484	0.629043	
$\Delta Q1_{t-1}$	0.086011	0.026233	3.279	0.001288	***
$\Delta Q1_{t-2}$	−0.069508	0.026523	−2.621	0.009648	***
$\Delta Q2_t$	0.011925	0.036683	0.325	0.745549	
$\Delta Q2_{t-1}$	0.125912	0.037455	3.362	0.000976	***
$\Delta Q2_{t-2}$	−0.130727	0.038497	−3.396	0.000869	***
$\Delta Dummy\ 2020_t$	0.002062	0.022297	0.092	0.926447	
$\Delta Dummy\ 2020_{t-1}$	0.018111	0.022235	0.815	0.416599	
$\Delta Dummy\ 2020_{t-2}$	0.006771	0.02215	0.306	0.760257	
$\Delta Dummy\ 2020_{t-3}$	−0.089954	0.021969	−4.095	6.79×10^{-5}	***

Note: (***) Significance at 1%, (**) Significance at 5%, (*) Significance at 10%.

It should be remembered that the dependent variable of the Error Correction model is the variation of the logarithm of the GDP in period t. Then, the intercept, which is 4.295214, is highly significant. This indicates that, when all explanatory variables are equal to zero,

the average of the variable ΔGDP_t is 4.295214. The effect of $\ln(GDP_{t-1})$ is a decrease of 0.385804 and is highly significant. This suggests that an increase in GDP in the earlier period is associated with a decrease in the dependent variable in the short run. The coefficient estimate of $\ln(Portfolio_{t-1})$ es -0.016934, but the same is not significant. This indicates that this variable does not have a significant effect in the short run, but with deposits, the coefficient is 0.175444, which is significant at 5%.

The ARDL bounds testing approach proposed by Pesaran et al. (2001) was chosen for several reasons. First, it allows the estimation of both long- and short-run dynamics simultaneously within a single equation framework, which is particularly suitable for small samples like Ecuador's monthly macroeconomic data. Second, ARDL does not require all variables to be integrated of the same order, unlike the Johansen cointegration technique, which assumes all variables are $I(1)$. Given that the ADF and Phillips-Perron tests indicate mixed integration orders in the series used, the ARDL model is methodologically appropriate.

Additionally, dynamic panel methods such as GMM are not applicable in this context due to the single-country design of the study and the limited time span of the interpolated monthly data. The GMM approach is primarily suited for multi-country panel datasets and relies on large cross-sectional dimensions for instrument validity.

However, it is acknowledged that the ARDL model, while suitable for this case, is not without limitations. For instance, it may be sensitive to lag selection and structural instability if not addressed properly. This is why the model incorporates structural break testing and robustness checks to strengthen its reliability.

Inflation and the unemployment rate have a negative and significant effect on the variation of the logarithm of national production; the opposite is the case with the logarithm of M2, which has a positive effect on the variation of growth; however, this effect is not significant. Regarding the variable that captures the effect of the 2020 crisis, a negative effect is obtained, but like M2 it does not have a significant effect in the short term.

Regarding the Bounds Test, details of the results are shown in Table 4.

Table 4. Bounds Test for cointegration of the ARDL model.

Statistical	Value
F-Statistical	4.933912
Upper limit I(0)	2.466597
Lower limit I(1)	3.632263
Significance level (alpha)	0.05
p-value	0.003279

Note: The Bounds Test has as null hypothesis the non-cointegration of the variables, in addition, for this case, a model with drift and trend was assumed given the nature of the variables of interest.

The test compares the F statistic with two limits in the case that the statistic is lower than the lower limit the null hypothesis is not rejected, if the statistic falls within the lower and upper limits, the test is inconclusive, but if the F statistic is greater than the upper limit, the variables cointegrate, This last case is the one presented in this paper, so it is concluded that there is a real long term relationship between the variables and with special attention it can be said that economic growth is related to the banking variables in the period analyzed and it is not a simple spurious relationship.

With these results, we can now derive a long-run equation, and additionally, the variable that measures the correction of the long-run disturbances in the short run. The results of this are presented in detail in Table 5.

Table 5. Long-term multipliers and error correction term.

