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The Effect of Banking Channels and Efficiency Indicators on Bank Profitability

El efecto de los canales bancarios y los indicadores de eficiencia en la rentabilidad bancaria

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ABSTRACT

This article proposes two models to analyze profitability banking. Using panel data methodology, it examined the relationship between operational efficiency indicators and banking access channels alternative to the branch with ROA and ROE. The main findings are that Net Operating Margin (MNO) has a direct relationship. Net noninterest Margin (MNNI) and Asset Utilization (RA) have a negative impact on ROA. Regarding access channels, Automatic Teller Machines (ATMs) have a positive, albeit weak, impact. Point of Sale Terminals (POS) are significant but in reverse. As for ROE, MNO and MNNI are related in the same sense as ROA. The Capital Multiplier (MC) presents a negative relationship. Mobile Banking (NBM) and POS show a significant inverse relationship, while ATM is direct.

Keywords: Multiple Banking, financial indicators, branchless banking.

JEL CODE: G21.

RESUMEN

Este artículo propone dos modelos para analizar la rentabilidad bancaria. Mediante metodología de datos de panel se analiza la relación entre los indicadores de eficiencia operativa y los canales de acceso bancario alternativos a la sucursal con ROA y ROE. Los principales hallazgos son que el Margen Operativo Neto (MNO) tiene una relación directa. El margen neto sin intereses (MNNI) y la utilización de activos (RA) tienen un impacto negativo en el ROA. En cuanto a los canales de acceso, los Cajeros Automáticos (ATM) tienen un impacto positivo, aunque débil. Los Terminales de Punto de Venta (POS) son significativos, pero a la inversa. En cuanto a ROE, MNO y MNNI están relacionados en el mismo sentido que ROA. El Multiplicador de Capital (CM) presenta una relación negativa. La Banca Móvil (NBM) y POS muestran una relación inversa significativa, mientras que ATM es directa

Palabras clave: Banca Múltiple, indicadores financieros, banca sin sucursales.

Código Jel**:** G21

INTRODUCTION

Commercial banking is essential in the development of a country. The centrality played by banks in their role as an intermediary as creditor and custodian of society's monetary surpluses, in addition to guaranteeing liquidity among economic agents that promotes the development of productive sectors, makes the performance of the sector a relevant issue for all economic sectors. Banking is also a leading actor in increasing financial inclusion, which drives economic growth and reduces poverty (Palaon et al., 2020). To achieve this scenario is necessary for banks to be profitable and adequately capitalized to guarantee not only their operation but also their expansion. Hence, bank profitability is a recurring theme in the financial literature. Research lines that incorporate multiple determinants into their analyzes with increasingly robust and sophisticated models.

According to the literature consulted, the performance of bank profitability is due to multiple factors that, for practical purposes, are classified into two categories: internal and external factors. The former depends on the management of the senior management of each bank, such as risk indicators, liquidity, efficiency, and profitability, among others. On the other hand, external factors influence profitability but are unrelated to the banks' decisions. Examples of these are changes in the economic environment, such as inflation, economic growth, changes in the regulation of the sector, the market structure in which banks operate, and the development and adoption of technologies.

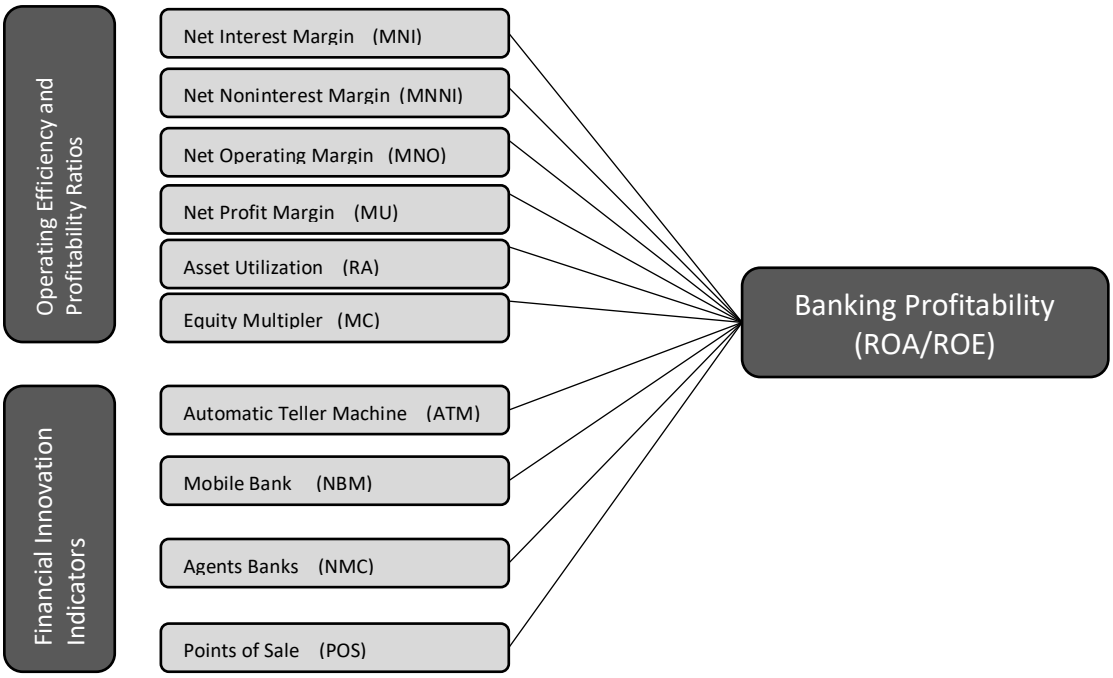
This article seeks to contribute to the literature by proposing an extension of a model that explains bank profitability based on indicators of operating efficiency and profitability with the incorporation of independent banking access channels to the traditional branch, see Figure 1. These channels are considered independent variables that affect the performance of banks.

