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ORIGINAL ARTICLE

Market Structure and Competition of the Peruvian Financial System in the period 2011–2022

Estructura de mercado y competencia del sistema financiero peruano en el periodo 2011 – 2022

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Abstract

This research analyzes the market structure and its relationship to the level of competition in the Peruvian financial system during the period 2011–2022. A quantitative, non-experimental, and explanatory approach is employed, using concentration indicators such as the concentration ratio and the Herfindahl–Hirschman Index, as well as competition measures based on the Panzar–Rosse, Lerner, and Boone models. The analysis is conducted using balanced panel data from 45 financial institutions supervised by the Superintendency of Banking, Insurance, and Pension Funds. The results reveal a high level of concentration, particularly in the multiple banking sector, with concentration ratios ranging from 72% to 77% and Herfindahl–Hirschman Index values between 1500 and 1760. The H-statistic, with a value of 0.78, indicates a monopolistic competition environment. The Lerner and Boone indices initially reflect high levels of competition; however, both exhibit a declining trend over the analyzed period. Additionally, the banking sector is observed to maintain greater market power compared to the non-banking segment. In conclusion, the Peruvian financial system is characterized by high concentration and monopolistic competition, with competition levels progressively decreasing as market power increases.

Keywords: *Competition, Concentration, Panzar-Rosse model, Financial system.*

Resumen

La presente investigación analiza la estructura de mercado y su relación con el nivel de competencia del sistema financiero peruano durante el periodo 2011-2022. Se emplea un enfoque cuantitativo, no experimental y explicativo, utilizando indicadores de concentración, como ratio de concentración e índice Herfindahl-Hirschman, así como las medidas de competencia basadas en los modelos de Panzar-Rosse, Lerner y Boone. El análisis se aplica a datos de panel balanceado de 45 entidades financieras supervisadas por la Superintendencia de Banca, Seguros y AFP. Los resultados muestran un elevado nivel de concentración, especialmente en la banca múltiple, con ratio de concentración entre 72% y 77% y el índice Herfindahl-Hirschman entre 1500 y 1760. El estadístico H, igual a 0.78, evidencia un entorno de competencia monopolística. Los índices de Lerner y Boone reflejan inicialmente altos niveles de competencia; sin embargo, ambos muestran una tendencia decreciente a lo largo del periodo analizado. Asimismo, se observa que la banca mantiene mayor poder de mercado en comparación con el segmento no bancario. En conclusión, el sistema financiero peruano se caracteriza por alta concentración y competencia monopolística, con niveles de competencia que disminuyen progresivamente mientras aumenta el poder de mercado.

Palabras clave: *Competencia, Concentración, Modelo de Panzar-Rosse, Sistema financiero.*

1. Introduction

The financial system plays an important role in economic development, whose basic function is to mobilize resources toward investment activities. In the Peruvian case, the structure of the financial system has exhibited processes of mergers and acquisitions, driven by development and innovation, as well as technological and regulatory changes. According to information and statistical reports from the Superintendence of Banking, Insurance, and Pension Funds (SBS), a high level of concentration is observed, especially in the multiple banking sector, where only four banks dominate most of the assets, loans, and deposits. This dynamic raises the need to evaluate the market structure and competition of the Peruvian financial system.

In empirical studies, competition measures such as the Lerner index (1934), which measures a firm's market power, have been used, and one of the most widely used methods is the Panzar & Rosse (1987) model, which estimates competition in the banking industry by calculating the H-statistic. These models have been applied internationally, demonstrating their usefulness in diverse contexts, and have been analyzed by authors such as Bikker & Haaf (2002), Claessens & Laeven (2004), and Yeyati & Micco (2007). In turn, Boone (2008) measures competition by relating efficiency to profits. According to Claessens & Laeven (2004), banking competitiveness depends more on ease of entry and the reduction of restrictions than on market structure. Likewise, Martinez-Miera & Repullo (2010) show that the relationship between competition and stability is non-linear, where moderate levels of competition minimize risk, while very high levels increase it.

International evidence shows that banking systems mainly operate under monopolistic competition or competitive oligopoly schemes. McHugh (2023) and Flores Arévalo (2021), using the Panzar–Rosse model, find that banking markets exhibit limited competition, though distinct from pure monopoly. Likewise, Guidi (2021) shows that concentration processes tend to reduce competition. In turn, Malini & Putri (2020) show structural differences across countries, where higher levels of concentration are associated with greater banking market power.

In Latin America, concentration in the financial system has shown a similar pattern, accompanied by foreign capital participation (Yeyati & Micco, 2007; Yildirim & Philippatos, 2007). Authors such as Torres & Castaño (2020) for the case of Colombia and Camino-Mogro & Armijos-Bravo (2018) for the case of Ecuador found that banking markets operate under monopolistic and oligopolistic competition, where a few institutions dominate the market. In this sense, other factors such as technological development, financial inclusion, and efficient regulation have shaped the levels of competition (Khan et al., 2017; Ventouri, 2018).

In the Peruvian case, studies agree in pointing to a high degree of banking concentration and low levels of competition. Bravo et al. (2022) and Jiménez Rivera (2020) find that the credit and deposit market is dominated by a few institutions, with limited competition. Likewise, Huayta et al. (2018) and Céspedes-Reynaga & Orrego (2014) conclude that both multiple banking and microfinance institutions operate under a monopolistic competition framework, while Mayorca & Aguilar (2016) warn that higher levels of competition may negatively affect the quality of the loan portfolio. Taking these studies and findings into account, the present research complements and reinforces the results on concentration and competition by analyzing the evolution of market structure and the degree of competition in the Peruvian financial system.

The causes of banking concentration may arise from higher entry barriers, high costs, economies of scale, and stringent regulations (Heflebower, 1957; Zurita, 2014). Likewise, product differentiation and market segmentation support the market share of leading financial firms (De Guevara et al., 2005; Petersen & Rajan, 1995). In addition, larger banks have integration advantages, which expand access to more developed networks, systems, and infrastructure (Malini & Putri, 2020). The consequences

of high banking concentration and lack of competitiveness may include higher financial margins, a reduction in credit supply and an increase in its cost, lower innovation, and reduced efficiency in credit allocation (Beck et al., 2004; Spierdijk & Shaffer, 2015). Nevertheless, it is argued that, despite high banking concentration, competition can be enhanced, fostering stability and resilience to crises (Simatele, 2015).

1.1 Literature on market structure and competition

The Structure–Conduct–Performance (SCP) model, as a traditional approach, was proposed by Joe S. Bain in the 1950s. The hypothesis of the model is that, according to Bain (1951), market structure, such as concentration, influences firm behavior, and behavior affects measurable market performance, such as profit margins. Therefore, market structure determines firm conduct, and this in turn determines performance (Heflebower, 1957). The SCP model has been developed through numerous applied studies in industrial organization and in the financial system, especially in the banking industry; these studies are based on the premise that market structure affects firm behavior, which in turn influences outcomes such as profitability and efficiency. In this way, greater market concentration limits the levels of competition and strengthens firms' market power (Bikker & Haaf, 2002; Guidi, 2021; Khan et al., 2017; U-Din et al., 2018).

In turn, the Efficient Structure Hypothesis (ESH) argues that market concentration arises from competition, where firms with better technologies, lower costs, economies of scale, and more effective management obtain higher profits and increase their market share (Demsetz, 1973; Lelissa & Kuhil, 2018). This approach specifies that the positive relationship between concentration and performance is due to firms' efficiency rather than to collusive practices, as suggested by the SCP paradigm (Bikker & Haaf, 2002; Navin & Sinha, 2019). The ESH approach maintains that, in a competitive environment, the most efficient firms win the competition and expand, which allows them to obtain higher profits and a larger market share (Lelissa & Kuhil, 2018). This context leads to greater market concentration, and this concentration is the result of the competitive superiority of firms that have lower costs, better products, and that take advantage of economies of scale, rather than of collusion or monopolistic practices (Berger et al., 2004; Demsetz, 1973; Khan et al., 2017; Navin & Sinha, 2019). Likewise, antitrust policies could reduce efficiency and hinder the growth of large firms (Guidi, 2021). In summary, concentration is more closely related to efficiency than to collusion, and inefficient public policies may negatively affect economic progress (Demsetz, 1973).

Meanwhile, the New Empirical Industrial Organization (NEIO) emerged as an alternative and as a response to SCP studies, focusing on the analysis of specific industries rather than on cross-industry analysis, in order to understand firm behavior within a sector based on statistical evidence (Lelissa & Kuhil, 2018; Waldman & Jensen, 2016). These NEIO approaches assess levels of competition and analyze firms' competitive conduct without requiring information on market structure (Bikker & Haaf, 2002).