Variable	Estimate	Standard Error	Valor t	Valor p
$Intercept$	11.133144 ***	0.651914	17.077608	1.88×10^{-37}
$ln(Portfolio_t)$	−0.043892	0.148828	−0.294920	0.7684
$ln(Depsitos_t)$	0.454747 **	0.183804	2.474089	0.0144
$Inflation_t$	−6.149695 **	2.571072	−2.391879	0.0179
$ln(M2_t)$	−0.123788	0.208201	−0.594562	0.5530
$Unemployment_t$	−2.086474 *	1.075878	−1.939322	0.0542
$Q1$	0.047042 *	0.027882	1.687195	0.0935
$Q2$	0.091373 *	0.042822	2.133764	0.0344
$Dummy\ 2020_t$	−0.055452	0.056674	−0.978452	0.3297
ecm	−0.385804 ***	0.092573	−4.168	5.10×10^{-5}

Note: (***) Significance at 1%, (**) Significance at 5%, (*) Significance at 10%.

Since the interest variables are measured in logarithms, the coefficients of $ln(Portfolio_t)$ and $ln(Deposits_t)$ can be interpreted as long-run elasticities, for the case of the loan portfolio there is not enough evidence to affirm that the long-run elasticity between this variable and economic growth is significant in the long run. On the other hand, if deposits increase by 1%, this implies that the country's GDP will increase by an average of 0.454% units in the long run.

Regarding inflation and unemployment, it is evident that they have significant and negative effects on long-term economic performance, while the monetization variable and the 2020 crisis have no significant effect in the long run. On the other hand, the structural breaks variables are significant indicating the change in the GDP trend in the analysis period.

2.4. Causality Test

The Granger causality test was utilized to examine the dynamic relationship between growth and banking variables. Table 6 shows the test results.

Table 6. Granger causality test results for GDP and banking variables.

Analysis Between GDP and Portfolio		Analysis Between GDP and Deposits	
Null Hypothesis	p-value	Null Hypothesis	p-value
Portfolio NOT cause GDP	0.0151	Deposits NOT cause GDP	0.0235
GDP NO cause Portfolio	0.9134	GDP NOT cause Deposits	0.5763

Note: The Granger causality test is based on the F-statistic.

It is important to clarify that Granger causality refers only to predictive or temporal precedence, not structural causality. While the test can suggest whether changes in banking variables help forecast changes in GDP, it does not imply a direct or true causal mechanism. Additionally, the presence of potential endogeneity—due to reverse causality, omitted variables, or measurement errors—cannot be fully ruled out. Although the ARDL framework addresses some of these concerns through lag structures and error correction, future research could benefit from the use of instrumental variables or structural models to more robustly address causality.

In the case of the relationship between GDP and Portfolio, the logarithm of Portfolio causes Granger to the Logarithm of GDP, but not in the opposite direction, i.e., changes in the banks' Loan Portfolio occur before changes in GDP, i.e., past Portfolio values influence the present value of GDP. In the case of the relationship between GDP and Portfolio, it is found that the logarithm of the Portfolio causes Granger to the Logarithm of GDP, but not in the opposite direction, this means that the changes in the banks' Loan Portfolio occur

before the changes in GDP, or in other words, the past values of the Portfolio influence the present value of GDP.

On the other hand, bank deposits and loans have been identified as "driving" GDP growth according to the results obtained. However, it is important to note that Granger causality, employed in this study, reflects only a temporal precedence relationship between variables, without necessarily establishing structural or true causality in a broader sense. Therefore, it is recognized that this methodology is useful for understanding temporal patterns but should not be interpreted as definitive evidence of a direct causal link.

In addition, possible endogeneity problems that could influence the results should be considered. Factors such as omitted variables or mutual relationships between deposits, loans, and economic growth could generate biases in the estimation. To address this limitation, we suggest exploring additional strategies, such as the use of instrumental variables or structural models that allow us to validate the findings and assess the causal relationship with greater precision.

2.5. Robustness Analysis

In this paper, it has been decided to apply different methodologies, one to measure GDP and another to impute unemployment data, this can be the basis for criticizing the results obtained, that is, why alternative methodologies such as Delton–Cholette and Spline imputation were used, the data obtained from this analysis are used to re-estimate the long-run multipliers and the Bounds Test.

First, the comparisons of the long-term multipliers are presented in Table 7. The estimation where the Chow-Lin methodology was used for GDP and Kalman for unemployment is denoted as Model 1. On the other hand, Model 2 is the model where the Delton–Cholette methodology was used for GDP and Spline for unemployment.

