Fintech as a Driver of Financial Inclusion: A Quantitative Study of Digital Demand and Impact in Colombia

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Resumen

El presente estudio analiza el potencial de las Fintech como alternativa para la inclusión financiera en Colombia, basándose en la percepción social y el interés de búsqueda en línea de servicios financieros digitales. Se postula que estas búsquedas en internet reflejan una exploración activa de alternativas a los canales financieros tradicionales, sirviendo como un indicador útil de la demanda y el potencial de adopción de servicios digitales. Metodológicamente, se emplea un enfoque cuantitativo explicativo-correlacional, especificando y estimando nueve modelos de datos panel para 32 departamentos y Bogotá (2022-2023). La estimación se realizó utilizando la técnica de Mínimos Cuadrados Generalizados Factibles (FGLS), lo que permitió abordar la heterocedasticidad presente en los datos.

Los resultados de los modelos demuestran una relación estadísticamente significativa entre el interés de los usuarios por el ecosistema Fintech y la inclusión financiera, medida en sus dimensiones de acceso, uso y cobertura. Se encontró que la búsqueda de términos como Fintech, P2P, Crowdfunding y Crédito Digital impacta positivamente el acceso a productos crediticios (crédito total, microcrédito y tarjetas de crédito) y el uso de depósitos electrónicos y cuentas de ahorro. Sin embargo, se identificaron efectos negativos de la búsqueda de Billetera Digital y Pagos Digitales sobre el microcrédito, y de Crowdfunding sobre los depósitos electrónicos. En cuanto a la cobertura, el interés en Fintech, Crowdfunding, P2P y Pagos Digitales impulsa la expansión de corresponsales móviles y digitales, mientras que los pagos digitales muestran una relación negativa con los corresponsales físicos. De manera consistente en todos los modelos, el PIB per cápita se asocia positivamente con un mayor acceso, uso y cobertura de servicios financieros. Las Fintech potencializan significativamente la inclusión financiera en Colombia. Sin embargo, su capacidad está condicionada principalmente por el nivel de inclusión digital y las condiciones socioeconómicas de las personas y las regiones. El estudio valida que el interés digital de los usuarios es un impulsor clave en el comportamiento del sector financiero hacia una mayor inclusión.

Palabras clave: Fintech, Inclusión financiera, Crowdfunding, crédito digital y pagos digitales.

Clasificación JEL: G2, G4, G20(General), G21, G23, O3, O16

Abstract

This study analyses the potential of fintech as an alternative for financial inclusion in Colombia on the basis of social perception and online search interest in digital financial services. It is postulated that these internet searches reflect an active exploration of alternatives to traditional financial channels, serving as a useful indicator of demand and the potential for adopting digital services. Methodologically, a quantitative explanatory-correlational approach is employed, specifying and estimating nine panel data models for 32 departments and Bogotá (2022--2023). The estimation was performed via the feasible generalized least squares (FGLS) technique, which allowed us to address the heteroscedasticity present in the data.

The principal findings demonstrate a statistically significant relationship between user interest in the fintech ecosystem and financial inclusion, measured across its dimensions of access, usage, and coverage. The search for terms such as fintech, P2P, crowdfunding, and digital credit positively impacts access to credit products (total credit, microcredit, and credit cards) and the use of electronic deposits and savings accounts. However, negative effects were identified from the search for Digital Wallet and Digital Payments on microcredit and from Crowdfunding on electronic deposits. In terms of coverage, interest in fintech, crowdfunding, P2P, and digital payments drives the expansion of mobile and digital correspondents, whereas digital payments have a negative relationship with physical correspondents. Across all the models, GDP per capita is consistently positively associated with greater access, usage, and coverage of financial services. Fintech technologies significantly increase financial inclusion in Colombia. However, their capacity is primarily conditioned by the level of digital inclusion and the socioeconomic conditions of individuals and regions. The study validates that users' digital interest is a key driver in the financial sector's behavior towards greater inclusión

*Keywords***:** Fintech, Financial inclusion, Crowdfunding, Digital credit, Digital payments.
JEL: G2, G4, G20(General), G21, G23, O3,O16

1 Introduction

Digital modernization in banking is a fundamental factor in terms of competitiveness and progress. Currently, the financial sector is undergoing a transformation to respond to changes in behavior, needs, and the ways in which clients and users acquire products and services. This process involves the adoption of technologies, knowledge management, and innovation in products, services, and customer service channels that are increasingly tailored to client needs.

In this context, it is essential to discuss fintech—companies that use technology to improve or create financial processes and services and employ new business models based on these technologies to offer innovative financial services to individuals, businesses, and governments through mobile payment systems, peer-to-peer lending, crowdfunding schemes, etc. (Ocampo & Santa Catarina, 2017). These companies have generated significant ideas that make a range of ventures available to people, aimed at improving living conditions and addressing needs related to access to financial services—something that traditional banking has not been able to achieve. This becomes even more relevant given the barriers that limit access to financial services through traditional banking. The chief among these are informality, followed by the high costs associated with acquiring and/or using financial products, as well as geographic limitations.

Given this, it is interesting to observe the dynamics of financial tools—Fintech—in the Latin American and Caribbean regions. In this regard, it is worth highlighting figures presented by Finnovista et al. (2024), which show a significant expansion of startups with companies distributed across various Latin American countries. The number of platforms that make up the fintech ecosystem in Latin America and the Caribbean (LAC) has grown by 340% since 2017, reaching a record 3,069 platforms by the end of 2023. In terms of country distribution by number of platforms, Brazil leads the region with a 24% share, followed by Mexico with 20%, and Colombia in third place with a significant 13% share. In other words, these three countries account for 57% of all fintech companies in the region.

This reflects the consolidation and growth of the fintech sector and highlights its major contribution to the digital transformation of the financial sector, offering impactful new

technological developments across different segments, including payments and remittances, with 632 companies representing 21%; lending, with a 19% share; business finance management, with 13%; financial institution technology, with 12%; and wealth management, with an 8% share. In light of this, there is potential for the emergence of new financial models such as collaboration between the financial industry and new entrants. This is vital for the implementation of an open finance ecosystem, as well as collaboration between public and private entities and stakeholders. In fact, 90% of banking associations see open finance as an opportunity to personalize products and stimulate competition, emphasizing the role of fintech in offering innovative solutions (Herrera et al., 2023).

Within this context, this research focuses on the study of financial services—Fintech—as an alternative for financial inclusion in Colombia. From a methodological standpoint, this is a quantitative study with an explanatory-correlational scope. Initially, the study examines fintech behavior from the demand side, specifically the search trends of major fintech categories during the 2022–2023 period, including digital payment solutions, digital credit, investments, and collaborative financing.

Additionally, data are collected on financial inclusion indicators, such as the percentage of the population with access to credit, savings accounts, and the use of digital payments, among other indicators, covering all 32 departments of Colombia and the capital district of Bogotá.

Finally, nine models were estimated via the statistical technique of feasible generalized least squares (FGLS) to determine the relationships between user interest in major digital financial services, the actual behavior of the sector, and financial inclusion, considering the dimensions of access, usage, and coverage. The study concludes that financial technology has played a key role in advancing financial inclusion, facilitating access for individuals and businesses traditionally excluded from the financial system, and contributing to greater economic participation and a reduction in financial inequality (UN, 2023).