1.1.1 Concentration measure indices

The concentration ratio (CR_k) shows the level of concentration within an industry, measured by market share. This index is the cumulative share of the k largest firms in the industry, and typical values of k are 4, 5, 8, and 10. Thus, CR_4 is the sum of the market shares of the four largest firms in the market. Commonly, sales are used as the variable to measure market size, but other variables such as assets or employment are also often used (Memić, 2015; Waldman & Jensen, 2016). The index is presented as follows:

$$CR_k = \sum_{i=1}^{k} S_i = S_1 + S_2 + S_3 + \cdots + S_k \tag{1}$$

Where S_i is the individual market share of firms, and k is the chosen number of the largest firms in the industry. The values of the indicator range from slightly above 0 for a perfectly competitive market to a value of 1 for a monopoly (Waldman & Jensen, 2016).

The Herfindahl–Hirschman Index (HHI) is a statistical measure of market concentration that takes into account both the number of firms and the distribution of market shares. The HHI is calculated as the sum of the squares of the market shares of all firms in the industry (Memić, 2015; Waldman & Jensen, 2016).

$$HHI = \sum_{i=1}^{n} S_i^2 = S_1^2 + S_2^2 + S_3^2 + \cdots + S_n^2 \tag{2}$$

Where S_i is the market share of firm i, and n is the total number of firms in the industry. The values of this indicator range from 0 for a perfectly competitive industry to 10,000 for a monopoly (Waldman & Jensen, 2016; Zurita, 2014). The higher the value of the indicator, the greater the market concentration and the lower the level of competition. The interpretation of the results is as follows: if $HHI < 1000$, the industry is considered competitive with low concentration; if $1000 < HHI < 1800$, it is a moderately concentrated market; and if $HHI > 1800$, it is a highly concentrated market (Bravo A. et al., 2022; Malini & Putri, 2020). Finally, the HHI is more sensitive to the market shares of the largest firms and makes them stand out due to the squared calculation, which requires accurate data for large firms rather than for smaller ones (Waldman & Jensen, 2016).

1.1.2 Market power and competition

The Lerner Index (LI) measures market power and was proposed by Lerner (1934) in the context of microeconomics, focusing on monopoly analysis. It allows the calculation of a firm's ability to set prices above marginal costs, thereby indicating the level of firms' market power. It is defined as:

$$LI = \frac{P - MC}{P}$$

Where P is the price of the product and MC is the marginal cost derived from total cost. This index ranges from 0 (perfect competition) to 1 (monopoly), where values close to 0 indicate competitive markets and higher values indicate greater market power, reflecting the ability to set prices above marginal costs (Lerner, 1934; Malini & Putri, 2020; Mayorca H. & Aguilar A., 2016).

In turn, the Panzar & Rosse (1987) model measures the level of market competition through an indicator known as the H-statistic. This model is based on the elasticity of revenues with respect to input prices (Sanchez-Cartas, 2020). It also assumes that firms respond, depending on the competitive environment of the market, to changes in the prices of production factors; that is, the level of competition is assessed according to the impact that changes in input prices have on equilibrium revenue levels (Zurita, 2014).

In the market, equilibrium is achieved under the zero-profit condition, where total revenues are equal to total costs, implying that firms earn no profits in the long run (Panzar & Rosse, 1987; Zurita, 2014).

$$R_i(y_i, v_i) = C_i(y_i, w_i, q_i) \tag{3}$$

Where R_i and C_i are the revenues and costs of firms, respectively, y_i represents output, w_i is the vector of prices of the k production factors, and v_I and q_i represent the exogenous variables that influence firms' revenues and costs, respectively.

At the firm level, the equilibrium condition is established by profit maximization, where marginal revenues are equal to marginal costs (Navin & Sinha, 2019; Zurita, 2014), therefore:

$$R_i'(y_i, v_i) = C_i'(y_i, w_i, q_i) \tag{4}$$

Based on these two initial conditions, the Panzar & Rosse model measures the degree of competition in the market through the H-statistic. The H-statistic is the total sum of the revenue elasticities with respect to the prices of the inputs of the k production factors (Navin & Sinha, 2019; Sanchez-Cartas, 2020; Zurita, 2014). It is given by:

$$H = \sum_{x=1}^{k} \frac{\partial R_i}{\partial w_{ki}} \cdot \frac{w_{ki}}{R_i} \tag{5}$$

The interpretation of the values of the H-statistic is as follows: $H \leq 0$ indicates that the industry behaves as a monopoly or a collusive oligopoly; $0 < H < 1$ reflects scenarios of monopolistic competition with different levels of competitiveness; and $H = 1$ indicates perfect competition in long-run equilibrium (Bikker et al., 2012; Céspedes-Reynaga & Orrego, 2014).

Likewise, the Boone index evaluates competition in markets by using the relationship between firm efficiency and profits; this model was developed by Boone (2008). The indicator is based on the premise that, in more competitive markets, more efficient firms achieve higher market shares and returns, while less efficient firms are penalized in terms of profits (Jiménez Rivera, 2020; Khan et al., 2017).

Boone (2008) develops the measure of Relative Profit Differences (RDP), which reflects the process by which competition reallocates production toward more efficient firms. The RDP increases as the intensity of competition rises, either due to more aggressive strategies among firms or to reductions in entry barriers. Likewise, the reallocation of production toward more efficient firms in more competitive environments implies that these firms will gain greater market share (Torres & Castaño, 2020). The intensity of competition is estimated from the following equation:

$$\ln \pi_i = \alpha + \beta \ln c_i + \varepsilon_i \tag{6}$$

Where π_i represents the profits (or market share) of bank i, c_i denotes its marginal or average costs, β is a measure of competition (the Boone indicator), and represents the elasticity of profits with respect to costs. The parameter β is theoretically negative because firms with higher marginal costs are associated with lower profits and vise versa. Thus, in competitive environments, more efficient firms (with lower marginal costs) displace less efficient ones, so that the lower the value of the index, the higher the level of competition (Khan et al., 2017; Torres & Castaño, 2020).

2. Materials and methods

The study adopts a quantitative approach, with a non-experimental and longitudinal panel design, and a correlational and explanatory scope. According to the SBS and the BCRP, the financial system comprises banking and non-banking institutions. Financial information is taken from multiple banking, finance companies, municipal savings and credit banks (CM), rural savings and credit banks (CRAC), and credit companies, as provided by the SBS. For the econometric estimations, a balanced panel is used, resulting in a total of 45 financial institutions, of which 14 are banking institutions and 31 are non-banking institutions over the period 2011–2022. The banking system includes multiple banking, while the non-banking system comprises finance companies, municipal banks, rural banks, and credit companies.

In the present study, the variables were selected based on the literature on the structure and competition of the financial system developed by Navin & Sinha (2019), Céspedes-Reynaga & Orrego (2014), Yeyati & Micco (2007), Yildirim & Philippatos (2007), Jiménez Rivera (2020), and Mayorca H. & Aguilar A. (2016). The operationalization of the variables is summarized in Table 1.

It is well known that there is a variety of concentration indicators proposed in the industrial organization literature, the most common being: (a) the concentration ratio (CR_k), defined as the sum of the market shares of the largest firms, and (b) the Herfindahl–Hirschman Index (HHI), defined as

Table 1. Variable Operationalization

Variables	Notation	Measurement	Unit	Data Source
Dependent Variables				
Financial Income	IF	Total financial income	Millions of PEN	SBS
Return on Assets	ROA	Annual net profit over total annual assets	Percentage	Author's calculation, SBS
Return on Equity	ROE	Annual net profit over total equity	Percentage	Author's calculation, SBS
Total Financial Cost	CT	Financial expenses plus operating expenses	Millions of PEN	SBS
Independent Variables				
Labor Costs	CL	Personnel expenses over total assets	Percentage	Author's calculation, SBS
Cost of Funds	CF	Interest expenses over total liabilities	Percentage	Author's calculation, SBS
Fixed Capital Cost	CK	Depreciation over annual fixed assets	Percentage	Author's calculation, SBS
Non-Performing Loans	RP30	Non-performing loans over total loans (> 30 days)	Percentage	SBS
Other Income	OI	Income from financial services over total assets	Percentage	Author's calculation, SBS
Capital-to-Assets Ratio	KA	Equity over total assets	Percentage	Author's calculation, SBS
Loans	COL	Direct loans over total assets	Percentage	Author's calculation, SBS
Liquidity	LQ	Total cash and equivalents over total assets	Percentage	Author's calculation, SBS
Real Total Assets	TAR	Total assets of the balance sheet deflated by CPI	Millions of PEN	SBS
Deposits	DEP	Deposits over liabilities	Percentage	Author's calculation, SBS
Inflation Rate	TINF	Annual inflation rate	Percentage	BCRP
Interbank Rate	TIB	Interbank interest rate	Percentage	BCRP

Note: CPI is Consumer Price Index. The data are obtained from the balance sheet and the income statement of financial institutions, as provided by the SBS. Own elaboration.

the sum of the squared market shares of all firms in the industry (Yeyati & Micco, 2007; Yildirim & Philippatos, 2007). For the analysis in this study, these two indicators are used, and the concentration ratio CR_4 is employed since four financial institutions dominate the Peruvian financial system. Market share is defined as $S_i = \frac{TA_i}{TA_n}$, where TA_i denotes the total assets of a financial institution in the sample, and TA_n is the total assets of all n financial institutions in the sample.