Table 7. Comparison of results of long-term multipliers in models with different monthlyization and imputation approaches.

Variable	Model 1	Model 2
$Intercept$	11.133144 ***	9.550405 ***
$ln(Portfolio_t)$	−0.043892	−0.187226
$ln(Deposits_t)$	0.454747 **	0.637689 *
$Inflation_t$	−6.149695 **	−15.449960 ***
$ln(M2_t)$	−0.123788	−0.07178059
$Unemployment_t$	−2.086474 *	−2.12804243
$Q1$	0.047042 *	0.01632419
$Q2$	0.091373 *	0.04485436
$Dummy\ 2020_t$	−0.055452	−0.18395231 ***
ecm	−0.385804 ***	−0.671832 **

Note: (***) Significance at 1%, (**) Significance at 5%, (*) Significance at 10%.

It is observed that the results of the banking variables are maintained in both Model 1 and Model 2, since again, deposits are significant, and loans have no effect on economic growth. The value of 0.6376 is interpreted as percentage points by which GDP increases when deposits increase by 1%.

It should be noted that the unemployment and structural breaks variables are no longer significant, but the dummy variable indicating the economic crisis of 2020 is now significant.

Now, if we proceed with the Bounds Test for Model 2, the summary of the test is presented in Table 8.

Table 8. Prueba de Bounds Test para cointegración del modelo ARDL.

Statistical	Value
F-Statistical	3.539306
Upper Limit $I(0)$	2.229949
Lower Limit $I(1)$	3.397648
Significance level (alpha)	0.05
p-Value	0.0363592

Note: The Bounds Test has as null hypothesis the non-cointegration of the variables, in addition, for this case, a model with drift and trend was assumed given the nature of the variables of interest.

Model 2 again shows that the variables of the model cointegrate, which means that they share a long-term trend, and it is not a spurious relationship, which would confirm once again that deposits follow the path of GDP over time and are positively related to it. These results confirm the first findings and contribute to their robustness.

3. Discussion

Contrary to the findings of King and Levine (1993), the banks' portfolio does not seem to have a significant relationship with economic growth in the period analyzed for Ecuador, which suggests that there may not be a good distribution of capital in the country, which may be preventing stable economic growth, obviously when analyzing economic growth not only one variable is considered the most determinant, but these findings suggest that loans are not in any case cooperating with the growth of the country. This may be because the literature suggests that, in the absence of good institutional quality, economic growth is not affected by financial development (Asante et al., 2023). This can be seen as an indication of the deterioration of national institutions. And, in fact, Wen et al. (2022) propose similar recommendations as in this paper; the loan portfolio variable has no effect on growth.

If we compare the findings of this article with the findings of Cheng et al. (2021), we find discordance with the effect of the private financial sector on growth, since these authors show that the banking sector is detrimental to economic growth, but it should be considered that the authors investigate the effect of ICTs, and their interrelation with the private financial sector, on economic growth, and that this interrelation positively affects growth.

Additionally, the effect of the credit portfolio on growth can be non-significant due to non-performing loans, and special attention should be paid to this because, according to Mamatzakis et al. (2019) and Tölö and Virén (2021), non-performing loans, besides having no effect on the economy, also hinder the lending capacity of banks in the future.

Unlike Abbas et al. (2022), who found bidirectional causality, when in this study the causality was analyzed by means of the Granger test between the variables of interest, a unidirectional causality of the financial variables with GDP was evidenced, the latter being caused, in the Granger sense, by the two financial variables (Loans and Deposits). But the results are in harmony with Mhadhbi et al. (2020) who do the analysis for developing countries.

This study found a similarity with the research conducted by Zhang and Zhou (2021), which identified a positive relationship between the variables. However, as Zhang and Zhou used calibration to test their hypotheses, this study could not capture the inverted U-shaped relationship they proposed.

Regarding deposits, the results are compatible with those of Vrotslavskyy and Dropa (2024), since deposits, in addition to having a positive effect on GDP, also have a long-term relationship; even so, favorable political conditions must be maintained so that this does not change.

The results contradict the traditional hypothesis that financial development automatically boosts growth (King & Levine, 1993). Instead, they suggest that in contexts with low institutional quality (Asante et al., 2023), credit loses its effectiveness due to: (a) inefficient allocation to non-productive sectors, and (b) high levels of non-performing loans. This supports the 'institutional threshold' theory, where only economies with certain regulatory soundness maximize the benefits of the banking sector. Future research should explore this threshold in oil economies.