The present study is structured as follows: Section two presents a literature review focused on fintech's role in financial inclusion, detailing its evolution as a research field and its potential to

overcome traditional financial access barriers. In Section three, the methodological strategy is described in detail, including the variables and their sources, the sample size, and the research hypotheses. This section concludes with the outline of the panel data model's structure, its assumptions, and the control for departmental GDP per capita. Section four presents the research results and their discussion in light of the literature and findings, concluding with a mention of the study's general limitations. Finally, Section five presents the overall conclusions derived from the research.

2 Literature review

From a theoretical perspective, Carballo and Dalle Nogare (2019) refer to how financial technologies (Fintech)—morphologically, a contraction of the words “Finance” and “Technology”—represent a form of technological innovation that brings both opportunities and challenges to the supply, demand, and regulation of financial services. Fintech presents end users with direct products and services through online and mobile channels. Likewise, the term is used to refer to the technological tools and systems that support financial services in pursuit of greater efficiency, convenience, and affordability.

Building on this and considering the study presented by Carballo (2020), fintech tools play an important role in how people access a type of technological service that guarantees a digital communication channel with fast, secure response times and, above all, high standards of quality. In this context, Philippon and Philippon (2019), as cited by Cardona, 2020), state that financial services aim to get closer to their clients and interact with them in new ways through the use of mobile phones, computers, and applications that enable greater connectivity and real-time tracking of operations.

In line with this, authors such as Andrés (2017) affirm that:

> "Fintech solutions can offer alternatives with a novel approach, adapted to the new economy characterized by new digital models, likely with the capacity to reach populations that face difficulties accessing financial services through traditional means, with a fully adapted and dedicated usability proposal." (p. 7).

Fintech has emerged as a key alternative for financial inclusion, especially for excluded populations, by leveraging the gaps left by traditional banks and understanding digital natives (Atehortúa, 2019; Montalvo et al., 2025). Its ability to integrate more people into the formal financial system stimulates economic activity, savings, and access to credit, thereby improving well-being and contributing to national growth and stability. Financial inclusion is defined as the access to and responsible use of a wide range of formal financial services (Burjorjee & Scola, 2015, as cited by Carballo, 2020), which enables individuals to make better financial decisions and improve their quality of life (Rivera & Bernal, 2018, as cited by León et al., 2022). This process is a global priority for economic growth (Iqbal & Sami, 2017), driven by financial technology, which supports balanced and sustainable development aligned with the SDGs (Arner et al., 2018).

The flexibility of fintech, its consumer-centric approach, and the offering of 100% online products democratize access to financial services regardless of location or socioeconomic status, enhancing inclusion (Barón & Forero, 2022). The growing demand for diverse financial solutions, including the exploration of fintech, suggests that studying these technologies can meet broad needs. However, the effectiveness of fintech in promoting financial inclusion depends on factors such as the availability of online services, regional technological development, and willingness to adopt (Zhang, 2023, as cited by Moreno & Meriño, 2024), where perceived usefulness and ease of use are crucial (Davis, 1989, as cited by Del Sarto & Ozili, 2025). Barriers still persist, such as geographic limitations (limited infrastructure in rural areas), socioeconomic constraints, and a lack of opportunity (Beck et al., 2007, as cited by Rodríguez & Rodríguez, 2016; Andrade et al., 2025; Iqbal & Sami, 2017), which restrict access to traditional financial services.

The scientific study of fintech as a research field began in approximately 2010, after which this type of financial technology gained momentum and relevance following the global financial crisis of 2008. Although this research process has evolved significantly over time, it can be explained in three main stages.

In its initial phase, the academic literature documented the emerging phenomenon of mobile money as a precursor to fintech in the context of financial inclusion. At this stage, the contributions of Jack and Suri (2011) stand out, as they were among the first to use econometric methods to study

the impact of M-Pesa in Kenya, observing effects on financial resilience, savings, and poverty reduction. Exploratory studies have focused on terms such as crowdfunding, P2P, blockchain, and other financial services.

In the second stage, between approximately 2015 and 2020, the number of scientific publications increased. The first systematic literature reviews on the topic were conducted (Schueffel, 2017; Ozili, 2018), and studies using econometric methods to quantify impacts and analyse risks began to appear. Notably, Jack and Suri (2016) and Demirgüç-Kunt et al. (2018) explicitly incorporated metrics on the use of digital payments and mobile money. Additionally, the topic of regulatory technology was explored as a means to improve and facilitate compliance in the financial sector (Arner et al., 2015).

The third stage began in 2020 with the onset of the COVID-19 pandemic. This period marked the consolidation and deepening of scientific research in the fintech field. It is characterized by the study of a wide range of technologies, such as blockchain, artificial intelligence, and big data, as well as their functional applications in areas such as RegTech, Robo-advisors, SupTech, and InsurTech. Likewise, emphasis is placed on systemic implications related to banking competition, financial stability, and cybersecurity, among others. In this context, highlighting the continuous and significant contributions of various pioneering authors in the evolution of fintech as a key player in financial inclusion is relevant. The important research output from institutions such as the Inter-American Development Bank and the International Monetary Fund is also noteworthy.

3 Methods

From a methodological standpoint, this is a quantitative research study with an explanatory and correlational scope. The following section presents the methodological strategy in detail, including variables, data, techniques, and instruments. The sample used in this study consists of 33 territorial units, comprising the 32 departments of Colombia and the Capital District of Bogotá. Following the methodological strategy proposed by Cardona-Arenas et al. (2020), a panel data model was specified to evaluate the behavior of these units across two time periods: 2022 and 2023. This results in a total of 66 observations, allowing for both cross-sectional and temporal analyses.

In response to the indicator that accounts for each of the variables selected to measure financial inclusion, a database was constructed using information from Banca de las Oportunidades and the Financial Superintendence of Colombia (Financial Inclusion Report, 2022) for the 2022–2023 period. This allowed for the definition of nine response or dependent variables: total credit, electronic deposits, savings accounts, microcredit, credit cards, physical banking agents, digital and mobile banking agents, bank branches per 10,000 adults, and POS terminals per 10,000 adults.

For the explanatory variables, various financial technologies were included: fintech, crowdfunding, digital credit, digital wallet, P2P, and digital payments. The selection of this group is based on their relevance as demand-side indicators, according to Google Trends search trends, which suggests their potential to explain the endogenous variables in each model. The following section presents the set of variables and indicators by category, corresponding to the dependent variables, as shown in the estimation results in ***Table 1***.

Table 1

Variable and indices for each category

Category	**Indicator**
Access	Adults with at least one financial product (%)
Credit	Adults with at least one financing product (%)
Deposits	Adults with at least one deposit financial product (%)
Usage	
Electronic deposits	Number of transactions by channel type (%)
Savings accounts	Adults with at least one active product (%)
Coverage	
	Number of physical correspondents per 10,000 adults
	Number of mobile and digital correspondents per 10,000 adults
	Number of branches per 10,000 adults
	Number of POS terminals per 10,000 adults

Source: Own elaboration based on data from the Financial Inclusion Report 2022–2023.

3.1 Research hypotheses:

According to the purpose of the research, the following hypotheses were formulated:

H1: There is a significant relationship between the social perception of digital financial technologies (Fintech) and their capacity to achieve financial inclusion.

H2: The capacity of Fintech to achieve financial inclusion is conditioned by the level of digital inclusion in the different regions of the country.