2.1 Panzar and Rosse Model (1987)

The Panzar and Rosse (1987) model is widely used to measure competition and has been applied in numerous studies to assess competition in the financial system (Yeyati & Micco, 2007). Following the specification of Céspedes-Reynaga & Orrego (2014), Yeyati & Micco (2007), and Navin & Sinha (2019), the following reduced-form revenue equation is estimated to obtain the H-statistic:

$$\ln IF_{it} = \alpha_0 + \alpha_1 \ln CL_{it} + \alpha_2 \ln CF_{it} + \alpha_3 \ln CK_{it} + \beta_1 \ln RP30_{it} + \beta_2 \ln OI_{it} + \sum_j \delta_j \ln FEX_{j,it} + \sum_j \omega_j X_{jt} + \mu_{it} \quad (7)$$

Where IF_{it} denotes financial income, CL_{it} denotes labor costs, CF_{it} denotes funding costs, CK_{it} denotes fixed capital costs, $RP30_{it}$ denotes the loan portfolio past due by more than 30 days, OI_{it}

represents other financial income, and $FEX_{j,it}$ denotes exogenous factors of financial institutions, which include the capital-to-assets ratio (KA_{it}), loans (COL_{it}), liquidity (LQ_{it}), real total assets (TAR_{it}), and deposits (DEP_{it}). X_{jt} represents macroeconomic factors that include the inflation rate ($TINF_t$) and the interbank interest rate (TIB_t). The H-statistic competition indicator is the sum of elasticities, as follows:

$$H = \alpha_1 + \alpha_2 + \alpha_3 \tag{8}$$

According to Céspedes-Reynaga & Orrego (2014) and Bikker et al. (2012), the sign of the prices of productive factors will depend on the competitive environment. Likewise, the expected sign of OI is negative, since a higher ratio value indicates a greater share of non-financial income. The expected sign of KA is also negative, because a higher ratio value implies lower leverage, which leads to lower income. In contrast, the expected sign of COL is positive, as risk is transferred to companies and households through interest rates, generating higher income. For its part, the variable LQ is expected to have a negative sign, since higher liquidity implies lower financial income. The predicted sign of the variable DEP is more complex; this variable reflects volatility in the funding sources of financial institutions, which induces them to be more or less intensive in order to achieve higher financial income. Finally, TAR should have a positive sign, as it implies that larger institutions obtain higher financial income. Macroeconomic factors are also expected to have a positive sign.

To assess whether the competitive structure has changed over time due to institutional changes, we follow the model of Céspedes-Reynaga & Orrego (2014), who use binary time variables:

$$\begin{aligned}\ln IF_{it} = &\alpha_0 + \sum_{\gamma}\left(\alpha_{1\gamma}\ln CL_{it} + \alpha_{2\gamma}\ln CF_{it} + \alpha_{3\gamma}\ln CK_{it}\right) + \beta_1 \ln RP30_{it} + \beta_2 \ln OI_{it} \\ &+ \sum_{j}\delta_j \ln FEX_{j,it} + \sum_{j}\omega_j X_{jt} + \mu_{it}\end{aligned} \tag{9}$$

Where $\alpha_{1\gamma}$, $\alpha_{2\gamma}$ and $\alpha_{3\gamma}$ are equal to zero if year t does not belong to year y. Thus, the H-statistic of competition varies over time and is calculated for each year t as follows:

$$H_t = \alpha_{1t} + \alpha_{2t} + \alpha_{3t} \tag{10}$$

Since the Panzar and Rosse model is static, it is only valid when the financial market is in long-run equilibrium (Gasaymeh et al., 2014; Świtała et al., 2013). This assumption is tested by estimating the following equation for the financial system:

$$\begin{aligned}\ln(1 + ROA_{it}) = &\alpha_0 + \alpha_1 \ln CL_{it} + \alpha_2 \ln CF_{it} + \alpha_3 \ln CK_{it} + \beta_1 \ln RP30_{it} + \beta_2 \ln OI_{it} \\ &+ \sum_{j}\delta_j \ln FEX_{j,it} + \sum_{j}\omega_j X_{jt} + \mu_{it}\end{aligned} \tag{11}$$

Where ROA_{it} is the return on assets, since some financial institutions report negative ROA, a constant value of 1 is added to ROA (Gasaymeh et al., 2014; Navin & Sinha, 2019).

The E-statistic is defined as $E = \alpha_1 + \alpha_2 + \alpha_3$. The null hypothesis $E = 0$ is tested using an F-test; if it is rejected, the market is assumed not to be in equilibrium. Under equilibrium conditions, the return on assets of financial institutions should not be related to input factor prices (Gasaymeh et al., 2014; Świtała et al., 2013).

The static revenue equation has been criticized due to the long-run equilibrium assumption, since the values obtained from this specification tend to be biased toward zero, implying higher levels of competition (Khan et al., 2017; Navin & Sinha, 2019). The dynamic model constitutes an alternative

approach for estimating the Panzar–Rosse H-statistic, as it incorporates lagged endogenous variables (Ventouri, 2018). Moreover, this specification does not require the market equilibrium assumption, and its estimation must follow an appropriate procedure because it violates the assumption of no correlation between the explanatory variables and the error term (Świtała et al., 2013). This study applies the Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1991), as shown below:

$$\ln IF_{it} = \varphi \ln IF_{i(t-1)} + \alpha_{11} \ln CL_{it} + \alpha_{21} \ln CF_{it} + \alpha_{31} \ln CK_{it} + \beta_{11} \ln RP30_{it} + \beta_{21} \ln OI_{it} + \sum_{j} \delta_{j1} \ln FEX_{j,it} + \sum_{j} \omega_{j1} X_{jt} + \upsilon_{it} \tag{12}$$

According to Ventouri (2018), the dynamic H-statistic is given by:

$$H = \frac{\alpha_{11} + \alpha_{21} + \alpha_{31}}{1 - \varphi} \tag{13}$$

2.2 Lerner and Boone Index estimation

The Lerner index is a recognized indicator in economic literature and the financial system that measures market power; higher values indicate greater market power and less competitive environments (Khan et al., 2017), and it is calculated using the following formula:

$$IL_{it} = \frac{P_{it} - CM_{it}}{P_{it}} \tag{14}$$

Where P_{it} denotes the price of output and is defined, as an approximation, as the ratio of financial income (IF_{it}) to loans (Q_{it}) $P_{it} = \frac{IF_{it}}{Q_{it}}$ (Aguilar & Portilla, 2018). The marginal cost CM_{it} is derived from the following translogarithmic cost function:

$$\ln CT_{it} = \beta_0 + \beta_1 \ln Q_{it} + \frac{1}{2}\beta_2 (\ln Q_{it})^2 + \sum_{j=1}^{3} \alpha_j \ln C_{j,it} + \frac{1}{2} \sum_{j=1}^{3} \sum_{k=1}^{3} \alpha_{jk} \ln C_{j,it} \ln C_{k,it} + \sum_{j=1}^{3} \delta_j \ln Q_{it} \ln C_{j,it} + \gamma_1 T + \frac{1}{2}\gamma_2 T^2 + \sum_{j=1}^{3} \gamma_{j1} T \ln C_{j,it} + \gamma_3 T \ln Q_{it} + \varepsilon_{it} \tag{15}$$

Where CT_{it} denotes total cost, Q_{it} is output (total loans), and $C_{j,it}$ represents the price of each input factor (price of labor, price of funds, and price of capital, with $j = 1, 2, 3$). T is the time trend factor, which captures technological change. Finally, the subscripts i and t refer to the i-th financial institution at time t. Following Aguilar and Portilla (2018), the translog cost function must satisfy the following restrictions to ensure the condition of linear homogeneity in input prices and compliance with Young's Theorem:

$$\sum_{j=1}^{3} \alpha_j = 1 \quad ; \quad \sum_{j=1}^{3} \sum_{k=1}^{3} \alpha_{jk} = 0 \quad ; \quad \sum_{j=1}^{3} \delta_j = 0 \quad ; \quad \sum_{j=1}^{3} \gamma_{j1} = 0 \quad ; \quad \alpha_{jk} = \alpha_{kj}$$

From the cost function, the marginal cost CM_{it} is obtained as follows:

$$CM_{it} = \left(\frac{CT_{it}}{Q_{it}}\right) \left(\beta_1 + \beta_2 \ln Q_{it} \sum_{j=1}^{3} \delta_j \ln C_{j,it} + \gamma_3 T\right) \tag{16}$$

The marginal cost is then used in the Lerner Index formula. The indicator is calculated for each individual institution over time, and subsequently the group average is computed.