These findings are consistent with recent research by Saliba et al. (2023), who demonstrate that in emerging economies, elevated political, economic, and financial risks contribute to higher credit risk and non-performing loans. Their study, focusing on the BRICS countries, shows that when institutional weaknesses and systemic vulnerabilities prevail, the effectiveness of bank lending in stimulating economic growth is significantly reduced. This supports the argument that, in Ecuador, the limited impact of credit on GDP may stem from persistent inefficiencies in credit allocation and institutional fragility.

The results obtained have important public policy implications. First, there is evidence of the need to strengthen financial supervision by regulatory agencies (e.g., the Superintendency of Banks and the Central Bank). Stricter control of bank asset quality would help reduce delinquency levels and ensure sounder lending practices. Second, it is essential to improve the efficiency of credit allocation: financial institutions should direct a greater proportion of their lending to productive and high-development-impact sectors. Targeted lending policies and appropriate incentives could ensure that deposits collected are channeled into sustainable growth-enhancing investments. Overall, a robust supervisory framework and improved credit distribution would contribute to enhancing the role of the banking system as an engine of Ecuador's economic growth, while mitigating the current institutional weaknesses that limit credit effectiveness.

4. Materials and Methods

In order to achieve the objectives of this article, a non-experimental quantitative methodology is used in this research, the reason for this approach is due to the econometric analysis of the time series used and the nature of obtaining the data, which belong to the Central Bank of Ecuador (Banco Central del Ecuador, 2025), in the case of GDP, inflation and the level of M2 monetization; the statistics portal of the Superintendency of Banks (Superintendencia de Bancos, 2025) for the Amount of Loans or Portfolio and for the total Deposits; finally, the unemployment rate was obtained from the INEC (2025). Specifically, the dependent variable is GDP, which measures economic growth, the independent variables of interest are the amount of private bank loans and total deposits, and the control variables are unemployment, inflation, and the level of M2 monetization.

The objective is to find if there is a real long-term relationship between the total portfolio of banks and bank deposits with economic growth, for this it is required that the time series that make up the data have the same length and temporal frequency. In the case of banking variables, the information is of a monthly nature; however, the GDP series has a quarterly time series, which is why this series must be monthly before performing the analysis. Fortunately, the Central Bank of Ecuador publishes the so-called Economic Activity Index on a monthly basis, with this information the GDP can be monthlyized using the methodology proposed by Chow and Lin (1971). The method is designed to convert low frequency data to high frequency data. In summary, the treatment of GDP is as follows.

Since a way is sought to match the monthly data with the quarterly aggregation, the concept of conversion matrix is introduced. In a matrix fashion, the conversion matrix comes into play as follows.

$$\boldsymbol{GDP_{qtr}} = \boldsymbol{C}[\boldsymbol{GDP_{mth}}] \quad (1)$$

where $\boldsymbol{GDP_{qtr}}$ is the GDP vector with quarterly frequency data, $\boldsymbol{GDP_{mth}}$ is the monthly frequency GDP vector, and is the one to be estimated, and C is the conversion matrix whose function is to sum the monthly GDP data so that they coincide with the quarterly GDP. The Economic Activity Index enters into the monthly GDP estimation through the following regression.

$$\mathbf{GDP}_{mth} = \mathbf{b}[\mathbf{IDEAC}_{mth}] + \boldsymbol{\varepsilon} \tag{2}$$

where $\boldsymbol{IDEAC_{mth}}$ it is the Monthly Economic Activity Index, and ε is the error term, which is assumed to follow an AR(1) process. That is, the monthly GDP is estimated using a variable that reflects the country's economic reality. If the first expression is combined with the second, an equation is obtained that relates the quarterly GDP to the Monthly Economic Activity Index. Specifically, the expression is as follows.

$$\mathbf{GDP}_{qtr} = \mathbf{C}[\mathbf{b}[\mathbf{IDEAC}_{mth}] + \boldsymbol{\varepsilon}] \tag{3}$$

This model is estimated using the Generalized Least Squares method. Once the monthly GDP variable is available, a database can be created that shares the same frequency as the private banking sector's portfolio information.