H3: The economic development of a department influences the adoption of Fintech solutions and the increase in the level of financial inclusion in Colombia.

H4: An increase in the demand for Fintech financial services in Colombia leads to an increase in indicators of access to and use of formal financial products in the country.

To evaluate the behavior of the units of analysis (32 departments and the capital district of Bogotá) during the years 2022 and 2023, a panel data model was specified. This empirical strategy, inspired by Cardona-Arenas et al. (2020) and grounded in the research problem and hypotheses, enabled an analysis using pooled coefficients. The panel data structure is ideal for analysing cross-sectional observations—such as territorial units—across different points in time.

$$Y_{it} = B_0 + B_1 x_{1it} + B_2 x_{2it} + B_3 x_{3it} + \cdots + B_k x_{kit} + \varepsilon_{it},$$

where Yit represents the dependent variable for unit i at time t, xkit represents the independent variables (regressors) for unit i at time t, B0 represents the common intercept, Bk represents the estimated coefficients and εit, represents the random error term. Importantly, (i) represents the unit of analysis corresponding to each department, for a total of N=32 departments plus the capital district “Bogotá D.C.” (i.e., i=1,…,33). These are cross-sectional sample observations for each variable and for the temporal unit t (2022--2023). The model, expressed in closed notation, corresponds to the following expression:

$$\mathrm{Y_{it}} = \mathrm{B_0} + \sum_{\mathrm{j=1}}^{\mathrm{k}} \mathrm{B_j\, x_{jit}} + \mathrm{\varepsilon_{it}} \quad (5)$$

$B1$, $B2$, $B3$, $B4 \ldots Bk$ are the parameters to be estimated to identify the relationship and magnitude of the effect of the vector of independent variables X:[Crowfundig1,Digital credit2,Peer_to_peer3 , Digital Payments4, Fintech5] on the dependent variable Yit. This study considers the outcome dimensions as the categories of access to the financial system, usage of financial products, and financial coverage. Therefore, the vector of dependent variables is composed of$Y$:[Usage1 ,Coverage,Products3]

As a recursivity assumption, the model adheres to the following estimation assumption: the error term ε_{it} is assumed to have a mean of zero $E\left[\varepsilon_{it} \mid x_{1\mathrm{it},\ldots,} x_{1\mathrm{it}}\right] = 0$, a constant variance $Var[\varepsilon_{it}] = \sigma^2$, and no autocorrelation across time periods or cross-sectional units (departments) $Cov\left[\varepsilon_{it,}\varepsilon_{js,}\right] = 0 \; \forall \; i \neq j \; y \; \forall \; t \neq s$. In other words, for the purposes of this study, this implies that unobserved factors in the model that influence the dependent variable are not correlated across different time periods or across departments (i). Finally, it is important to mention that the model is estimated while controlling for departmental GDP per capita. While this is also a variable of interest, it additionally captures an approximate effect of unobserved elements that are related to the explained variable but not with the set of core explanatory variables.

4 Results and Discussions

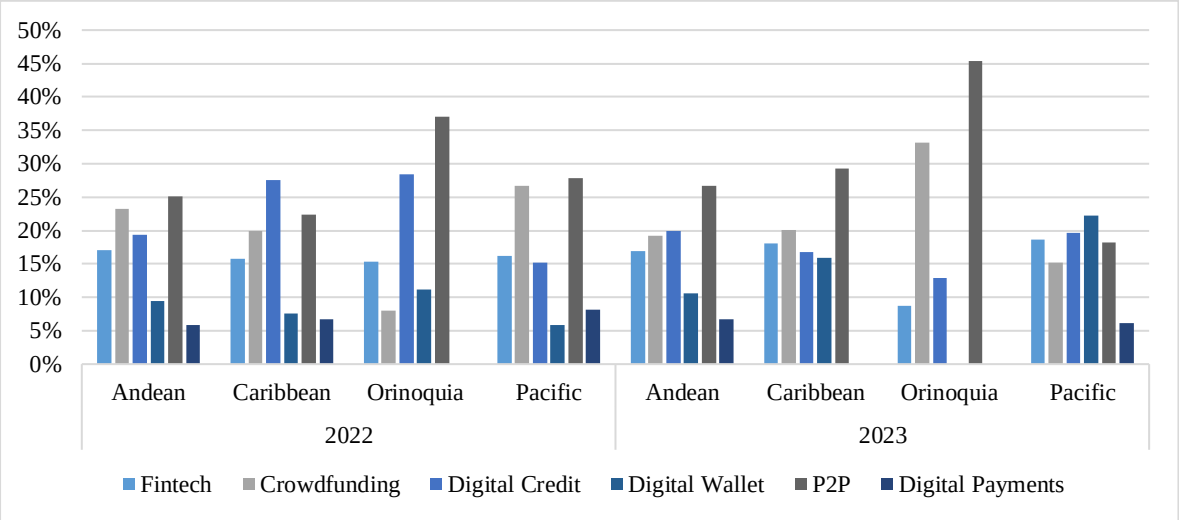
The following section presents the behavior of fintech based on demand, specifically from the search trends of the main fintech categories during the 2022–2023 period. The services analysed are fintech, crowdfunding, digital credit, digital wallet, P2P, and digital payments. These terms were selected because of the availability of information and because they best capture the demand side effect of this type of financial technology.

Initially, the general behavior of financial services during this time period is analysed. The information is subsequently classified by region to conduct a descriptive analysis of the behavior of these services, and finally, the dynamics across the different departments of the country are examined. In this context, Figure 1 presents a regional comparison. Notably, the Amazon region is not included in the graph, as it reports very limited information—data are only available for one

department in 2023 and in just one category. For this reason, it was decided to exclude it from this particular analysis.

Figure 1

Regional comparison 2022 vs. 2023



Source: Own elaboration based on data from the Financial Inclusion Report 2022–2023.

Compared with that in the previous year, interest in digital financial services in general increased by 2.04% in 2023. In particular, the term fintech maintained an upwards trend, reflecting sustained interest in financial technologies. As noted by Rentería et al. (2021), the widespread adoption of the internet and technological innovations are key factors that have driven the global development of fintech, including in Colombia.

Continuing with the regional analysis, the Andean Region consistently showed the highest interest in fintech service searches during both periods, recording the highest search frequencies for all services. This could be attributed to its level of economic development and technological infrastructure, especially in Cundinamarca and Bogotá D.C. Regarding specific services, Digital Wallets and P2P experienced considerable growth in 2023, with increases of 50.8% and 8.63%, respectively, highlighting the growing adoption of these technologies in financial services.

On the other hand, Crowdfunding showed a negative variation of approximately 8% in 2023 compared with 2022. Nevertheless, it maintained one of the highest search frequencies in both

periods, especially in the Andean Region. This suggests continued interest in collective financing alternatives, whose success, according to Giraldo et al. (2024), is attributed to the reduction of intermediaries and fees through online platforms. Digital credit stood out for its high search levels in both periods, although it registered a decrease of 11.7% (from 1,239 searches in 2022 to 1,094 in 2023). Despite this variation, the service appears to be well established in the country. In this context, Jiménez (2022) highlights that the financing options offered by fintech, particularly digital credit, facilitate access to efficient financial services, help alleviate poverty and offer a safer alternative to more expensive or illegal options.