In recent decades, the development of Information and Communication Technologies (ICTs) has impacted all economic sectors, and commercial banking is no exception. The different financial innovations adopted by banks have modified the traditional interaction in bank branches with their users (Mbama, 2016; Olavarría et al., 2018).

Users who are increasingly digital demand comfort, speed, and ease in requesting, contracting, and using their financial products and services. To meet this demand, banks have invested in the expansion of alternative banking channels to the branch, such as ATMs (Automatic Teller Machines), POS (Point of Sale Terminals), BM (Mobile Banking), and Commission Agents (also called banking correspondents). This banking infrastructure is supported by Information and Communication Technologies (ICTs), and different investigations have analyzed its relationship with banking performance, finding significant

relationships in different channels (Le & Ngo, 2020; Medyawati et al., 2021; Moudud-Ul-Huq & Hossain, 2020).

Figure 1
Variable Model



Source: own elaboration

The articles that analyze the relationship between profitability and efficiency in the banking sector are vast. The relationship between these indicators is inversely significant, indicating that the higher the profitability, the efficiency indicators tend to be lower (Buchory, 2015; Christaria & Kurnia, 2016; Phan et al., 2020). In Mexico, the literature that addresses this relationship is scarce. Rodríguez & Venegas (2010) analyze Mexican banks' profitability and operational efficiency indicators classified by the number of assets they own. They also find evidence that these banks have more significant advantages in the Net Interest Margin and the Net Operating Margin.

The authors Guerrero & Villalpando (2009) analyze the context of the banking sector from the transformation process that began at the end of the last century with the authorization of foreign investment, which generated a change in concentration, being this and the power of the market variables with a strong influence on bank profitability. In the same vein, Maudos & Solisa (2009) find evidence that average operating costs and market power mainly explain the high margins obtained by Mexican banks.

On the other hand, incorporating innovation variables in the proposed model that analyzes bank profitability is theoretically based on the Schumpeterian principle of creative destruction, the diffusion of innovation theory (Rogers et al., 2014), and, in addition, the Theory of the Acceptance of Technology. This Theory affirms that the ease of use of the technology indicates to implement and to learn new systems of information. Therefore, the model emphasizes the ease of use of the new technology affecting the perceived usefulness (Venkatesh & Davis, 2000).

According to Alvarez (1993), innovation is adapting the offer to the demand of the clientele and the markets. However, a broader definition of financial innovation is given by Khraisha & Arthur (2018), who define it as a process carried out by any institution which involves the creation, promotion, and adoption of new (including both incremental and radical) products, platforms and processes or enabling technologies that introduce new forms or changes in the way of carrying out a financial activity. These definitions fit with the current situation in which the banking sector tends to invest more in alternative channels to physical branches as demanded by digital users.

The incorporation of banking access points in financial innovation research is aligned with the term branchless banking. Said concept measures the effect of adopting alternative banking infrastructure on the bank branch. Most empirical research is done in developing countries with large territorial extensions. Another characteristic these countries have in common is that they have many rural communities with low populations, irregular settlements, and a high poverty level on the periphery of large cities. For private commercial banks, it is not profitable to open branches in these areas. To cover this lack of coverage, banks invest in expanding banking access channels, being a viable alternative for banks that meets the needs of users (Magallón et al., 2022). Due to the characteristics of unequal access to banking services in Mexico and given the information to which one has access, the branchless banking construct is considered to measure financial innovation.

With information from the information portfolio of CNBV and through an econometric data panel model, the aim is to elucidate the relationships between the determinants of the proposed model with the performance of the ROA and ROE profitability indicators of the seven leading banks operating in Mexico. No research was found in the Mexican literature incorporating financial channels as explanatory variables of bank profitability, which is the main contribution.

The rest of this article comprises the Literature Review section with a description of empirical articles that analyze the relationship between efficiency indicators and banking infrastructure with bank profitability. The third section presents the methodology of the econometric model and the description of the data collection used. The fourth and fifth sections present our

analysis's results, discussion, and conclusions. Finally, topics for future lines of research are proposed.

LITERATURE REVIEW

The banking sector is analyzed from different lines of research in the academic literature in which its history, relationships, and performance are investigated. As mentioned above, this research proposes a model that explains bank profitability with internal determinants of operational efficiency and external determinants that measure banking infrastructure. However, before citing theoretical and empirical research that supports this research, a review of the most critical events in the Mexican banking sector is made to contextualize the evolution of Mexican banking.

Table 1 presents a brief chronology of momentous events in the sector during the last three decades. Although these events are not the only ones, the author considers them the most relevant to explain the consolidation of a healthy and capitalized banking sector. These events have allowed it to face the economic and financial crises presented in this century without the shocks of yesteryear.