Likewise, following Jiménez Rivera (2020), Khan et al. (2017), and Moshoeshoe & Thokoa (2021), the Boone model supports the following market share equation, which is used to measure the degree of competition in the financial system.

$$\ln S_{it} = \alpha + \beta \ln CM_{it} + \varepsilon_{it} \tag{17}$$

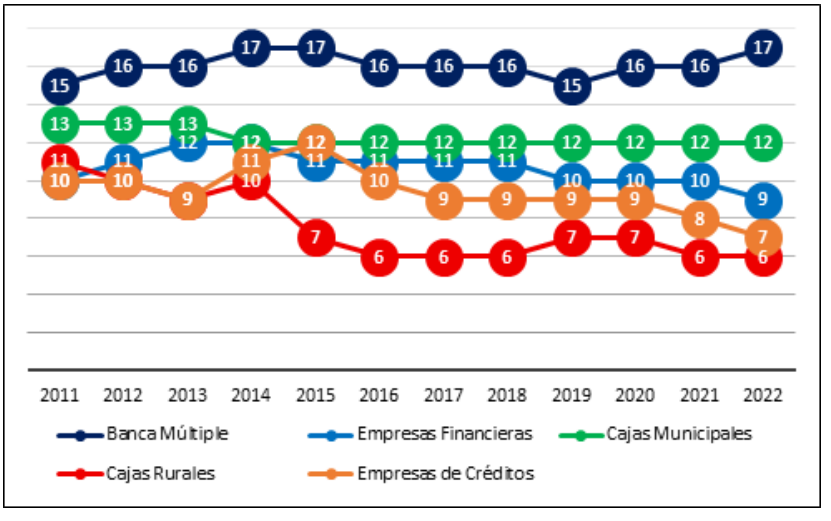
Where S_{it} is the market share of entity i at time t, and CM_{it} is the marginal cost. To estimate the marginal cost, a translog cost function is used. It is expected that financial entities with lower marginal costs will have greater market shares. As competition increases, the absolute value of β becomes larger; thus, under perfect competition, β tends toward negative infinity, whereas β = 0 is consistent with a monopoly situation (Jiménez Rivera, 2020).

3. Results

3.1 Market structure of the financial system

Between 2011 and 2022, the Peruvian financial system underwent a process of transformation. In the banking system, the entry of new banks occurred through acquisitions and changes in corporate names. In contrast, the non-banking system showed greater vulnerability, as evidenced by frequent mergers, interventions, and liquidations. Overall, these changes can be said to strengthen institutions with greater capital backing and solvency, which in turn manage to remain in the market while maintaining or increasing their market share, whereas smaller institutions face difficulties in competing. Figure 1 shows the changes in the number of financial institutions in Peru from 2011 to 2022.

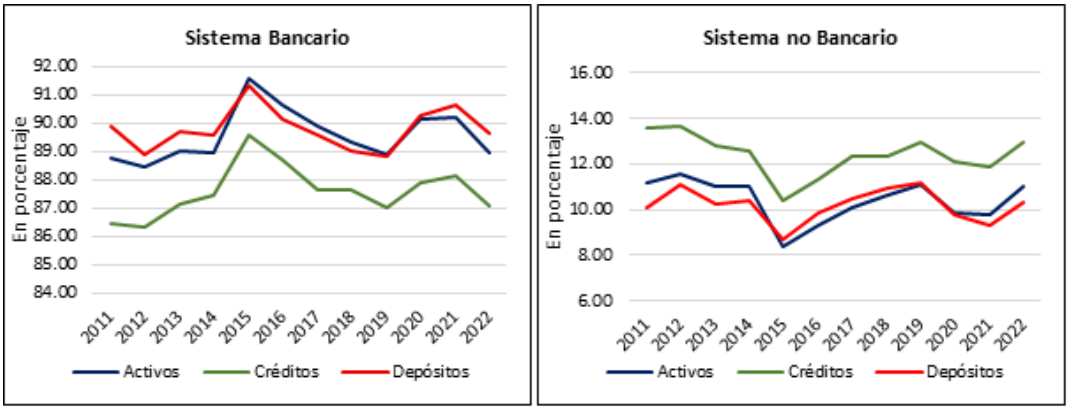
Figure 1. Number of Institutions by Multiple-Operations Firms, 2011–2022



Source: Information from the SBS. Own elaboration.

Figure 2 shows the evolution of the shares of the banking and non-banking systems over the period 2011–2022. The Peruvian banking system exhibited dominance over the main financial aggregates, with its share ranging between 88% and 92% of total assets, 86% to 90% of loans, and 88% to 92% of deposits, reflecting its superiority over the non-banking system. It is also observed that in 2015 it reached its highest point, when multiple banking recorded shares of 91.61%, 89.60%, and 91.31% in assets, loans, and deposits, respectively. In contrast, the non-banking system maintained shares of 8% to 12% in assets, 10% to 14% in loans, and 8% to 11% in deposits, with its lowest point also occurring in

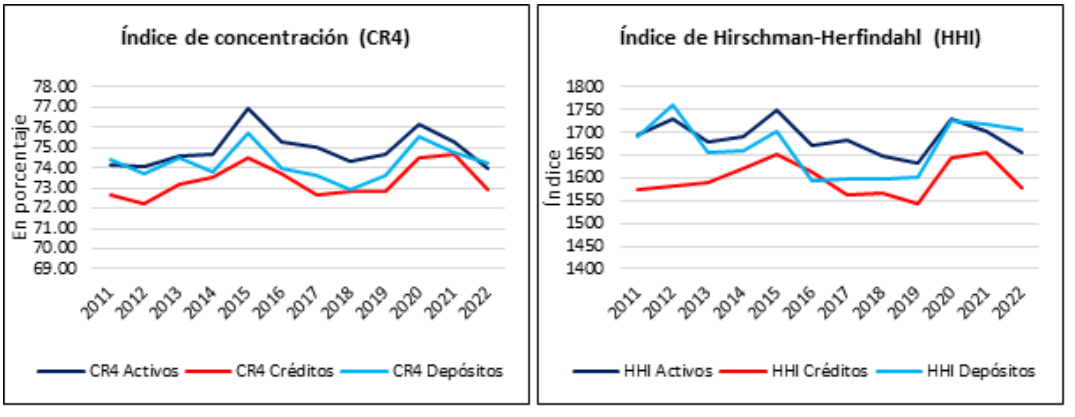
Figure 2. Banking and Non-Banking Systems: Evolution of Market Share in Assets, Loans, and Deposits, 2011–2022



Source: Information from the SBS. Own elaboration.

2015. In summary, the Peruvian financial system shows a structural dependence on the banking system (multiple banking), which holds a share above 86%, while the non-banking system remains below 14%, whose aggregate contribution is minimal compared to multiple banking. This fact confirms that the Peruvian financial system operates in a highly concentrated banking market.

Figure 3. Peruvian Financial System: Evolution of Concentration (CR4 and HHI) during 2011–2022



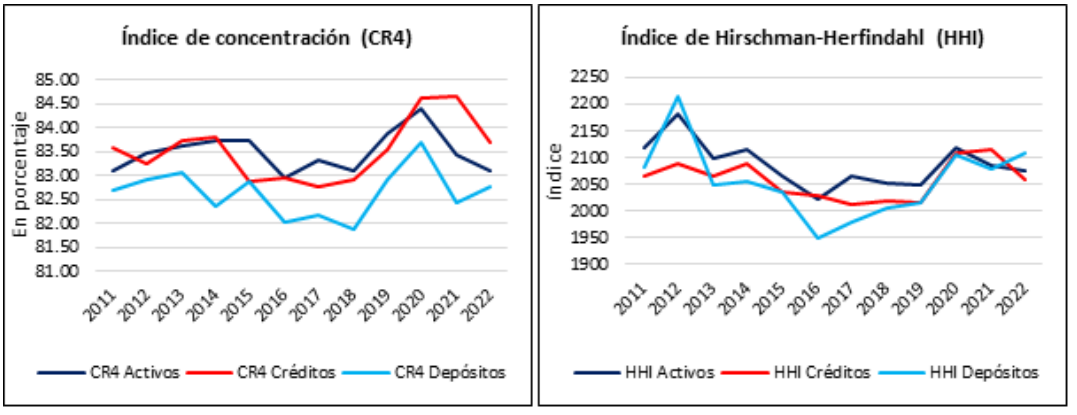
Source: Information from the SBS. Own elaboration.