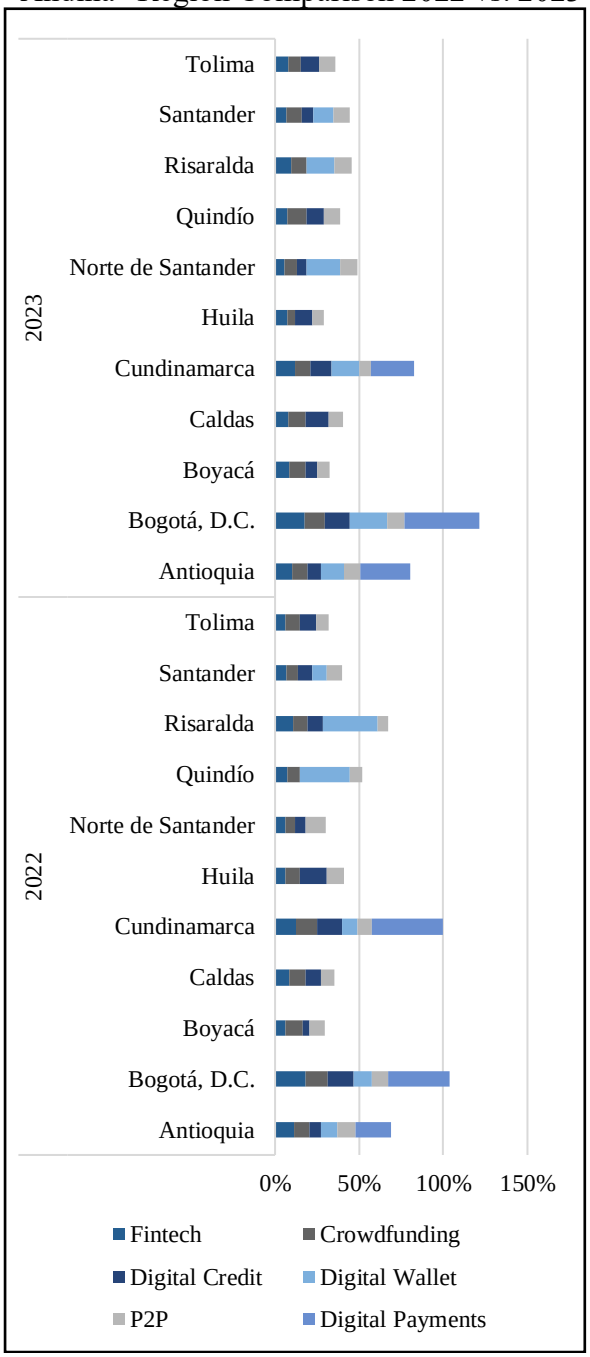
With respect to digital credit, high search levels were observed in both periods, although it experienced a decline of 11.7%, dropping from 1,239 searches in 2022 to 1,094 in 2023. Despite this trend, the service appears to be consolidated in the country. In his research on new financing modalities to combat poverty in Colombia, Jiménez (2022) argues that the financing options offered by fintech facilitate access to efficient financial services. He also stated that this type of service contributes to poverty alleviation and that adequate financing improves quality of life, offering an opportunity that frees many from more expensive, illegal, and dangerous alternatives. Similarly, Giraldo et al. (2024) conclude that the increase in digital credit reflects progress in financial inclusion, given its accessibility through digital channels. Credit approvals are carried out automatically via clients' digital data, allowing users to apply for, pay, and collect loans from any location.

Finally, digital payments were one of the terms with the lowest search percentages, especially in the Caribbean and Orinoquia regions. However, it is worth noting that this service increased in the Andean Region and stabilized in the Pacific Region.

In this context, given the adoption of these types of services, it is relevant to cite Sánchez (2022), whose research compiles information on sources of financing that combat poverty in Colombia. Sánchez states that fintech is having a growing impact on the economy, standing out for serving segments neglected by the traditional financial system and reaching more remote areas owing to technology. Their services are highly diverse, agile, and fast—often more so than those of traditional banks. After this general analysis, a detailed examination of each region of the

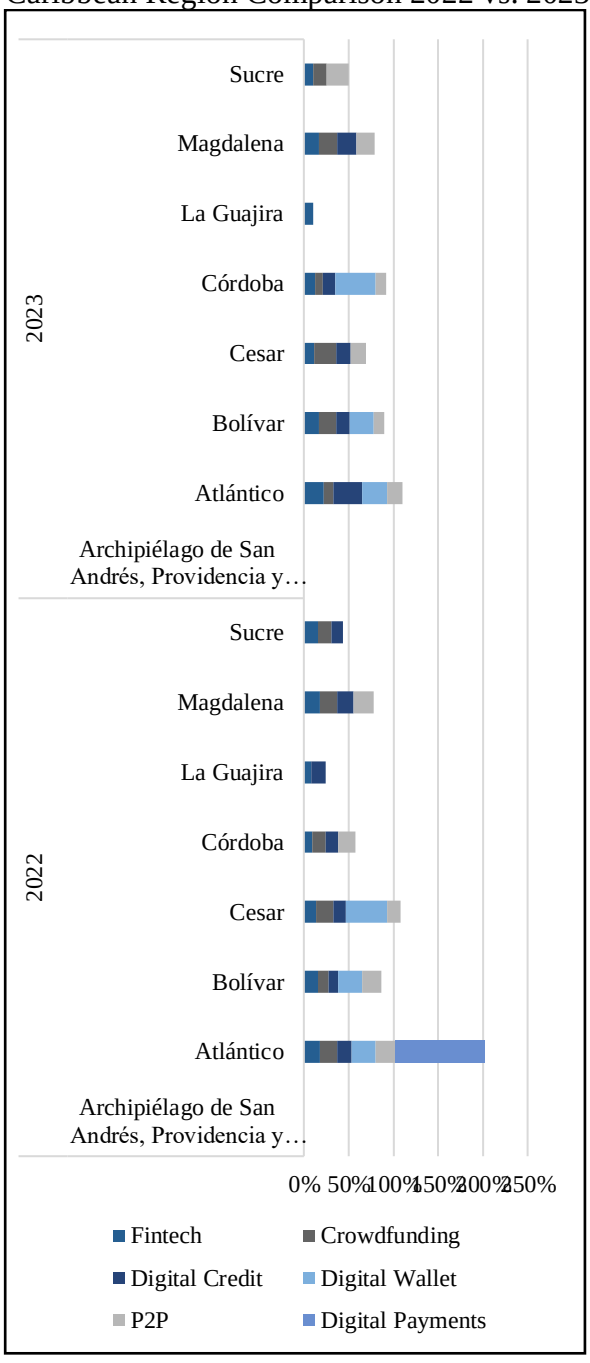
country and its dynamics regarding digital financial services enabled by fintech technologies follows.