Table 1

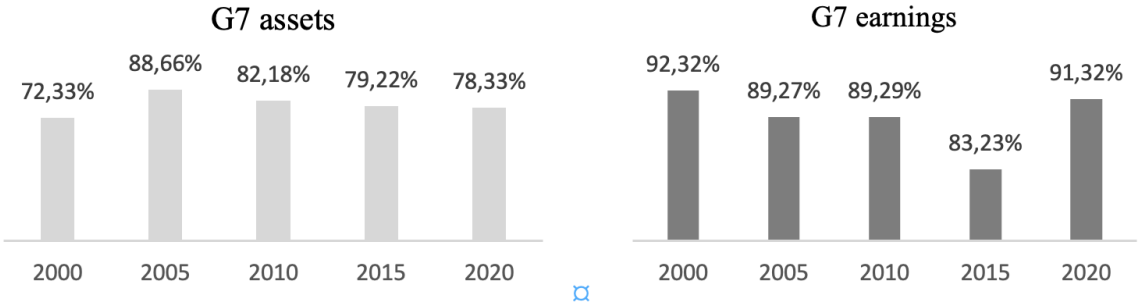
Main events in the Mexican banking sector in recent years

Event	Year	Reference
President José López Portillo nationalized private commercial banks in response to the economic crisis. It sought to curb speculation with the exchange rate, contain the flight of foreign currency, and control inflation.	1982	(Fong, 1990; Turrent, 2009)
The financial reform reprivatizes banking and radically deregulates the sector. It is argued that private companies are more efficient than the State.	1990	(Hernández & López, 2001)
The amendment to Article 28 of the Constitution and the Bank of Mexico Law published in the Official Gazette on August 20 and December 23, 1993, conferred autonomy on the central bank, giving it a new legal nature and regime to safeguard that autonomy. , in addition to updating the purposes and functions of the bank and strengthening its powers. Banking only allows 8% of foreign capital participation..	1993	(Borja, 1995)
The liberalization, deregulation, and competition of the Mexican banks to the participation of foreign capital prior to the entry into force of the Free Trade Agreement with the United States and Canada. Up to 25% foreign capital is allowed.	1994	(Girón, 1994)
The reorganization of banks by the Banking Fund for the Protection of Savings (FOBAPROA) today, the Institute for the Protection of Bank Savings (IPAB), and the subsequent reprivatization of banks by the leading world financial groups and the consolidation of others.	1998	(Hernández & López, 2001).
At the beginning of this century, commercial banking was opened to foreign capital, which allowed consolidation as a dynamic sector with growing capitalization. There is no restriction on the participation of foreign capital.	2000 y 2001	(Turrent, 2008)
The financial crisis that began in the United States due to subprime mortgages substantially impacted the world banking sector. In Mexico, Banco de México (BANXICO) reactivated the sale of dollars for up to 400 million dollars a day. Furthermore, exchange lines were agreed upon with the US Federal Reserve for up to 30 billion dollars.	2008	(BANXICO, 2022)

Source: Own elaboration

Although these events consolidated the sector's finances, they failed to change the concentration level. To exemplify this behavior of the banking market, Graphic 1 presents the percentage of asset possession and income of the Mexican banking system's seven largest banks (G7) in the last two decades.

Graphic 1
G7 share of assets and earnings



Source: Own elaboration with data from the National Banking and Securities Commission.

With data from the CNBV as of December 2020, the G7 had 78% of the sector's assets and 91% of the income. The concentration is similar to 2000, when these banks had 72% of the assets and 92.32% of the profits. Given the weight of the G7, it is easy to infer that the variations in its indicators impact the sector's performance.

Internal determinants

In Mexico, publications that analyze bank profitability with internal factors are scarce. Among them is the one carried out by Rodriguez & Venegas (2012), which classifies Mexican banks into four categories according to the number of assets they own. They analyze these categories through an analysis of liquidity, leverage, and profitability indicators in 2002 and 2009. They conclude that the significant determinants are long-term deposits that allow them to assume more profitable investments and short-term solvency.

Chavarín (2014) analyzes the levels of delinquency in the payments of the credits of the banking clients as not a determinant in profitability. Among his findings, he mentions that the factors that impact profitability are the level of capitalization, the size of the bank, the total level of risk exposure, administration expenses, and the mix of activities. For their part, Ronquillo Rodríguez et al. (2018) conclude that the financial factors that contribute the most to profitability are the financial margin adjusted for credit risks and administration and promotion expenses.

Regarding foreign research on this subject, there is the one carried out by Goddard et al. (2004) proposes a model to measure the profitability of European banks during the nineties and incorporate various elements such as the size of the bank, diversification, risk, efficiency, type of owner and dynamic effects. Efficiency and risk are the determinants that have the most significant effect on profitability. Furthermore, Chortareas et al. (2011) analyze the market where banks operate. Based on 2,500 observations of Latin American banks, they conclude that the efficient structure is the one that supports the profitability of banks in countries with more advanced economies, such as Brazil, Argentina, and Chile.

Neves et al. (2020) analyze efficiency indicators, bank size, macroeconomic variables, and profitability. Sixty-six Portuguese and Spanish banks are analyzed using the generalized method of moments (GMM) and data envelopment analysis (DEA). The latter measures efficiency and concludes that there is a positive and negative nonlinear relationship between the bank's size and its profitability and efficiency levels, respectively. Ercegovac et al. (2020) investigated the banking sector in the European Union during the period 2007-2019. The empirical evidence is in line with the initial assumptions: the efficiency of the banking firm, measured by the cost-income ratio and the delinquency rate, significantly influences bank profitability.

The solidity of the sector is also due to responsible internal management of its financial indicators. The relationship between bank profitability and financial ratios has been documented in the academic field, mainly by European, Asian, and American banking publications. Among the different indicators, the efficiency measurement is a line of research with fewer publications. Efficiency ratios show how well management has sustained revenue growth in the face of rising costs.