Another variable that needs to be estimated is the unemployment rate, as data is available from 2007 but only for the month of December. From that point onward, data is available for June and December each year until 2014. More frequent data, covering March, June, September, and December, became available until 2021, after which monthly data has been recorded through 2024. Given the relevance of the labor factor in economic growth, data imputation is performed using the Kalman Filter, as suggested by Gómez and Maravall (1994).

To account for growth periods influenced by temporary effects, some studies suggest seasonally adjusting the data (Kumar et al., 2020). To control for the seasonal component, the X-13 ARIMA-SEATS seasonal adjustment (U.S. Census Bureau, 2025) is applied. Additionally, to control for volatility, variables that exhibit trends, such as GDP, portfolio, deposits, and the level of monetization, are expressed in logarithms.

With the publication of Engle and Granger (1987), cointegration analysis began, aiming to identify long-term relationships between variables and avoid spurious regressions. While several cointegration approaches exist, this document employs the bounds testing approach to cointegration within the ARDL framework, as proposed by Pesaran and Shin (1999) and Pesaran et al. (2001). The rationale for using this methodology lies in its ability to handle variables integrated of order I(1) and I(0). This approach estimates an ARDL model, from which the Error Correction Model (ECM) can be derived.

The specification of the ARDL model is as follows.

$$\begin{aligned} ln(GDP_t) = {} & \alpha + \sum_{i=1}^{p} \beta_i ln(GDP_{t-i}) + \sum_{j=0}^{q} \gamma_{1,j} ln\left(Portfolio_{t-j}\right) + \sum_{k=0}^{r} \gamma_{2,k} ln\left(Deposits_{t-k}\right) \\ & + \sum_{l=0}^{s} \delta_{1,l} Inflation_{t-l} + \sum_{m=0}^{u} \delta_{2,m} ln(M2_{t-m}) \\ & + \sum_{n=0}^{v} \delta_{3,n} Unemployment_{t-n} + \sum_{z=0}^{w} \delta_{4,z} Dummy2020_{t-z} + \epsilon_t \end{aligned} \tag{4}$$

where GDP refers to Gross Domestic Product, which is the variable that measures growth. Portfolio and Deposits represent the total amount of loans from private banks and the total deposits of private banks, respectively, and are the key variables of interest in this study. The control variables include Inflation, measured by the Price Variation Index; M2, which represents the level of monetization in the economy; and Unemployment, which reflects the labor market situation.

Additionally, to account for the effects of the 2020 crisis, a dummy variable, Dummy2020, was included. This variable has a value of 1 if the year is 2020 and 0 otherwise. The error term is denoted by ϵ_t.

The lag orders of the variables included in the model (p, q, r, s, u, v, and z) are selected based on the Akaike Information Criterion (AIC). The selection process begins with up to 12 lags to capture the effects of lagged variables from the previous year, and from there, the best-fitting model is chosen.

Regarding the Error Correction Model (ECM) associated with the ARDL model, we have the following:

$$\begin{aligned}\Delta ln(GDP_t) = {} & \alpha + \lambda ECM_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta ln(GDP_{t-i}) + \sum_{j=0}^{q-1} \theta_{1,j} \Delta ln(Portfolio_{t-j}) \\ & + \sum_{k=0}^{r-1} \theta_{2,k} \Delta ln(Deposits_{t-k}) + \sum_{l=0}^{s-1} \delta_{1,l} \Delta Inflation_{t-l} \\ & + \sum_{m=0}^{s-1} \delta_{2,m} \Delta ln(M2_{t-m}) + \sum_{n=0}^{u-1} \delta_{3,n} \Delta Unemployment_{t-n} \\ & + \sum_{z=0}^{v-1} \delta_{4,z} \Delta Dummy2020_{t-z} + \epsilon_t\end{aligned} \tag{5}$$

where ECM_{t-1} expresses the long-term relationship between GDP and the independent variables in period $t-1$, and the value of λ measures the proportion of the disequilibrium (i.e., the deviation from the long-term equilibrium) that is corrected in each period. The formulation of the Error Correction Model (ECM) depends on the lag order of the model. A more general formulation of these processes is detailed in the works of Natsiopoulos and Tzeremes (2022), Nkoro and Uko (2016), and Kripfganz and Schneider (2023). To test for cointegration, the Bounds Test is applied. This test is based on the F-test.