Figure 2.
"Andina" Region Comparison 2022 vs. 2023



Source: *Own elaboration on the basis of data from the Financial Inclusion Report 2022–2023*

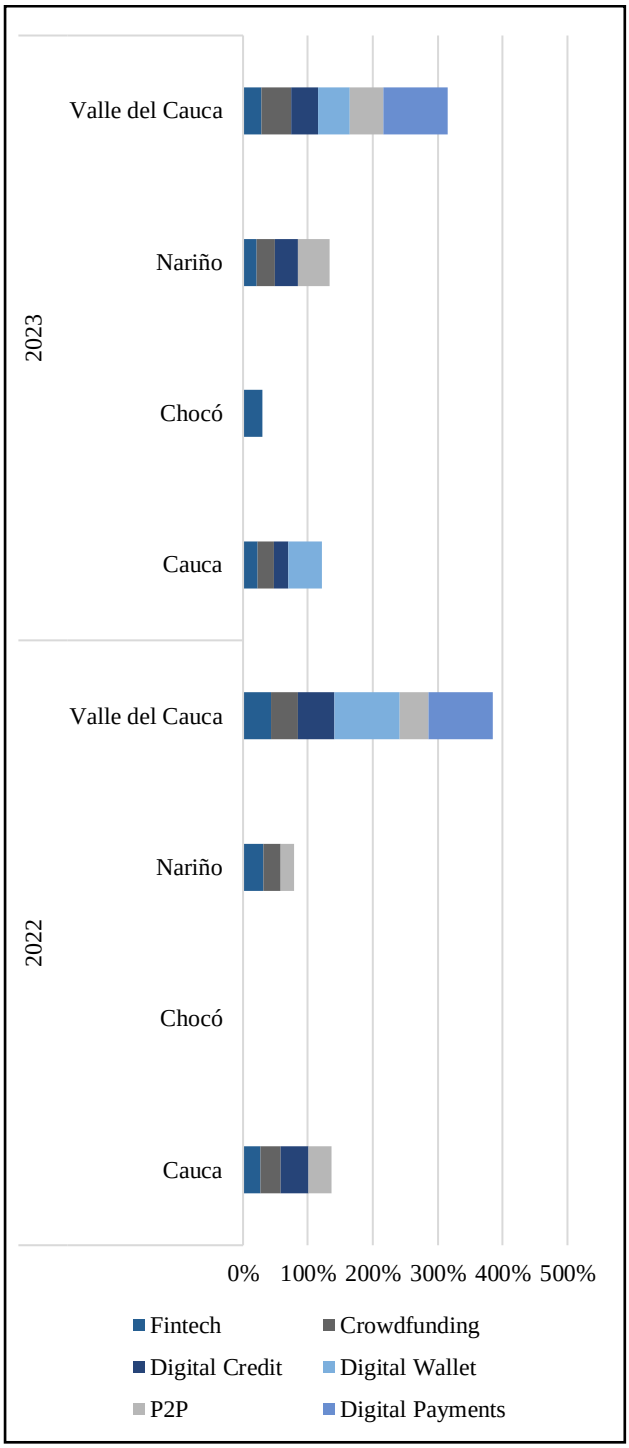
Figure 3.
Caribbean Region Comparison 2022 vs. 2023



Source: *Own elaboration on the basis of data from the Financial Inclusion Report 2022–2023*

Figure 4

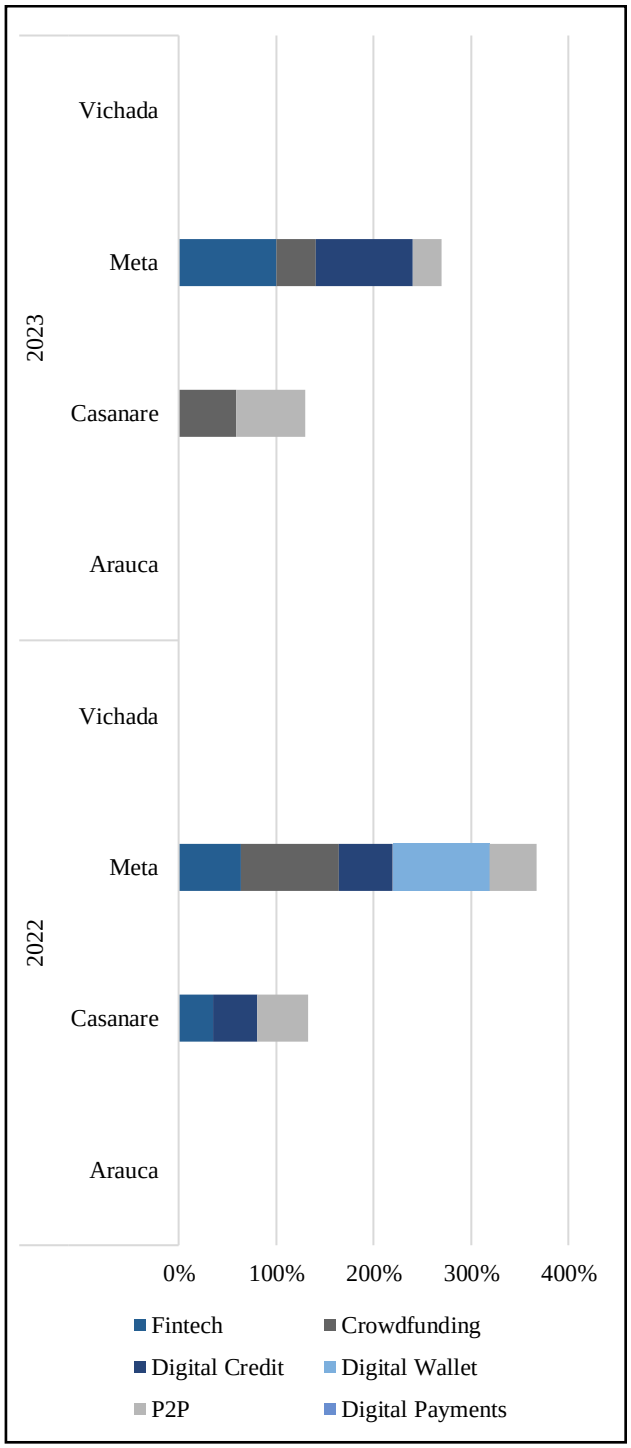
Pacific Region Comparison 2022 vs. 2023



Source: Own elaboration on the basis of data from the Financial Inclusion Report 2022–2023

Figure 5

"Orinoquía" Region Comparison 2022 vs. 2023



Source: Own elaboration based on data from the Financial Inclusion Report 2022–2023.

Table 2

Fintech Services Comparison 2022-2023

Year	Region	Fintech	Crowdfunding	Digital Credit	Digital Wallet	P2P	Digital Payments
2022	Andina	17%	23%	19%	10%	25%	6%
	Caribe	16%	20%	28%	8%	22%	7%
	Orinoquía	15%	8%	28%	11%	37%	0%
	Pacífico	16%	27%	15%	6%	28%	8%
2023	Andina	17%	19%	20%	11%	27%	7%
	Caribe	18%	20%	17%	16%	29%	0%
	Orinoquía	9%	33%	13%	0%	45%	0%
	Pacífico	19%	15%	20%	22%	18%	6%

Source: Own elaboration based on data from the Financial Inclusion Report 2022–2023.

4.1 Region "Andina" Analysis

The Andean Region stands out as the area with the highest interest in the search for and adoption of fintech and its ecosystem of financial services in Colombia. In 2023, this region showed a slight upwards trend in search interest, with a 2.33% increase compared with that in 2022—a pattern similar to that observed at the national level.