External determinants

With the advancement of new information technologies, retail banking competes with new alternative channels to the traditional business model of banks based on the number of branches. Among the first innovations that allowed financial users to carry out transactions outside the bank branch took place in the seventies. They appeared in electronic teller machines, Automatic Teller Machines (ATMs). Some studies that analyze the relationship between these and profitability are mentioned. Based on data from US banks, Massoud et al. (2003) analyze the relationship between ATMs and bank profitability and find a direct relationship between additional charges for using ATMs.

Itah & Emmanuel (2014) study Nigerian banking in which they examine the effect of ATMs, points of sale, and transactions through the Internet on bank profitability, using multiple regression analysis methods by ordinary least squares. The result showed that ATMs and points of sale are positively related to ROE. On the other hand, through a data panel, Medyawati et al. (2021) analyze the relationship between Indonesian banks and access

channels such as ATMs, mobile banking, and internet transactions. They conclude that ATMs are not significant in their relationship with ROA.

Mutua (2013) study the Kenyan banking sector, detecting a weak but positive relationship between mobile banking and ROA. The same conclusion was detected by Medyawati et al. (2021). They analyze banks listed on the Indonesian Stock Exchange and find that the relationship between mobile banking and profitability is significant with the ROA ratio. This result is similar to another study conducted in Kenya, which found a significant but weak positive relationship between mobile banking and profitability (Chipeta & Muthinja, 2018). On the other hand, Lebanese banks have no significant relationship with bank profitability (Chaarani & Abiad, 2018).

Regarding the empirical studies that analyze the relationship between profitability and point-of-sale terminals (POS). The one carried out by Le & Ngo (2020) with banks in 23 countries analyzed. It is found that the relationship between POS and bank profitability is significant. Itah & Emmanuel (2014) conclude that point-of-sale terminals positively affect Nigerian banks' profitability, measured by ROE.

In Mexico, the commission agent model's proliferation is due to banks' strategies to have new access points for their users. In addition, the expansion of chains such as Oxxo adds new stores every year (ENIF, 2018). The strategies of the correspondents another essential factor that explains the acceptance of the commission model is the high cost that opening a branch in a distant town implies for banks, such as the bordering areas of large cities and rural towns (Peña & Vázquez, 2012).

In rural Kenya, the installation of two access channels, Mobile banking, and agent banking, is studied by Irura & Munjiru (2013). It concludes that the main factors that encourage the adoption of these financial innovations are: the improvement and guarantee of security, reliability, and trust and the improvement of the propensity to assume risks on the part of SMEs that adopt the technology. In addition to the improvement in the political framework, the telecommunications infrastructure, among others. Some publications analyze banking agents as a factor that drives the performance of commercial banks (Barasa & Mwirigi, 2013; Irura & Munjiru, 2013; Kandie, 2013; Shrader & Duflos, 2014; Waleed & Tahir, 2020).

A large part of the studies that analyze banking access channels has the term Branchless Banking in common. Branchless Banking is a concept that brings together the main innovations in access points outside the bank branch. Its use as a proposal to measure banking innovation is used mainly by developing countries with large territories and marginalized areas where banks have little or no penetration and, therefore, a population excluded from the formal banking system (Ky et al., 2021; Palaon et al., 2020; Zhu et al., 2021). The

following section details the Methodology used in this article to assess the relationship between the explanatory variables with profitability.

METHODOLOGY

In order to comply with the Basel III agreements, Mexican banks must publish their financial statements monthly on the CNBV website. Transparency offers an essential source of information that allows interested parties to investigate banks' financial and operational performance. The indicators' values are obtained from secondary sources and monthly financial reports published in the Information Portfolio section. Among the main advantages of working with indicators is establishing a comparable base for all the institutions evaluated regardless of their size, nationality, or membership. The second decade of this century is analyzed using a panel data econometric model (Hill, Griffiths & Lim, 2018). The program used for the processing and analysis of the database is R-studio.

The ratios and financial indexes of profitability and operating efficiency used in the present analysis measure and evaluate the performance of the administrative policies of the senior management of each bank. This index allows us to evaluate the banks' strategies to elucidate the indicators that have the most significant relationship with profitability.

The indicators assume the role of independent variables, and it is explored if they are statistically significant with the dependent variable, ROA and ROE. The financial ratios are obtained from the book "Bank Management and Financial Services" (Rose & Hudgins, 2008), and their formulas and description are shown in Tabla 3. The innovation variables: ATM, POS, NBM, and NMC are the access points that present greater adoption by Mexican users, as observed in the evolution of the data.

Following the specialized literature consulted, and due to the characteristics of the database used, study units (banks) in periods (monthly financial indicators for the period between 2011-2020), the panel model methodology is used. Of data to evaluate profitability, ROA, and ROE. The estimation is made by Ordinary Least Squares (OLS), and the following general equation is used:

$$ROA/ROE_{i,t} = \alpha + \beta_1 MNOX_{i,t} + \beta_2 MNIX_{i,t} + \beta_3 MNNIX_{i,t} + \beta_4 RAX_{i,t} + \beta_5 MCX_{i,t} + \beta_6 MUX_{i,t} + \beta_7 ATMX_{i,t} + \beta_8 log\,(NMC)_{i,t} + \beta_9 log\,(NBM) + \beta_8 POS\varepsilon_{i,t}$$

Equation 1

The dependent variable is the banking profitability measured by the ROA and ROE indicators. The explanatory variables correspond to the following financial ratios of profitability and operating efficiency: Operating Efficiency (EO), Net Interest Margin (MIN),

Net Non-Interest Margin (MNNI), Asset Turnover (RA), Capital Multiplier (MC), and Profit Margin (MU).