The ARDL (Autoregressive Distributed Lag) approach was selected in this study due to several methodological advantages that make it particularly suitable for the analysis of monthly data on a single time axis. This method stands out for its ability to handle time series with different orders of integration, allowing the inclusion of variables that are stationary in levels (I(0)) and those that are stationary in first differences (I(1)), something that is not possible with methods such as Johansen's cointegration method. In addition, ARDL is highly efficient in small samples, such as the one used in this analysis (2000–2022), whereas Johansen's method usually requires a considerably larger sample size to obtain robust results.

Another key advantage of ARDL is its ability to simultaneously identify and estimate short- and long-run relationships between variables, which is especially useful in Ecuador's economic context, characterized by complex structural dynamics. However, we recognize that ARDL is not without limitations. One of them is its sensitivity to the presence of structural breaks, which, if not properly detected, can bias the results. To mitigate this challenge, in the present study, we applied the Bai–Perron test, which allowed us to identify and control for significant breaks in the structure of the data.

On the other hand, although Dynamic Panel GMM is a common methodology in similar research, its approach is more suitable for multilevel analysis or with more complex panel data, which does not correspond to the unidimensional nature of this research.

As mentioned above, the variables must be I(1) or I(0), but they cannot be of a higher order of integration, to check this assumption the unit root tests of Dickey and Fuller (1979) called Augmented Dickey–Fuller and the test of Zivot and Andrews (1992) are applied, the latter unit root test has the advantage of being robust to structural changes.

Given the period of analysis, structural breaks are a feature to be considered in the GDP series. The first thing to consider is the dates where the breaks in the GDP series exist. To locate these points, we use the Bai–Perron test (Bai et al., 1998). And to analyze the direction of causality between banking variables and economic growth, the Granger causality test (Granger, 1969) is used.

Finally, to test the robustness of the results, given the monthlyization and imputation methodologies used, it has been decided to compare the results with a model where GDP uses the Delton–Cholette methodology (Denton, 1971) to monthlyize quarterly GDP and the spline methodology (Schoenberg, 1988).

The Chow-Lin and Denton–Cholette methodologies have key differences in their approach and application. The Chow-Lin methodology uses a regression model to estimate high-frequency series from an indicator series. This approach minimizes the mean square error and ensures that the sum of the estimates is consistent with the low-frequency data. In contrast, the Denton–Cholette methodology focuses on preserving the motion patterns of an indicator series during conversion to higher frequencies. It is more flexible since it does not strictly depend on a high correlation with the indicator series.

On the other hand, the imputation of missing data using the Kalman filter and using splines also shows important methodological differences. The Kalman filter is based on a dynamic state-space approach that combines prediction and correction to estimate missing values. In contrast, spline imputation uses polynomial functions to create smooth curves that interpolate missing values. RStudio Desktop Open Source 2024.02 is the statistical software used to carry out all these procedures.

5. Conclusions

This paper evaluated the relationship between bank deposits and credit on economic growth in Ecuador, using cointegration and Granger causality techniques. The findings show that bank deposits have a positive and statistically significant long-run relationship with GDP, with an estimated elasticity of 0.378%. In contrast, credit does not exhibit a significant long-run effect. Granger causality tests suggest that banking variables cause economic growth, although this relationship is more robust in the case of deposits.

The absence of a long-run effect of credit may reflect inefficiencies in credit allocation or a high proportion of non-productive lending. Policymakers and financial institutions should assess the quality of credit portfolios and promote better credit targeting to enhance the developmental impact of lending. For the Central Bank of Ecuador, institutionalizing the analysis of structural breaks in macro-financial forecasting, and incorporating early-warning indicators related to global commodity prices and systemic shocks would strengthen resilience and policy responsiveness. Additionally, the creation of a public-private observatory to monitor delinquency and credit allocation at the subnational level could improve transparency and support evidence-based financial policy.

These findings confirm the hypotheses formulated in the introduction. First, deposits show a positive and significant long-run relationship with economic growth, consistent with financial intermediation theory and previous empirical research in developing economies. Second, credit does not exhibit a significant effect, suggesting that institutional limitations may weaken the theoretical link between credit and growth in the Ecuadorian context.

The results also have theoretical and policy implications. Theoretically, the findings reinforce the idea that deposit mobilization plays a more consistent role in growth than credit expansion in resource-dependent economies with weak institutional settings. From a policy perspective, efforts should focus on strengthening financial supervision, improving institutional quality, and increasing the efficiency of credit allocation to unlock the potential of the banking sector as a driver of growth.