A crucial aspect in this region is the concentration of fintech companies. According to Colombia Fintech (2023), Bogotá D.C. is home to 69.3% of the fintech companies established in the country, consolidating its position as the main economic and technological hub. Similarly, the department of Antioquia accounts for 19.3% of these companies, meaning that 88.6% of all fintech firms in the country are located in just two departments within the Andean Region. This is attributed to the high level of economic and productive activity, advanced technological infrastructure, and access to funding sources in these areas.

An analysis of departmental participation within the region in 2022 revealed that Bogotá D.C. led the general interest in financial services with 14.8%, followed by Cundinamarca (13.4%), Risaralda (10.3%), Antioquia (10.2%), Huila (8.64%), Quindío and Santander (7.6% each), and

Caldas (7.5%). The departments with the lowest interest in fintech technologies during this period were Tolima (6.8%), Norte de Santander (6.6%), and Boyacá (6.5%).

In 2023, the leadership trend continued, with Bogotá D.C. increasing its share to 16.3%. It was followed by Cundinamarca (11.5%), Antioquia (11.2%), Caldas and Norte de Santander (8.3% each), Quindío and Santander (8.1% each), Risaralda (7.9%), and Tolima (7.4%). The departments with the lowest participation this year were Boyacá (6.6%) and Huila (6%). Finally, during the study period, the frequency of searches for specific services in the Andean Region did not significantly change in terms of overall ranking. The most frequently searched service was P2P, followed by digital credit and crowdfunding. The term "Fintech" remained relatively stable, with a similar level of search interest, whereas digital wallets and digital payments were the least searched terms.

4.2 Caribbean region análisis

The Caribbean Region ranks as the second most interesting region in the country in terms of financial technology services. However, in 2023, the region exhibited a negative trend, with a 5.7% decrease in search interest compared with that in 2022.

Despite this overall declining trend, some departments showed distinct dynamics. The department of Atlántico had the highest participation in both periods, although a 4% decrease was recorded in 2023. It was followed by Bolívar (17.1%), Córdoba (16.8%), and Magdalena (16.5%) in the same year. Notably, despite the regional trend, departments such as Córdoba, Sucre, and Bolívar experienced growth in interest in fintech services, with increases of over 4%, 3.1%, and 2.5%, respectively, compared with the previous year. In contrast, La Guajira showed the lowest degree of participation (1.8%), with a 3.8% decrease in search interest for fintech services compared with that in 2022. Moreover, the Archipelago of San Andrés showed no change, maintaining a 0% search frequency for the analysed services in both periods.

An analysis of specific financial services in the Caribbean Region for 2023 reveals that digital credit generated the highest search interest, followed by P2P, crowdfunding, fintech, digital

wallets, and digital payments. While digital credit and digital payments showed growth in search frequency during 2023, crowdfunding services remained stable, representing a total share of 20% in both periods. On the other hand, the terms fintech, digital wallets, and P2P experienced a decline in search interest, with negative variations ranging between -7% and -8% compared with the figures reported in 2022.

4.3 Pacific region analysis

The Pacific Region ranks third in terms of interest in financial technology searches, with a 4% increase in 2023 compared with 2022. Within this region, the department of Valle del Cauca stands out for its participation in both periods, although it experienced a 6% decrease in 2023 compared with the previous year, dropping from a general search interest of 53% to 47%. In contrast, the departments of Cauca and Nariño showed uniform participation of 24% in 2023. Notably, Nariño increased by 5%, whereas Cauca decreased by 5%, decreasing from 29% to 24%.

The department with the lowest degree of participation in fintech services in the region is Chocó. However, in 2023, Chocó showed a 5% interest, reversing the previous year's trend, during which no interest was recorded for any of the analysed services, as illustrated in Figure 5. Continuing with the analysis of digital services in this region, in 2023, digital wallets led in search of interest with a 22% share, followed by digital credit (20%), fintech (19%), P2P (18%), crowdfunding (15%), and, finally, digital payments with the lowest share (6%). When comparing the evolution of financial technology services (Table 2), it is evident that fintech, digital credit, and digital wallets showed positive trends, reflected in increased search interest and acceptance. In contrast, crowdfunding, P2P, and digital payments experienced a decline in the Pacific Region.

4.4 Orinoquía region análisis

The Orinoquía Region is the area of the country that shows the greatest decline in interest in fintech ecosystem services, with a negative variation of 19% in searches for these services in 2023 compared with 2022.

A more detailed analysis revealed that within this region, the department of Casanare had the highest participation in the subject of study, with 52% in 2023, followed by the department of

Meta, with 48%. Importantly, Casanare experienced a significant 14% increase in search interest during this year, whereas Meta saw a 15% decrease compared with that in 2022. The search interest in Casanare was focused mainly on P2P and crowdfunding services. In contrast, the department of Meta showed a more diverse interest, with notable attention to fintech, crowdfunding, digital credit, and P2P services.

On the other hand, ***Figure 5*** (referencing the figure showing participation) shows that the departments of Arauca and Vichada did not exhibit any participation in either of the analysed periods.

Finally, when comparing services by search frequency in 2023, P2P was the most common search service, with 45%, followed by crowdfunding, with 33%. These services showed positive trends in search interest; P2P accounted for an 8% increase, and crowdfunding accounted for a significant 25% increase compared with that in 2022. Third, digital credit accounted for 13% of searches in 2023, followed by fintech, with 9%. Additionally, there was low interest in services such as digital wallets and digital payments, both of which reported 0% search frequency for this period.

4.5 Modelling the Link between Digital Financial Interest and Financial Inclusion via Feasible Generalized Least Squares (FGLS)

Nine models were estimated via the feasible generalized least squares (FGLS) technique, with the aim of determining the relationship between user interest in digital financial services, the actual behavior of the sector, and financial inclusion—considered from the dimensions of access, usage, and coverage. Importantly, in the estimation of each model, the per capita GDP of each department was included as a control variable, thereby accounting for geographic heterogeneity. In other words, the level of development of each region and its influence on the relationships among the different variables of interest were taken into consideration. This approach was intended to produce more accurate estimates and minimize bias due to omitted variables.

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Table 3

Pooled regression model by feasible generalized least squares (FGLS)