One of the main indicators to assess profitability is ROA. The indicator measures the performance of a company, and in the banking sector, it is widely used due to the uniformity in its calculation, where the assets that are taken into account are: cash, deposits retained by Banxico, cash on hand and instruments with a maturity of the bank, investment, and loans. The ROE indicator evaluates the return of a shareholder who invests his capital in the bank.

The explanatory variables of innovation measure the evolution of the banking infrastructure of access points other than traditional branches. These channels are used as independent variables that are related to bank profitability. Table 3 presents the definition and estimated equation for each indicator. For NMC, it is the number of transactions operated in the commission businesses of bank i at time t. NBM is the number of bank accounts that have the mobile application contracted from bank i at time t. ATMs provide information on the number of ATMs that bank i has at time t. POS is the point of sale terminals bank i have at time t.

According to the data from the CNBV, the evolution of access channels has a constant growth. In the decade analyzed in the present investigation, ATMs grew by 55.51%, translating into 17,725 more ATMs. The POS went from 469,028 units in 2011 to 1,245,003 in 2020, representing a growth of 145.67%. The amounts of transactions in commission businesses had a growth of 846.53%. The most remarkable growth in the analyzed channels is Mobile Banking. With a growth of close to 36 million accounts from 2011 to 2020. On the other hand, bank branches decreased from their highest point reached in 2016. By the end of 2020, the G7 has 7,507, representing a decrease of 5.58%. (Table 2)

Table 2
G7's evolution banking access points

Year	ATM's	BM	POS	Branch	Transaction amount in Commission Agents (in millions of pesos)
2011	31,931	161,990	469,028	7,711	$ 56,639.77
2012	34,217	803,966	487,949	7,756	$ 95,309.29
2013	35,713	2,699,378	570,933	7,927	$ 127,801.01
2014	37,632	5,065,017	660,365	7,758	$ 166,532.26
2015	40,120	7,556,531	760,990	7,808	$ 216,745.70
2016	42,159	13,315,183	796,112	7,951	$ 296,310.30
2017	43,511	14,362,532	848,304	7,904	$ 394,902.03
2018	46,739	23,841,933	899,369	7,881	$ 483,250.28
2019	49,008	30,116,625	1,152,183	7,938	$ 524,197.40
2020	49,656	36,054,333	1,245,003	7,507	$ 536,114.46

Source: Own elaboration with data from the National Banking and Securities Commission

Table 3
Operability of the Variables Model

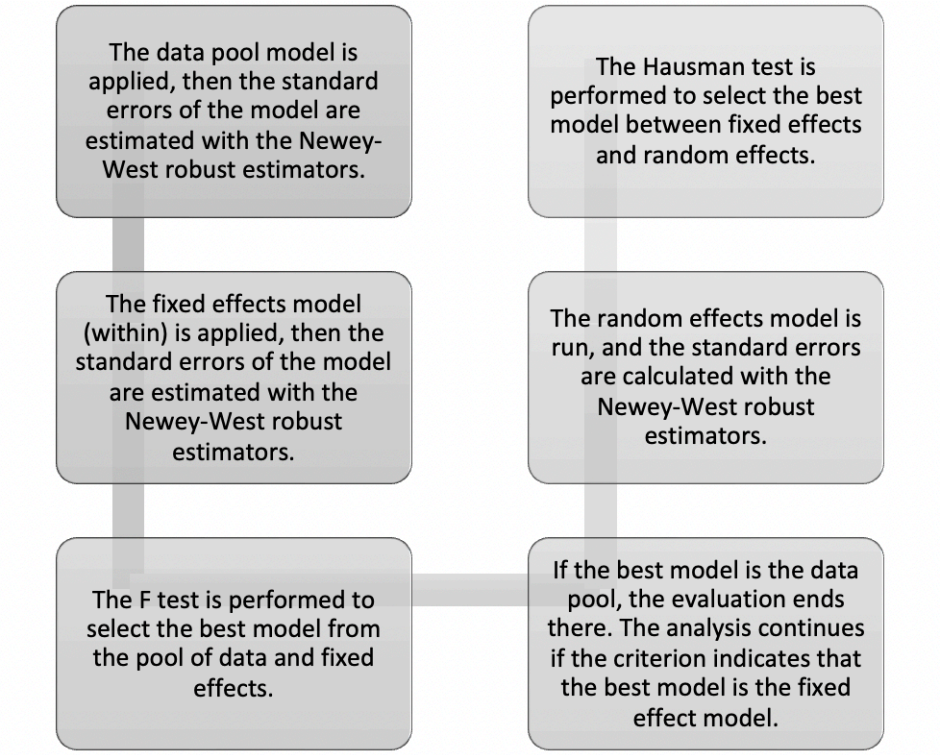
Type of Variable	Variable	Description	Indicator
Dependent	Return on Assets (ROA)	Administration's ability to generate returns from its resources. An acceptable result would be between 1% and 1.5%.	$ROA = \frac{Revenues}{Total\ Assets}$
	Return on Equity (ROE)	Profit for own funds. A result between 10% and 22% is considered acceptable.	$ROE = \frac{Revenues}{Total\ Equity}$
Independent	Net Interest Margin (MNI)	Evaluate the differential between interest income and interest cost management through strict control in obtaining assets and the search for more accessible sources of financing. The expected results of this indicator are between 3% and 4.5%.	$MIN = \frac{\text{(Financial Margin annualized monthly flow (Monthly flow } * \text{ 12))}}{\text{(} * \text{ Productive Assets for the month. (Balances at the end of the month))}}$
Independent	Net Margin Non-Interest (MNNI)	Measures the amount of non-financial revenue from service fees that the finance company has collected relative to the amount of non-financial costs incurred (including wages and salaries, facility repair and maintenance, and loan loss expense). The result is expected to be negative.	$MNNI = \frac{(Total\ operating\ income\ ** - Expenses\ without\ interest)}{Total\ asset}$
Independent	Net Operating Margin (MNO)	Indicates how well management and staff have been able to sustain revenue growth (mainly from loans, investments, and service fees) before rising costs, primarily interest on deposits and other loans compensation and salaries and benefits of the employees.	$MNO = \frac{Total\ income\ per\ operation - Expenses\ without\ interest)}{Total\ Assets}$
Independent	Net Profit Margin (MU)	It provides us with information about the effectiveness of the administration in controlling costs and the pricing policy for services. The higher the result, the income for the bank will be higher.	$MU = \frac{Net\ Income}{Total\ Operating\ Income}$
Independent	Asset Utilization (RA)	It provides us with information about portfolio management, especially about the mix and performance of assets. The result of this indicator is usually higher for smaller banks.	$RA = \frac{Total\ Income\ per\ Operation}{Total\ Assets}$
Independent	Equity Multipler (MC)	Provides information on the institution's financing policies if the sources chosen for leverage are debt or equity. It is interpreted as the number of assets that back the capital.	$MC = \frac{Total\ Assets}{Total\ Equity}$
Independent	Automatic Teller Machine ATM	These variables are defined as innovation and measure the alternative channels for a banking operation. This infrastructure is aligned with the branchless banking concept. For POS and ATM, each data represents the number of units bank i has at time t. For the variables accounts with access contracts to the mobile banking application (NBM) and the number of operations carried out in commission businesses (NMC) for handling large numbers, logarithms are used to be estimated.	$Número\ de\ ATM\ of\ bank\ i\ in\ time\ t$
Independent	Point of sale POS		$Number\ of\ Points\ of\ sale\ of\ bank\ i\ in\ time\ t$
Independent	Movil Banking NBM		log(Number of accounts with mobile banking)
Independent	Banking Agents NMC		log(Amount of transactions carried out in commission businesses)