Given that bank deposits exhibit a positive and statistically significant long-run relationship with Ecuador's GDP—while bank credit does not, likely due to high delinquency rates and institutional inefficiencies—and considering the country's vulnerability to external shocks as evidenced by the structural break analysis, several concrete policy actions are recommended to enhance the developmental impact of the financial sector. First, it is essential to strengthen financial supervision and institutional quality by reducing non-performing loans and improving the efficiency of credit allocation. Second, macroprudential planning should be enhanced by institutionalizing the monitoring of structural breaks and incorporating early-warning indicators linked to global commodity price fluctuations and

financial volatility, thereby increasing the resilience of the economy to external shocks. Third, a permanent public-private credit observatory should be established to monitor loan performance and subnational credit distribution, enabling timely and evidence-based adjustments in financial policy. Finally, there is a need to promote the sustainable mobilization of domestic savings by fostering public trust in the banking system and expanding financial inclusion, ensuring that increased deposits are efficiently channeled into productive investment. While tailored to the Ecuadorian context, these policy proposals may also serve as a framework for economies with similar structural features—namely, high financial concentration, commodity dependence, and institutional fragility—seeking to reinforce the finance–growth nexus.

While the methodology ensures robust results, some limitations should be acknowledged. GDP and unemployment series were harmonized using standard techniques (Chow-Lin and Kalman filter), which, although valid, may introduce estimation noise. Furthermore, the analysis could not be disaggregated by bank type or region, due to structural and data constraints. Future research could address these limitations by using disaggregated data, exploring nonlinearities, applying panel methods, or analyzing the role of fintech, institutional reforms, and financial inclusion in shaping the finance-growth nexus.

In methodological terms, the ARDL model poses specific limitations. In particular, the ARDL model can be sensitive to the choice of lags and assumes linear relationships among variables; therefore, it does not capture possible nonlinear or threshold effects (e.g., improvements in credit impact once a certain level of institutional quality is reached) unless additional specifications are introduced. Moreover, although structural break tests were incorporated in this paper to increase robustness, any unidentified structural changes or omitted variables could bias the estimates. It should also be cautioned that ARDL, by relying on a single cointegrating equation, does not fully address potential problems of endogeneity or simultaneous causality between financial variables and growth. For these reasons, the findings should be interpreted with caution. Future studies could adopt complementary approaches-such as nonlinear models, panel analysis, or instrumental variable techniques verify the validity of these results and further explore the relationship between bank lending, deposits, and economic growth.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Modelo ARDL

Variable	Estimated	Standard Error	t-Value	Pr	Significance
(Intercept)	366.569	0.83146	4.409	1.84×10^{-5}	***
L(GDP, 1)	0.16687	0.06992	2.387	0.018112	**
L(GDP, 2)	0.06720	0.06839	0.983	0.327170	
L(GDP, 3)	0.20458	0.06551	3.123	0.002106	***
L(GDP, 4)	0.21502	0.06272	3.428	0.000763	***
PORTFOLIO	−0.06820	0.04932	−1.383	0.168558	
DEPOSITS	0.13084	0.05430	2.409	0.017056	**
INFLATION	−131.912	0.86614	−1.523	0.129631	
L(INFLATION, 1)	−201.330	0.91094	−2.210	0.028440	**
L(INFLATION, 2)	120.052	0.88685	1.354	0.177645	
M2	0.39243	0.30032	1.307	0.193085	
L(M2, 1)	−0.89729	0.43397	−2.068	0.040196	**
L(M2, 2)	0.55162	0.29869	1.847	0.066529	*
UNEMPLOYMENT	−0.86910	0.22364	−3.886	0.000146	***
dummy_2020	0.03613	0.02161	1.672	0.096347	*
L(dummy_2020, 1)	−0.02093	0.02780	−0.753	0.452522	
L(dummy_2020, 2)	−0.02934	0.02777	−1.056	0.292334	
L(dummy_2020, 3)	−0.09714	0.02797	−3.473	0.000654	***
L(dummy_2020, 4)	0.09906	0.02244	4.414	1.81×10^{-5}	***

Note: (***) Significance at 1%, (**) Significance at 5%, (*) Significance at 10%.

Appendix B

Structural Breaks

Fraction of Data	Breaking Points
20%	August 2010 March 2014
30%	April 2013
40%	April 2014
50%	December 2014

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