Figure 3 presents the evolution of market concentration indicators (CR4 and HHI) for the three main financial aggregates. The concentration ratio (CR4) reveals a high level of concentration in the Peruvian financial system, where the four largest banks account for between 72% and 77% of assets, loans, and deposits. A slight increase in concentration is also observed from 2011 to 2022, reaching two peak values of 76.92% in 2015 and 76.15% in 2020 in terms of assets. Likewise, the HHI confirms that the financial system operates in a moderately concentrated market, with values ranging between 1544 and 1760. Assets show a higher degree of concentration, while loans exhibit a lower degree of concentration, and therefore are slightly more competitive.

Figure 4 shows the evolution of concentration indicators in the banking system. The CR4 results indicate that the system is highly concentrated, fluctuating between 82% and 85% of assets, loans, and deposits. It is observed that concentration increased up to 2020, when it reached its peak at 84.4%, 84.6%, and 83.7% in assets, loans, and deposits, respectively. In turn, the HHI ranges between 1950

and 2220, confirming that the banking system operates in a highly concentrated market. The HHI decreased from 2012 to 2016 and has been increasing since then. It is also observed that the banking system is slightly more competitive in terms of deposits. In summary, the banking system is highly concentrated, which suggests greater market power and less competitive environments, resembling an oligopoly structure.

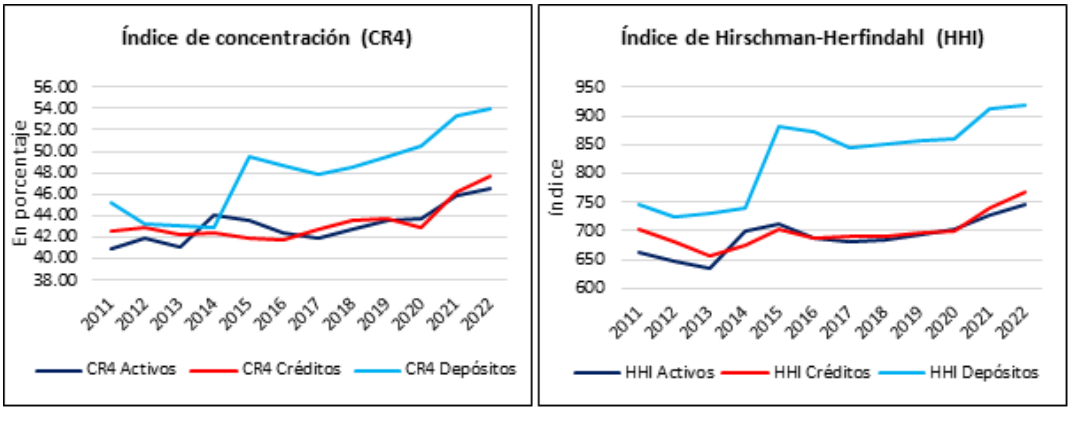
Figure 4. Banking System: Evolution of Concentration (CR4 and HHI) during the 2011–2022 period



Source: Information from the SBS. Own elaboration.

Similarly, results for the non-banking system are presented in Figure 5. The concentration ratio CR4 ranges between 40% and 54% for assets, loans, and deposits, and an increase is observed in recent years. These results indicate that the non-banking system has low market concentration, with deposits being more concentrated than assets and loans. In turn, the HHI results confirm that the industry operates in a competitive and low-concentration market. HHI values range between 630 and 920, with higher values for deposits, showing a higher degree of concentration than assets and loans. The trend of concentration indicators in the non-banking system is increasing.

Figure 5. Non-Banking System: Evolution of Concentration (CR4 and HHI) during the 2011–2022 period



Source: Information from the SBS. Own elaboration.

Based on the results, the Peruvian financial system is dominated by the banking industry (multiple banking). CR4 values show that the financial system as a whole, led by the four largest banks, concentrates between 72% and 77% of assets, loans, and deposits, while the banking system alone ranges from 82% to 85%, suggesting an oligopolistic structure. In turn, HHI values in the banking

industry range between 1950 and 2220, indicating high market concentration, whereas in the non-banking system, they only reach between 630 and 920, indicating more competitive markets and lower market power. The Peruvian financial system is therefore significantly dependent on the banking industry and highly concentrated, with lower competitiveness.

3.2 Results of the H statistic

First, Table 2 presents the estimation of the Panzar–Rosse (1987) H-statistic based on equation (7) for the financial system as a whole over the period 2011–2022. The estimation considers 45 financial institutions using balanced[1] panel data. The estimation was carried out using the panel-corrected standard errors (PCSE)[2] method in the static models. Table 2 reports the estimates using as dependent variables the natural logarithm of financial revenues, the natural logarithm of return on assets, and the natural logarithm of return on equity. In addition, a dynamic model with financial revenues in logarithms as the dependent variable is presented. The independent variables are expressed in natural logarithms, where financial income (-1) represents financial revenues lagged one period, which is included only in the dynamic model as in equation (12). The dynamic model was estimated using the generalized method of moments (GMM).

Table 2. Estimation of the Competition Measure in the Overall Financial System

	Static Model			Dynamic Model
	Financial income	Return on assets	Return on equity	Financial income
Financial income (-1)				0.1283**
Labor Costs	0.5224***	-0.0145**	-0.1308***	0.4350***
Cost of Funds	0.2090***	0.0212***	0.1051***	0.1697***
Fixed Capital Cost	0.0535**	-0.0076	-0.0339	0.0209
Non-Performing Loans	0.0961***	-0.0133***	-0.0869***	0.0950***
Other Income	-0.0047	-0.0031	-0.0292**	0.0177**
Capital-to-Assets Ratio	0.1920***	0.0395***	0.3509***	0.2633***
Loans	0.1818**	-0.0058	0.1489	0.1606
Liquidity	-0.0310	-0.0027	0.0615	-0.0629*
Real Total Assets	1.0893***	0.0094***	0.0690***	0.9487***
Deposits	-0.0274***	-0.0026*	-0.0131*	-0.0251***
Inflation Rate	5.3202***	0.0645	0.5530**	0.0459***
Interbank Rate	-1.1559***	-0.0097	-0.0772	0.0031
Constant				4.3040***
R-squared	0.9777	0.2985	0.3587	
Number of Observations	540	540	540	495
Number of Groups	45	45	45	45
H-Statistic	0.7849***			0.7176
H = 0 (Prob > chi2)	0.0000			0.0000
H = 1 (Prob > chi2)	0.0000			0.0003
E-Statistic		-0.0009	-0.0595	
E = 0 (Prob > chi2)		0.9206	0.3109	
Number of instrument				41
AR(1) (z = -3.14)				Pr > z = 0.002
AR(2) (z = -0.98)				Pr > z = 0.329
Test Hansen (Prob > chi2)				0.107

Note: Asterisks *, *, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The estimates are based on information from the SBS and the BCRP. Own elaboration.

According to the results, the H statistic presents a value of 0.78 in the static model, which suggests the existence of monopolistic competition in the Peruvian financial system as a whole, since the

1. Only financial institutions that operate from beginning to end during the analysis period are included; all have the same number of observations. Information from 14 banking institutions and 31 non-banking institutions is used.

2. Estimates for linear cross-sectional time series models where parameters are estimated by OLS or Prais-Winsten regression. Assumes that disturbances are, by default, heteroscedastic and are contemporaneously correlated across panels.

hypotheses H = 0 and H = 1 are rejected at the 1% significance level using the Wald test. The elasticities that compose the H statistic are statistically significant, with the parameter associated with the fixed capital cost (CK) contributing to a lesser extent to competition and being significant at the 5% level. The elasticity of labor costs (CL) contributes to a greater extent to competition and is significant at the 1% level; the value indicates that if labor costs increase by 1%, financial income increases by 0.52%. Non-performing loans (RP30) have a positive relationship with financial income, which may be reflected in accounting records where income from overdue loans continues to be recorded even if they are not collected, or by the interest rate structure, which would imply higher rates. The capital-to-assets ratio has a positive and statistically significant sign, but it does not meet the expected negative sign; this implies that capital acts as a factor of growth and profitability rather than as a constraint despite lower leverage, with a solid capital base supporting credit expansion. The remaining significant variables present the expected signs, with the exception of the interbank rate, which should be positive.

The static model must satisfy the long-run equilibrium condition. This condition is evaluated through the estimation of the Panzar-Rosse (1987) model, using ROA and ROE as dependent variables, as indicated in equation (11). The results show that the market is in long-run equilibrium according to the Wald test, in which the null hypothesis that the E statistic is equal to zero is accepted. In this case, non-performing loans have a negative and statistically significant effect on returns.