Source: Obtained from the book Bank Management and Financial Services (Rose & Hudgins, 2008) and the National Banking and Securities Commission. *Productive assets = (Available funds + Margin accounts + Investments in securities + Benefits to be received in securitization operations + Current Portfolio + Repo

debtors + Securities loans + Valuation adjustment for financial asset coverage). **Total operating income (ITO) is obtained as follows: ITO= (Risk-adjusted Financial Margin + Commissions collected-Commissions paid + Intermediation result + other income from the operation).

In order to select the best data panel model that analyzes the relationship between the dependent variable profitability (ROE and ROA) and the financial and innovation ratios described in Table 3, the methodology described in Figure 2 is followed. Newey West and the selection criteria for panel data models given by the F and Hausman tests are described in the footnotes on this page.

Figure 2
The methodology used in profitability analysis



Source: Own elaboration with information from the book Principles of Econometrics (Hill, Griffiths & Lim, 2018)

Once this methodology has been carried out, we identify the data panel model that best analyzes the independent variables' data and the ROA and ROE values. With this, the corresponding inferences are obtained to contextualize the banks' strategy from the perspective of efficiency and innovation indicators that are significant in the performance of banks. The results are presented in the next section.

RESULTS

The results of this study are presented following the methodology described in the previous section. In addition, figures and indicators of the banks that make up the G7 are presented to help us understand their importance in the Mexican banking sector. With data as of December 2020, the seven banks analyzed in this investigation owned 78% of the assets and 91% of the system's profits. BBVA Bancomer and Santander, banks of Spanish origin, the largest in the sector, have 22% and 17% of total assets and 35% and 20% of profits (Table 4).

Table 4
Assets and profits of G7 banks (December 2020)

Bank		Assets	%		Income	%2
BBVA Bancomer	$	2,443,359.00	22%	$	36,172.34	35%
Santander	$	1,855,739.00	17%	$	20,144.36	20%
Banamex	$	1,357,143.00	12%	$	7,440.39	7%
Banorte	$	1,261,618.00	11%	$	20,383.64	20%
HSBC	$	780,037.00	7%	-$	707.96	-1%
Scotiabank	$	638,178.00	6%	$	3,018.68	3%
Inbursa	$	401,206.00	4%	$	6,860.10	7%
Total del G7	***$***	***8,737,280.00***	***78%***	***$***	***93,311.55***	***91%***
Total del sistema	**$**	**11,186,514.00**		**$**	**102,429.46**	

Source: Own elaboration with data from the National Banking and Securities Commission

Regarding the access channels, the figures as of December 2020 are present in the following table (Table 5), and it is observed that for the ATMs BBVA Bancomer, Santander, Banorte, and Banamex are the Credit Institutions with the most significant presence, the first account with 22.3% and the other three banks have 16% of the sector each. On the other hand, regarding POS, BBVA and Santander are the leaders, with 33.5% and 22.24%, respectively.