Model	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Dependent variable	Log_total_ credit	log_ Electronic deposits	log_ Savings account	log_ Microcredit	log_ Credit card	log_ Physical banking correspondents	log_ Mobile and digital banking correspondents	log_ Bank offices per 1,000 people	log_ Card payment terminals per 1,000
Wald chi2	5790.82	197.80	2027.30	152.80	1948.50	82.14	109.23	202.08	93.18
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FINTECH	0,0025*** [0,0010]	0,0045*** [0,0014]	0,0017** [0,0008]	-0,0038 [0,0024]	0,0050*** [0,0014]	0,0013 [0,0027]	0,0158*** [0,0068]	-0,0014 [0,0015]	0,0069* [0,0040]
CROWFUNDING	0,0022*** [0,0006]	-0,0019** [0,0010]	-0,0001 [0,0007]	0,0014 [0,0013]	0,0014 [0,0011]	0,0009 [0,0016]	-0,0200*** [0,0052]	0,0036*** [0,0012]	-0,0029 [0,0030]
DIGITAL CREDIT	0,0003 [0,0005]	-0,0001 [0,0006]	-0,0001 [0,0003]	0,0028** [0,0014]	0,0010 [0,0009]	-0,0002 [0,0014]	-0,0007 [0,0036]	-0,0016 [0,0011]	-0,0034*** [0,0015]
Digital Wallet	0,0000 [0,0003]	-0,0004 [0,0006]	0,0000 [0,0002]	-0,0020*** [0,0008]	0,0006 [0,0004]	-0,0015 [0,0010]	-0,0010 [0,0033]	-0,0005 [0,0006]	0,0017 [0,0013]
P2P	0,0010*** [0,0004]	0,0032*** [0,0008]	0,0015*** [0,0004]	0,0010* [0,0006]	0,0026*** [0,0008]	-0,0002 [0,0013]	0,0138*** [0,0034]	0,0001 [0,0007]	0,0015 [0,0018]
DIGITAL PAYMENTS	0,0003 [0,0004]	-0,0011 [0,0009]	0,0002 [0,0003]	-0,0083*** [0,0011]	0,0010 [0,0008]	-0,0030** [0,0011]	-0,0059** [0,0031]	-0,0016*** [0,0007]	0,0071*** [0,0022]
Log_GDP_ PC	0,4396*** [0,0300]	0,2866*** [0,0414]	0,2769*** [0,0216]	0,1773*** [0,0383]	0,5365*** [0,0326]	0,4447*** [0,0580]	0,5391*** [0,1779]	0,4930*** [0,0510]	0,5660*** [0,1101]
_cons	-4.180.027 [0,5000]	-0,9269 [0,6634]	-0,4489 [0,3508]	-0,9955 [0,6117]	-6.567.218 [0,5220]	-2.447.279 [0,9371]	-8.905.706 [2.788.503]	-7.636.825 [0,8069]	-4.327.603 [1.760.077]

Source: Own elaboration on the basis of data from the Financial Inclusion Report 2022–2023.

Note: The significance level corresponds to *** p < 0.01, ** p < 0.05, and * p < 0.1. The regression equations estimated via feasible generalized least squares (FGLS) were corrected for heteroscedasticity, with no autocorrelation. The estimation uses the force command in Stata to

adjust for unequally spaced observations and normalized standard errors under the nmk command in Stata; the coefficients in braces correspond to robust standard errors.

On the basis of the above, a detailed analysis of the models is presented below, highlighting the behavior of the dependent variables in relation to the search frequency of various fintech services. Notably, only those variables with a statistically significant relationship, represented by $P \leq 10\%$, were analysed. Consequently, variables with a P value greater than 10% were not considered significant and, therefore, were not analysed in this study.

4.6 Pooled Coefficient Analysis from FGLS Panel Model Estimations

Model 1: total credit

The term fintech has a positive effect. An increase in search frequency is associated with a 0.0026 percentage point increase in the total credit variable, indicating a statistically significant relationship. In this context, Colombia Fintech (2024) stated that these financial technology companies have a competitive advantage by offering innovative solutions that overcome the limitations of the traditional system, enabling a greater number of people to access credit—especially in vulnerable areas—and thus contributing to the country's economic and social development.

For crowdfunding, there is a statistically significant relationship between the search frequency of this term and the total credit variable. Each unit increase in the search for "crowdfunding" is associated with a 0.0022% increase in total credit, indicating that interest in collective financing platforms positively influences the increase in the model's dependent variable.

In the case of P2P, with a coefficient of 0.0010 and a p value of 0.0010, a one-unit increase in the search for this term is associated with a 0.0010% increase in the total credit variable.

Finally, the relationship between per capita GDP and total credit is positive and highly significant. Variations in per capita GDP, which measure the level of economic development, substantially influence total credit. Technically, a one-unit increase in per capita GDP is associated with an increase of 436.606 units in the total credit variable. This suggests that greater economic growth leads to a greater intention to access some form of financing. In this context, Beck (2020)

noted that lower-income population segments are often considered unbankable due to small and infrequent transactions, as well as a lack of formal documentation.

Model 2: Electronic deposits

This model analyses electronic deposits as the dependent variable, measured from the usage dimension and representing the number of Colombians who use this method for payments, transfers, deposits, and/or remittances. A statistically significant relationship is identified between digital financial services and per capita GDP. The results are detailed below:

An increase of one unit in the search frequency for the term fintech translates into a 0.0045% increase in electronic deposits. This positive relationship is explained by the fact that fintech companies, operating at lower costs than traditional banking structures do, can offer more attractive rates, thereby encouraging customers to transact their money through them (Atehortúa, 2019).

In contrast, a one-unit increase in the search for financial service crowdfunding is associated with a -0.0019% reduction in the use of electronic deposits. Although this collective financing practice has grown in Colombia, users' reluctance to share financial information online (Camargo, 2018) could be an obstacle explaining this negative effect.

P2P (peer-to-peer) service has a positive effect on electronic deposits, with a coefficient of 0.0032. This implies that a one-unit increase in the search frequency for this service is associated with a 0.0032% increase in the use of electronic deposits, highlighting its role in the dynamics of these deposits, as P2P loans are typically disbursed and collected online. Finally, per capita GDP has a positive and statistically significant effect on electronic deposits, with a coefficient of 0.2865 (p value = 0). This suggests that as departments exhibit higher per capita GDP, individuals tend to have greater disposable income, which translates into a higher proportion of electronic deposit usage.

Model 3: Savings accounts

With respect to fintech, an increase in the search volume for the term is associated with a 0.0017 percentage point increase in the use of savings accounts. This suggests that fintech services facilitate access to formal savings options by simplifying account opening processes through mobile applications, as noted by Vega (2025).

For P2P lending, an increase in the search for this financial service correlates with a 0.0016% increase in the use of savings accounts. This finding indicates that P2P services significantly facilitate money transfers between individuals, with a portion of these funds being moved through savings accounts.

Finally, from a statistical standpoint, the relationship between per capita GDP and the use of savings accounts is highly significant. This indicates that greater economic growth is associated with increased use of such financial products, as economic growth typically implies higher wages, more employment, or better investment returns. These factors, in turn, increase individuals' capacity to save, making savings accounts a viable option for managing financial surpluses.

Model 4: Microcredit

This model focuses on microcredit as the dependent variable, which is analysed from the access dimension and defined as the percentage of Colombian adults with an active microcredit line during the study period.

Digital credit has a positive effect. A one-unit increase in searches for this service is associated with a 0.0028% increase in access to microcredit. This suggests that digital credit facilitates access to this type of low-amount financing, helping to combat the informality of "gota a gota" (loan shark) lending and promoting greater financial inclusion (Atehortúa, 2019). This type of fintech financing is particularly suitable for small businesses and clients with limited access to traditional banking, who often resort to more expensive informal lenders (Claessens et al., 2018).

In contrast, digital wallets show a statistically significant but negative relationship. A one-unit increase in searches for this term is associated with a 0.0019% decrease in access to microcredit. This may suggest that individuals who use or are interested in digital wallets have less need to apply for microcredit, possibly because they access other financial alternatives through these platforms.

The relationship between searches for P2P services and access to microcredit is positive. As the search intensity for this term increases by one unit, access to microcredit increases by 0.0010%. This may be because both financing models target segments with limited income verification, which are often rejected by traditional banks.

Digital payments have a negative effect. A one-unit increase in the search frequency for this service is associated with a 0.0083% decrease in access to microcredit. This suggests that digital payment platforms often offer financial alternatives that may compensate for the need for traditional microcredit.