The dynamic model, in turn, reports an H-statistic value of 0.72, indicating that the Peruvian financial system operates under a monopolistic competition framework. The elasticities associated with labor costs and funding costs are statistically significant at the 1% level, whereas the cost of fixed capital is not significant. The reported degree of competition is lower than in the static model, suggesting persistence of market power. The lagged dependent variable (financial income (-1)) is statistically significant at the 5% level and reflects dynamic persistence, meaning that financial revenues from the previous period influence current financial revenues. According to the results in Table 2, the model satisfies the necessary conditions and is therefore valid. The Arellano–Bond AR(1) test rejects the null hypothesis of no first-order autocorrelation, and the z-value is negative, which is expected in any dynamic model. The AR(2) test indicates the absence of second-order autocorrelation in the errors, supporting the validity of the instruments. Likewise, the Hansen test confirms instrument validity, as the value of Prob > chi2 is greater than 0.1 and less than 0.25. Finally, the number of instruments is smaller than the number of groups, avoiding over-identification problems.

Second, the estimation of the H-statistic from equation (7) for the banking system is presented. The estimation considers 14 banking institutions[3]. The model is estimated using Feasible Generalized Least Squares (FGLS)[4]. Table 3 reports the estimation of the static models with the natural logarithm of financial income, the natural logarithm of return on assets, and the natural logarithm of return on equity as dependent variables. The results of the dynamic model are not reported because it does not satisfy the necessary conditions for model validity.

The results show that the competition indicator H takes a value of 0.68, indicating that the banking system operates under a monopolistic competition framework. Applying the Wald test, both perfect competition and monopoly are rejected at the 1% level of statistical significance. The elasticities associated with input costs are statistically significant, with the elasticity of physical capital cost (CK) contributing the least to competition, while the cost of funds (CF) contributes the most. The estimated coefficient indicates that a 1% increase in the cost of funds leads to a 0.32% increase in financial income. A similar result is found for non-performing loans (RP30) with respect to the overall financial system, as it shows a positive and statistically significant relationship with financial income. Likewise, the capital-to-assets ratio (KA) exhibits a positive and significant sign, reinforcing the results obtained for the financial system as a whole. Finally, the remaining statistically significant variables display

3. Information from Alfin Banco, BBVA, Falabella, Banco GNB, Banbif, Banco Pichincha, Ripley, Santander, Comercio, BCP, Citibank, Interbank, Mibanco, Scotiabank.

4. It allows estimation in the presence of AR (1) autocorrelation within panels, as well as cross-sectional correlation and heteroscedasticity between panels.

Table 3. Estimation of the Competition Measure in the Banking System

	Static Model		
	Financial income	Return on assets	Return on equity
Labor Costs	0.3005***	0.0007	-0.0104
Cost of Funds	0.3244***	0.0028	0.0220
Fixed Capital Cost	0.0568**	-0.0025	-0.0315
Non-Performing Loans	0.1523***	-0.0073***	-0.0643***
Other Income	-0.0153	0.0004	-0.0045
Capital-to-Assets Ratio	0.3853***	0.0292***	0.2040***
Loans	-0.1292	-0.0118	-0.0782
Liquidity	-0.1580***	-0.0051	-0.0362
Real Total Assets	1.0026***	0.0043***	0.0413***
Deposits	-0.1137	-0.0183**	-0.1604*
Inflation Rate	0.0459**	-0.0029	-0.0253
Interbank Rate	0.0024	0.0046***	0.0393***
Constant	4.7468***	0.0543***	0.2326
Number of Observations	168	168	168
Number of Groups	14	14	14
H-Statistic	0.6817***		
H = 0 (Prob > chi2)	0.0000		
H = 1 (Prob > chi2)	0.0000		
E-Statistic		0.0010	-0.0198
E = 0 (Prob > chi2)		0.8055	0.6488

Note: Asterisks *, *, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Estimates are based on data from the SBS and the BCRP. Own elaboration.

the expected signs. Moreover, the long-run market equilibrium condition is satisfied, implying that profitability is not related to factor prices in the long run.

Third, Table 4 presents the results of the estimation of competition under equation (7) for the non-banking system. The analysis considers 31 non-banking institutions, and the estimation was carried out using feasible generalized least squares (FGLS) for the static models. The dynamic model was estimated using GMM.

The results of the competition estimation indicate that the non-banking system operates under a monopolistic competition scenario. The H-statistic has a value of 0.77, and the coefficients associated with factor costs are statistically significant. In this case, labor costs (CL) make the greatest contribution to competition, while fixed capital costs contribute the least. The results for non-performing loans and the capital-to-assets ratio are similar to those found for the banking system and the financial system as a whole, showing positive and statistically significant signs. Likewise, the remaining statistically significant variables display the expected signs, except for the interbank interest rate, which should be positive. The equilibrium condition holds when ROA is used as the dependent variable, but not when ROE is used.

The dynamic model reinforces the monopolistic competition result, with an estimated H-statistic of 0.64. It should be noted that the elasticity associated with fixed capital costs is not statistically significant, while labor costs make the largest contribution to competition. The H value is lower than that obtained in the static model, indicating a lower degree of competition and persistence of market power. The lagged financial income variable (Financial income (-1)) is statistically significant at the 1% level, showing that current income depends on income from the previous period, which reinforces the dynamic specification. In addition, the model satisfies the validity conditions: the Hansen test value is 0.345 (below 0.8), AR(1) is negative and statistically significant at the 5% level, and the number of instruments is lower than the number of groups.

Likewise, Figure 6 shows the evolution of the H-statistic obtained from equation (10). It is observed that competition remains under monopolistic competition, with differences across segments. For the financial system as a whole, the H-statistic ranges between 0.73 and 0.84, remaining relatively stable and around 0.81 from 2011 to 2019; however, in 2020 it experienced a decline in the degree of

Table 4. Estimation of the Competition Measure in the Non-Banking System

	Static Model			Dynamic Model
	Financial income	Return on assets	Return on equity	Financial income
Financial income (-1)				0.4293***
Labor Costs	0.4686***	-0.0210***	-0.1358***	0.2642***
Cost of Funds	0.2641***	0.0149***	0.0522**	0.0558***
Fixed Capital Cost	0.0340*	-0.0002	-0.0075	0.0452
Non-Performing Loans	0.0745***	-0.0180***	-0.1173***	-0.0023
Other Income	-0.0015	-0.0006	-0.0080	-0.0014
Capital-to-Assets Ratio	0.1543***	0.0303***	0.1836***	0.1960***
Loans	0.3888***	0.0171	0.3440***	0.1015
Liquidity	0.0086	0.0034	0.0817***	-0.0179
Real Total Assets	1.0735***	0.0067***	0.0420***	0.6297***
Deposits	-0.0180***	-0.0014	-0.0087**	-0.0177**
Inflation Rate	0.3119***	-0.0102	-0.1199***	0.0142
Interbank Rate	-0.0725**	0.0120**	0.1227***	0.0393***
Constant	4.6553***	0.0713***	0.4425***	2.7871***
Number of Observations	372	372	372	341
Number of Groups	31	31	31	31
H-Statistic	0.7668***			0.6397***
H = 0 (Prob > chi2)	0.0000			0.0000
H = 1 (Prob > chi2)	0.0000			0.0404
E-Statistic		-0.0063	-0.0911	
E = 0 (Prob > chi2)		0.2372	0.0023	
Number of instrument				30
AR(1) (z = -2.73)				Pr > z = 0.006
AR(2) (z = -0.79)				Pr > z = 0.431
Test Hansen (Prob > chi2)				0.345

Note: Asterisks *, *, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Estimates are based on data from the SBS and the BCRP. Own elaboration.

competition to 0.73, coinciding with the pandemic. Competition in the non-banking system shows a similar pattern to the financial system as a whole, with H values around 0.81 during 2011–2019, which fell to 0.71 in 2020. The banking system presents lower H values from 2014 onward, reaching its lowest point in 2022 at 0.64, and averaging about 0.76. Analyzing the trend, the degree of competition tends to decrease, since higher levels of competition were observed in the early years of the decade. This decline is particularly noticeable in the banking system.