Table 5
Access channels available to each G7 bank as of December 2020

	ATM	%	TPV	%	MB	%	Commission Agents	%	Branches	%
BBVA Bancomer	12,961	22.34	492,541	33.50	14,844,596	29.84	15,737,050,009	21.73	1,745	14.46
Santander	9,448	16.28	327,048	22.24	4,801,475	9.65	7,762,481,470	10.72	1,037	8.60
Banamex	9,424	16.24	111,628	7.59	14,324,866	28.80	17,658,913,589	24.39	1,420	11.77
Banorte	9,387	16.18	161,651	10.99	1,948,787	3.92	5,161,381,644	7.13	1,193	9.89
HSBC	5,934	10.23	52,052	3.54		0.00	3,124,434,406	4.31	929	7.70
Inbursa	760	1.31	73,249	4.98		0.00	1,630,524,128	2.25	662	5.49
Scotiabank	1,742	3.00	26,834	1.83	134,609	0.27	1,601,370,454	2.21	521	4.32
G7	**49,656**	**85.58**	**1,245,003**	**84.68**	**36,054,333**	**72.48**	**52,676,155,700**	**72.74**	**7,507**	**62.22**
Total Sector Bancario	**58,023**		**1,470,257**		**49,745,798**		**72413380028**		**12,065**	

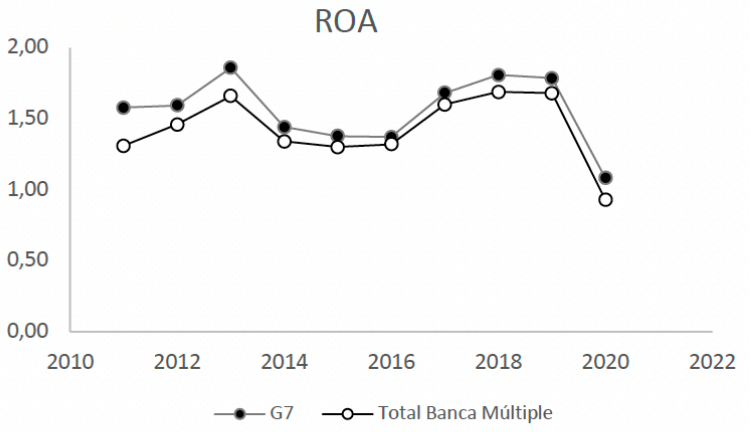
Source: Own elaboration with data from the National Banking and Securities Commission

BBVA Bancomer and Banamex are the leaders in Mobile Banking, with more than 14 million accounts each. Regarding the amounts in commission businesses, Banamex has 24.39% of the market, followed by BBVA Bancomer, which has 21.73%.

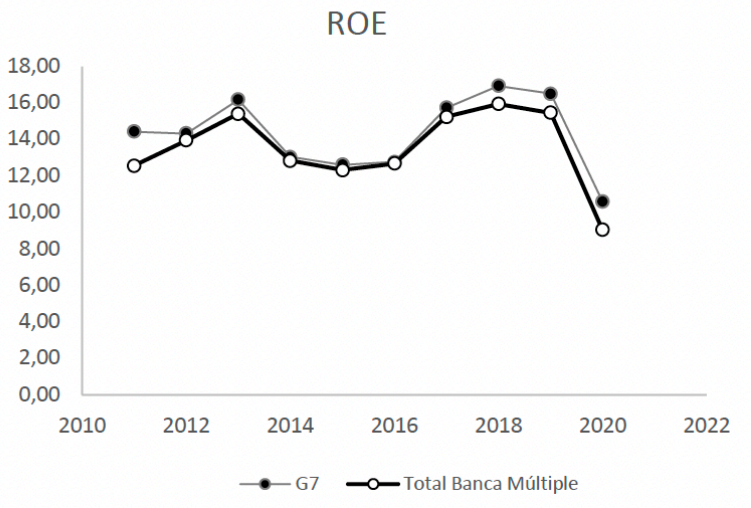
The behavior of the ROE indicator during the last decade is presented in Graphic 2. It can be observed that the performance of the sector (Total Multiple Banking) presents a similar behavior to that observed by the G7 banks. The same graph also shows the behavior of the ROA indicator of the seven banks. As in the ROE indicator, G7 influences the behavior of the ROA of the Mexican banking sector. This is explained because most of the elements that make up the indicator, net stockholders' equity and income, are contributed by the G7.

Graphic 2
Evolution of the ROA and ROE indicators of the G7 and the banking sector 2011-2020

Year	ROA G7	Total Multiple Banking
2011	1.58	1.31
2012	1.59	1.46
2013	1.86	1.66
2014	1.44	1.34
2015	1.38	1.3
2016	1.37	1.32
2017	1.68	1.6
2018	1.81	1.69
2019	1.79	1.68
2020	1.08	0.93



Year	ROE G7	Total Multiple Banking
2011	14.44	12.57
2012	14.34	13.96
2013	16.19	15.42
2014	13.05	12.85
2015	12.61	12.33
2016	12.77	12.69
2017	15.75	15.25
2018	16.94	15.95
2019	16.51	15.47
2020	10.60	9.04



Source: Own elaboration with data from the National Banking and Securities Commission

A drop is observed in the two indicators in 2020, partly due to the closure of several economic sectors in the first half of 2020. Despite the uncertainty caused by the Covid-19 pandemic, only the HSBC bank presented losses this year of 708 million pesos.