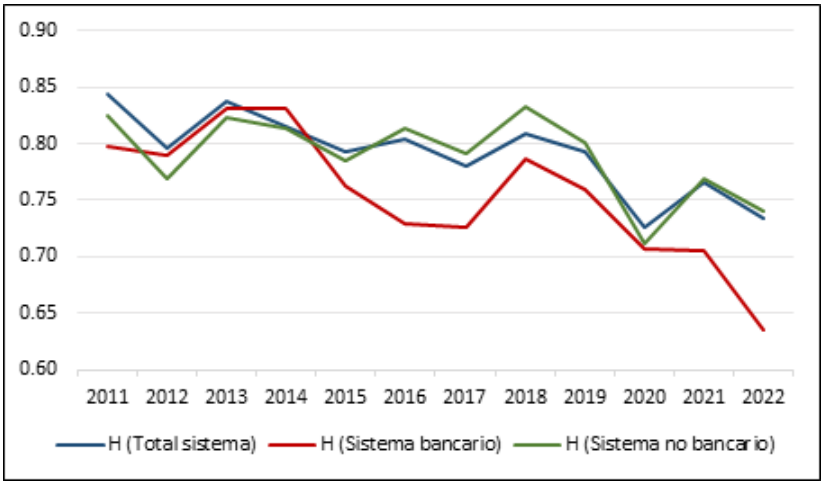
3.3 Lerner Index Results

The estimation of the translog cost function was carried out using feasible generalized least squares (FGLS). The results of the estimation are presented in Table 5, and marginal costs are obtained to calculate the Lerner Index by applying equation (14). The dependent variable of the function is the natural logarithm of total cost (financial expenses plus operating expenses), while the independent variables are the natural logarithm of loans (Q), labor cost (CL, personnel expenses over number of employees), cost of funds, cost of fixed capital (see Table 1), and the time trend.

Table 6 presents the results of marginal costs and the Lerner index for the banking system and the non-banking system, ordered from the lowest to the highest marginal cost. In the banking system, only the 10 institutions with the lowest marginal costs and the 4 institutions with the highest marginal costs are reported.

In the banking system, Banco Santander has the lowest marginal cost (0.0321), indicating that for every S/ 1,000 in loans it incurs a cost of S/ 32.10, while Alfin Banco records the highest marginal cost (0.2869). The average Lerner Index is 0.48, suggesting moderate market power and a higher level than in the non-banking system. Likewise, banks such as Banco Santander (0.61) and Ripley (0.61) stand out for their greater ability to set margins, whereas the dominant banks exhibit lower market power,

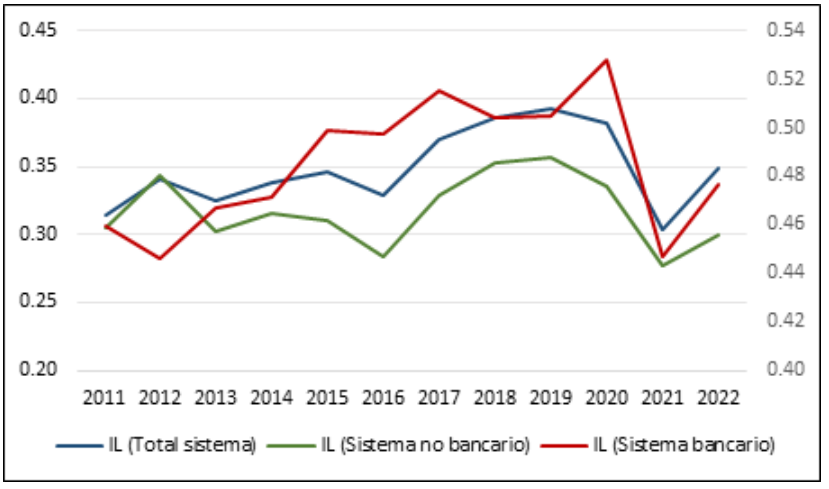
Figure 6. Evolution of the Panzar–Rosse H-Statistic in the Peruvian Financial System, 2011–2022



Source: Estimates based on data from SBS and BCRP. Own elaboration.

such as BCP (0.35), BBVA (0.44), Scotiabank (0.47), and Interbank (0.44), indicating more competitive environments. The non-banking system shows lower market power than the banking industry, with an average Lerner Index of 0.32, reflecting higher levels of competition.

Figure 7. Evolution of the Average Lerner Index in the Financial System, 2011–2022



Source: Estimates based on data from SBS and BCRP. Own elaboration.

Since the Lerner Index is calculated for each firm individually, the average across all banks in the same year is obtained in order to capture the trajectory of the indicator over time. Figure 7 presents the time-varying Lerner Index, showing an upward trend over the period 2011–2019, indicating an increase in market power and a decline in competition. A significant drop is observed in 2021, reflecting higher competitiveness, coinciding with the effects of the pandemic. The right axis corresponds to the Lerner Index of the banking system, which fluctuates between 0.45 and 0.53, while the non-banking system, shown on the left axis, ranges between 0.28 and 0.36, reflecting higher levels of competition and lower market power over the period 2011–2022.

Table 5. Estimation of the Translogarithmic Cost Function

Total cost	Total System	Banking System	Non-Banking System
Loans	0.6956***	0.6635	0.6277***
Loans^2	0.0233***	0.0543***	0.0274***
Labor cost	0.1051	-3.2256*	1.9410*
Cost of Funds	0.5542	1.5977	-0.2212
Fixed Capital Cost	0.1520	-1.7364	0.2456
Labor cost^2	-0.0835**	0.0047	0.0408
Cost of Funds^2	0.0599***	0.1052**	0.0650***
Fixed Capital Cost^2	0.0396**	-0.1587***	0.0375*
(Labor cost) x (Cost of Funds)	-0.0022	0.0898	-0.1232*
(Labor cost) x (Fixed Capital Cost)	-0.0349	-0.1964**	-0.0112
(Cost of Funds) x (Fixed Capital Cost)	-0.1296***	-0.0381	-0.1283***
(Loans) x (Labor cost)	-0.0868***	-0.0330	-0.0373
(Loans) x (Cost of Funds)	0.0531***	0.0995***	0.0307**
(Loans) x (Fixed Capital Cost)	0.0239*	-0.0890***	0.0142
Trend	2.0140	4.5052	0.9318
Trend^2	-0.2215*	-0.1980	-0.2316**
Trend x (Labor cost)	-0.0096	0.4846*	-0.3977**
Trend x (Cost of Funds)	-0.0857	-0.1830	0.0347
Trend x (Fixed Capital Cost)	-0.1111*	0.2374	-0.1267*
Trend x (Loans)	-0.0402*	-0.1110	-0.0265
Constant	-3.5533	-16.7249	1.2597
Number of Observations	540	168	372
Number of Groups	45	14	31
Wald chi2	27185.51	9402.92	13198.78
Prob > chi2	0.0000	0.0000	0.0000

Note: The asterisks *, *, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Estimation based on data from the SBS. Own elaboration.

3.4 Boone Index Results

Table 7 presents the results of the estimation of the Boone index using the Feasible Generalized Least Squares (FGLS) method with balanced panel data. The dependent variable is the natural logarithm of market share (credit over total industry credit), and the independent variable is the natural logarithm of marginal cost obtained from the cost function estimated in the previous section.

The Boone indicator is the parameter associated with marginal costs that has a negative relationship with market share and follows the expected sign: entities with lower marginal costs displace those with higher marginal costs. The results show that the financial system as a whole has a Boone indicator of -0.74, significant at the 1% level. In theory, a higher value of the indicator in absolute terms indicates greater competition. In the banking system, the coefficient is -0.15, also significant at the 1% level, reflecting weak competition and greater market power in the banking industry. This can be attributed to dominant banks, regardless of whether they have higher marginal costs. The non-banking system has a lower coefficient (-0.71) than the banking system, indicating that costs affect market share to a greater extent in absolute terms. This is consistent with a more competitive environment and lower market power, where the most efficient companies manage to maintain their market share and sustain profits. In short, the non-banking system is more competitive than commercial banks.

For the trajectory of the Boone indicator over time, dichotomous time variables were applied to equation (18), very similar to that applied in the Panzar-Rosse model for the H statistic. Figure 12 shows the results of the Boone indicator as a time variable, where it can be seen that it presents an increasing trend, showing a decrease in competition over time. The right axis is related to the banking system, where the Boone index fluctuates between -0.34 and -0.24, while the non-banking system, related to the left axis, varies between -0.99 and -0.83, reflecting more competitive environments than the banking industry.