Table 6
Result of the data panel with the dependent variables ROE and ROA

	ROE
MNO	0.098***
	-0.012
MIN	0.3
	-0.064
MNNI	-0.127*
	-0.056
MU	0.809
	-0.298
RA	0.006
	-0.006
MC	-0.129**
	-0.06
NATM	0.001**
	-0.0004
NTPV	-0.00002*
	-0.00001
log(NBM)	-0.851**
	-0.378
log(NMC)	0.176
	-0.674
Constant	4.285
	(10.988)
LLF	-1739.3348
Akaike	4422.6687
Observations	483
R2	0.345
Adjusted R2	0.331
F Statistic	12.278*** (df = 10; 466)

	ROA
MNO	0.216***
	(0.023)
MIN	0.035
	(0.075)
MNNI	-0.515***
	(0.101)
MU	0.446
	(0.297)
RA	-8.299*
	(3.861)
MC	-0.085
	(0.075)
NATM	0.0002**
	(0.0001)
NTPV	-0.00001**
	(0.00001)
log(NBM)	-0.131
	(0.076)
log(NMC)	-0.046
	(0.135)
Constant	3.642
	(2.198)
LLF	-962.1623
Akaike	2868.3247
Observations	483
R2	0.312
Adjusted R2	0.298
F Statistic	21.453*** (df = 10; 472)

Source: Own elaboration with data from the National Banking and Securities Commission

According to the F and Hausman tests, the data panel model that best fits the analysis of the ROE and ROA (Table 6) dependent variables is the data pool, which implies that α and β's are constant for the seven banks analyzed (Table 7).

Table 7
F test and Hausman Test for the choice of the Data Panel Model

	ROA		
	Pool	Fixed	Random
F test	**83.80919**	0	
Hausman test	**0**	0	

	ROE		
	Pool	Fixed	Random
F test	**48.76184**	0	
Hausman test	**0**	0	

Source: own elaboration

DISCUSSION AND CONCLUSIONS

The importance of banks' financial performance is an issue of vital importance for a country's economy. Given the interaction of the banking sector with other economic agents, it is essential to follow up on its main indicators. This research proposes to analyze the influence on bank profitability of the profitability and operational efficiency indicators, which measure the efficiency in the administration of its costs concerning its income, of the accounting capital's relationship with respect to the assets between others. In addition, the banking access channels that show significant growth and adoption by the Mexican market are integrated.

The Net Operating Margin (MNO) has a significant relationship with ROA and ROE. The reading of this indicator refers to the differential between income and operating expenses to assets. The higher the indicator, the bank is more efficient in its operations. It is usual for large banks to have a better result, given the economies of scale they manage. This result is in line with the research by Rodríguez & Venegas (2010).

Regarding the indicators that have a significant relationship with the ROA indicator, we find that the indicators:

The noninterest Net Margin, MNNI, has ROA influence but in a negative sense, coinciding with the literature consulted (Rose & Hudgins, 2008). This financial ratio does not indicate the relationship between the difference in income from commissions collected and noninterest expenses (mainly wages and salaries) with assets.

The management of the banks' portfolio refers to the income of the banks in the placement of their assets and is measured by the indicator of Asset Utilization, RA. It has a significant inverse relationship with ROA, which implies a low placement by banks.

Regarding the indicators of banking infrastructure, it is found that electronic teller machines, and ATMs, have a positive but weak influence on ROA. These results align with the research carried out by (Le & Ngo, 2020; Medyawati et al., 2021), who found a positive but weak relationship between ATMs in conjunction with other channels. The result is also consistent with a study by (Clemons, 1990), which concludes that ATMs help banks not to lose market share and not to be more competitive. Conversely, Moudud-Ul-Huq & Hossain (2020) conclude that ATMs have a negative relationship with ROA. On the other hand, Itah & Emmanuel (2014) conclude that ATMs alone negatively influence profitability. However, the relationship is positive if complemented by other innovations, such as Point of Sale Terminals.

Point of Sale Terminals, POS, present a negative relationship with ROA and a very weak effect. This result is in the same sense as the findings found by the investigations (Akhisar et al., 2015; Moudud-Ul-Huq & Hossain, 2020). In the research carried out in 23 countries by Le & Ngo (2020), it was found that POS positively affects bank profitability. On the other hand, Mobile Banking and commission businesses do not have a significant relationship with ROA.

Regarding the determinants that have a significant relationship with the ROE profitability indicator, the commissions charged for the assets held by the banks (MNNI) have a significant negative relationship. In addition, the Equity Multiplier influences profitability. This indicator refers to banks' leverage, whether it is with their capital or debt. It is common for bank management to finance projects with debt, resulting in greater profitability, so care must be taken not to present high levels of indebtedness.

As with the ROA indicator, the innovation indicators, ATM and POS, are related to ROE in the same sense, positive for the first and negative for the second channel. Also, the coefficients have a slight impact on profitability. The relationship is negative for the Mobile Banking channel, with a significance level of up to 0.05. Chipeta & Muthinja (2018) find in their study carried out for banking in Kenya that mobile banking is significant for ROE but in a direct sense. Imamah & Ayu Safira (2021) reach the same conclusion regarding the positive effect mobile banking has on the performance of bank profitability in Indonesia. Regarding the amounts negotiated in the Commission Agent, NMC businesses do not present a significant relationship.

Future Lines research

The CNBV portal presents an accessible database to analyze Mexican banking from different perspectives. In addition, incorporating new reports facilitates access to information on the sector, encouraging academic research in this sector.

Although the access channels present a weak relationship with the performance of the banks, their proliferation represents a virtual object of study to analyze other indicators of the banks, such as the effect on the indicators of efficiency, transactionality, and jobs in the banking sector, among others.

Determine if user satisfaction in using banking access channels contributes to efficiency. It would allow us to determine whether the application of these banking strategies impacts bank profitability.

It is also essential to study the disruption of Neo Banks, whose main characteristic is that they do not have branches that have their business model on their online platforms and mobile applications.

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