Table 6. Marginal Costs and Lerner Index of the Banking and Non-Banking Systems, 2011–2022

Banking System	CM	IL	Non-Banking System	CM	IL
Banco Santander	0.0321	0.61	Vívela	0.0749	0.18
Scotiabank Perú	0.0515	0.47	Mitsui Auto Finance	0.0919	0.41
Banbif	0.0520	0.43	CMAC Cusco	0.1029	0.39
Banco BBVA Perú	0.0536	0.44	CMAC Huancayo	0.1205	0.35
Banco GNB	0.0579	0.48	CMAC Arequipa	0.1206	0.40
BCP	0.0688	0.35	CMAC Tacna	0.1222	0.36
Citibank	0.0729	0.56	CMAC Ica	0.1315	0.38
Interbank	0.0736	0.44	CMAC Sullana	0.1341	0.33
Comercio	0.0771	0.49	CMAC Trujillo	0.1368	0.35
Banco Pichincha	0.0815	0.37	CMAC Maynas	0.1401	0.36
Mibanco	0.1174	0.46	Credivisión	0.2647	0.28
Banco Falabella	0.1274	0.54	Acceso Crediticio	0.2929	0.03
Banco Ripley	0.1311	0.61	TOTAL Servicios Financieros	0.3716	0.06
Alfin Banco	0.2869	0.53	Inversiones La Cruz	0.5082	0.46
Total	0.0917	0.48	Total	0.1851	0.32

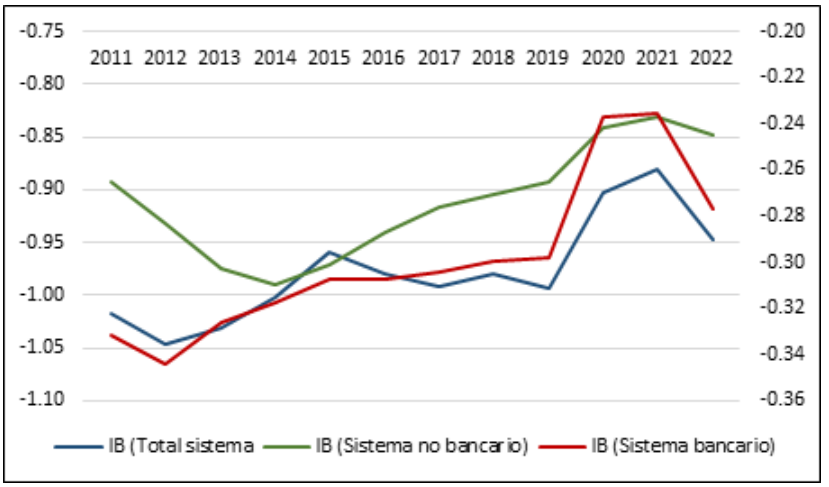
Note: CM denotes marginal cost, and LI denotes the Lerner Index. The estimates are obtained from the cost function using data from the SBS. Own elaboration.

Table 7. Estimación del Índice de Boone

lnSC	Total System	Banking System	Non-Banking System
lnCM	-0.7448***	-0.1511***	-0.7081***
Constante	-6.9932***	-4.0197***	-5.4723***
Number of Observations	540	168	372
Number of Groups	45	14	31
Wald chi2	113.74	50.16	70.2
Prob > chi2	0.0000	0.0000	0.0000

Note: All variables are expressed in logarithms; SC represents the share of total credit, and MC denotes marginal cost. The asterisks (***) indicate statistical significance at the 1% level. The estimation is based on marginal costs using data from the SBS. Own elaboration.

Figure 8. Evolution of the Boone index in the financial system 2011–2022



Source: Estimates based on data from SBS. Own elaboration.

4. Discussion

Concentration measures show that the Peruvian financial system has a high and persistent market concentration from 2011 to 2022, particularly in the commercial banking sector. The financial

system's CR4 (Concentration Ratio) ranged from 72% to 77% for assets, loans, and deposits, while the HHI (Human Capital Index) ranged from 1544 to 1760, indicating a slightly concentrated market with two peaks in 2015 and 2020. Analyzing the banking and non-banking sectors, the banking system's CR4 ranged from 82% to 85% for assets, loans, and deposits, and its HHI ranged from 1950 to 2220, confirming a highly concentrated market. The non-banking sector exhibited low concentration as measured by CR4 (40% to 54%), with an HHI ranging from 630 to 920, indicating greater competitiveness than the banking system. The concentration trend has been increasing in recent years during the analysis period (2011–2022). Regarding the number of financial institutions, these showed a reduction due to mergers, acquisitions, and liquidations, consolidating the dominance of the leading banks in the Peruvian financial system.

These results are in line with Bravo A. et al. (2022), who found that concentration was high in the Peruvian banking industry during the period 2000-2021, as measured by CR3, CR4, CR5, and HHI, where CR4 represents approximately 81% of loans. They also confirmed the dominance of BCP, BBVA, Scotiabank, and Interbank. Similarly, Céspedes-Reynaga & Orrego (2014) found greater banking concentration in the years 2001-2013, where HHI is close to 2000 in loan portfolios.

The Structure-Conduct-Performance (SCP) paradigm indicates that greater concentration increases market power, reducing competition and generating higher profit margins for entities. In the Peruvian case, this indicates increased profits for the four dominant banks.

According to the results, the financial system exhibited monopolistic competition during the period 2011-2022, with an H statistic of 0.78 under the static model and 0.72 under the dynamic model. On average, the H statistic was 0.75. The banking system, for its part, showed an H value of 0.68, indicating monopolistic competition. Similarly, the non-banking system was found to operate under a monopolistic competition scheme, with an average H value of 0.71. This dynamic suggests that the banking industry is less competitive than the non-banking industry, but the difference is small.

These results are similar to those found by Céspedes-Reynaga & Orrego (2014) for the period 2001-2013 in Peru, where the H value is around 0.5 in the banking industry and 0.65 in municipal savings banks, indicating monopolistic competition and higher levels than the banking system. Likewise, Yildirim & Philippatos (2007) found H equal to 0.70 and Yeyati & Micco (2007) found H equal to 0.55, in both cases with estimates from the 1990s. For the Peruvian microfinance system, Huayta et al. (2018) found H equal to 0.76, indicating monopolistic competition in the period 2002-2016.

The temporal variations in the H statistic values demonstrate that, although rivalry exists among financial institutions, market power persists, as competition tends to decrease during the 2011-2022 period. The Lerner index results indicate that the banking system (0.48) has greater market power than the non-banking system (0.32), reinforcing the notion that the banking industry is less competitive. The Lerner index trend shows a slight increase, reflecting a rise in market power and a decrease in competition levels. Mayorca H. & Aguilar A. (2016) found that competition intensified in the Peruvian microfinance sector during the 2003-2015 period. Aguilar & Portilla (2018) found a decreasing trend in the Lerner index for more than a decade, followed by an increase in market power during 2003-2016 in the Peruvian microfinance sector.

The Boone Index for the Peruvian financial system is -0.74, broken down to -0.15 for the banking system and -0.71 for the non-banking system. The Boone Index tends to increase during the period 2011-2022, with the banking industry having a lower value in absolute terms, indicating lower levels of competition. Jiménez Rivera (2020) found the Boone Index to be -0.67 during the period 2011-2016 in the banking system, and the trend indicated that competition had increased, although it has declined in the most recent period. In the microfinance sector, Huayta et al. (2018) found that the Boone Index increased during the period 2002-2016, suggesting increased levels of competition.

In Latin America, several studies have analyzed concentration and competition in the banking sector. Yildirim & Philippatos (2007) conclude that the banking sector operates under a monopolistic competition model, where concentration does not necessarily imply anticompetitive behavior. Yeyati & Micco (2007) found monopolistic competition in countries such as Argentina, Colombia, El Salvador,

Costa Rica, Mexico, Brazil, and Chile. Camino-Mogro & Armijos-Bravo (2018) concluded that the banking sector in Ecuador competes under monopolistic competition conditions and that regulatory reforms have benefited competition. Gómez Rodríguez et al. (2018) found moderate concentration in the Mexican banking sector and a monopolistic competition model. Finally, Torres & Castaño (2020) indicated a process of concentration and a decrease in competition levels in the Colombian banking market.

5. Conclusions

The market structure of the Peruvian financial system exhibited high concentration during the period 2011-2022. While concentration decreased in the early years, it has tended to increase in recent years. This dynamic can be attributed to mergers, acquisitions, or the liquidation of financial institutions. Furthermore, this high concentration demonstrates the consolidation and dominance of commercial banks, particularly the four banks with the largest market share. Non-bank financial institutions have exhibited more competitive behavior but have a smaller relative weight within the Peruvian financial system. It is noteworthy that the banking industry makes a significant contribution to assets, loans, and deposits, which makes the financial system dependent on commercial banks.

The Peruvian financial system was characterized by monopolistic competition during the period 2011-2022, with competition based on product differentiation that grants a degree of market power and facilitates the entry and exit of financial institutions. It is important to note that differences exist between the banking and non-banking systems, with competition being greater in non-banking entities, while the banking industry continues to hold greater market power. Considering the changes in competition during this period, a decrease in competition levels is evident, as confirmed by the three competition indicators.

Author Contribution

Eduard Salcca Lagar: Conceptualization, Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing.

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Conflict of Interest

The author declares no conflict of interest.

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