Finally, per capita GDP has a positive coefficient and a statistically significant relationship. This implies that as per capita GDP increases, so does the demand for microcredit. An improved economic capacity translates into greater repayment ability and access to more economic opportunities, whether to start or expand small-scale businesses.

Model 5: Credit card

The results show a positive and statistically significant relationship between fintech services and access to credit cards. A one-unit increase in searches for this term is associated with a 0.0050% increase in access to this financial product. This is because fintech companies finance a considerable volume of approved credit cards in the market because of the adoption of new risk assessment methods. These innovations allow them to reach a broader customer base by offering products to individuals who would often not be approved by traditional banks owing to the lack of a conventional credit history (Vega, 2025).

For P2P lending, a one-unit increase in the search frequency for this term is associated with a 0.0026% increase in access to credit cards. This suggests that individuals interested in digital P2P financial services also seek or diversify their portfolios across different entities or platforms, including credit cards.

Finally, per capita GDP shows a highly significant relationship with access to credit cards, with a coefficient of 0.5365 and a p value of 0.000. These results indicate that economic development, as measured by per capita GDP, has a substantial effect on access to credit cards. As economic development increases, so does access to financial services—and in this particular case, to credit cards.

Model 6: Physical banking correspondents

The search frequency for term digital payments has a negative effect. An increase in searches for this term is associated with a 0.0029 percentage point reduction in the number of banking correspondents per 10,000 adults. This is attributed mainly to the fact that digital payments do not require the intermediation of physical banking agents.

Per capita GDP has a positive and significant effect on the number of physical banking correspondents per 10,000 adults, with a coefficient of 0.4446 percentage points. This reflects a direct relationship with economic growth, as per capita GDP is a key driver of economic dynamism and development.

Model 7: Mobile and digital banking correspondents

An increase in the search frequency for the term fintech is associated with a significant increase of 0.0157 percentage points in the dependent variable. This positive relationship is explained by how fintech companies facilitate the inclusion of individuals in the financial sector, which is inherently linked to the functional structure of mobile and digital correspondents. For crowdfunding, a one-unit increase in the search frequency for this financial mechanism is associated with a 0.0199 percentage point increase in the number of mobile and digital correspondents per 10,000 adults.

P2P service has a positive and statistically significant relationship. An increase in the search for the term P2P translates into a 0.0137% increase in mobile and digital correspondents per 10,000 adults. This is particularly relevant considering the use of these correspondents as channels for the collection and withdrawal of funds from P2P loans.

With respect to digital payments, a one-unit increase in the search frequency for this term is associated with a 0.0058 percentage point increase in mobile and digital correspondents per 10,000 adults. As with the previously analysed variable, this relationship occurs because correspondents represent an important alternative for conducting digital transactions.

Finally, per capita GDP shows a highly significant and positive relationship with mobile and digital correspondents per 10,000 adults, with a coefficient of 0.539 percentage points. This suggests that economic growth drives the volume of financial transactions, which in turn leads to greater use of these services and an expansion of coverage.

Model 8: Bank offices per 1,000 people

The search frequency for the term crowdfunding has a positive and statistically significant relationship. A one-unit increase in searches for this term is associated with a 0.0035% increase in the number of branches. This suggests that greater interest in this alternative financing method correlates with a broader expansion of the physical branch network.

For digital payments, a one-unit increase in search frequency is associated with a 0.0016% increase in the number of branches per 10,000 adults. This positive and significant result implies that the perceived relevance of digital payments for higher-volume transactions may drive the need for physical branch infrastructure.

Finally, per capita GDP shows a positive and statistically significant relationship with the number of branches per 10,000 adults, with a coefficient of 0.4929 and a p value of 0.0000. This suggests that higher per capita GDP—indicative of economic growth and higher income levels—

leads to greater access to financial services. In turn, this drives demand for more branch infrastructure, as more people have the capacity to save, invest, and access financing.

Model 9: Card payment terminals per 1,000

An increase of one unit in the search frequency for the term fintech is associated with a 0.0068 percentage point increase in the number of POS terminals per 10,000 adults. This result reveals a positive relationship, indicating that technological tools such as POS terminals enable faster and more secure execution of various monetary transactions within the fintech ecosystem.

In contrast, a one-unit increase in the search frequency for the term Digital Credit is associated with a 0.0033 percentage point decrease in the number of POS terminals per 10,000 adults. These results show a negative and statistically significant relationship between the two variables, which is consistent with the fact that digital credit transactions do not require the use of POS terminals. With respect to digital payments, a one-unit increase in the search frequency for this term is associated with a 0.0071% increase in the number of POS terminals per 10,000 adults. This suggests that as the use or adoption of digital payments grows, businesses are more likely to install additional POS terminals to meet the demand for these payment alternatives.

Finally, per capita GDP has a positive and statistically significant effect (coefficient of 0.5660, $p = 0.0000$) on the number of POS terminals per 10,000 adults. Importantly, a higher per capita GDP may indicate greater purchasing power, which translates into a significant volume of commercial transactions—thus justifying a greater need for payment terminals such as POS devices.

5 Conclusions

This study aimed to analyse the role of fintech as an alternative for financial inclusion in Colombia by examining social perception through the interest expressed in online searches for various digital financial services. Our findings confirm that technology is a fundamental pillar in the development of alternative mechanisms that address the economic and financial needs of a broad population. By leveraging increasing technological penetration, fintech offers unprecedented

opportunities to overcome traditional barriers to access and use financial services, thereby enhancing inclusion. This research also highlights the consolidation of fintech in Colombia as a viable option for generating financial opportunities and digitizing the sector, with improvements in security and speed that strengthen user trust.

Our results demonstrate that social perception—reflected in online search interest in fintech services—is positively and significantly correlated with the industry's ability to foster financial inclusion. Online search activity emerges as a relevant indicator of public demand and interest in alternative financial solutions, which drives the adoption of these technologies. The digital nature of fintech minimizes costs and time, eliminates geographic barriers, and facilitates access to services from anywhere with an internet connection. Consequently, financial inclusion directly benefits from this accessibility.

The study also shows that financial inclusion is strongly linked to opportunity factors, particularly geographic and socioeconomic conditions. Therefore, it is crucial to understand the dynamics of each region, including economic development, productive activities, income levels, and informality, as these factors directly influence the adoption and impact of fintech services. In line with this, the estimated econometric models consistently revealed significant effects of digital financial services and economic development on the dimensions of access, usage, and coverage of financial inclusion. With respect to access to credit products (total credit, microcredit, and credit cards), greater interest in fintech, crowdfunding, and P2P searches is positively associated with increases in both total credit and access to credit cards. Likewise, searches for digital credit and P2P drive access to microcredit, facilitating inclusion for traditionally underserved segments. However, interest in digital whales and digital payments is negatively associated with access to microcredit, suggesting that these alternatives may meet liquidity or fund management needs, reducing reliance on traditional credit.

In terms of financial product usage (electronic deposits and savings accounts), greater interest in fintech and P2P is positively correlated with increased use of electronic deposits and savings accounts. In contrast, interest in crowdfunding showed a negative relationship with electronic deposits, which may indicate persistent trust barriers in this channel.

With respect to financial service coverage (physical, mobile, and digital correspondents, branches, and POS terminals), searches for fintech, crowdfunding, P2P, and digital payments are positively associated with the expansion of mobile and digital correspondents, indicating how these technologies facilitate inclusion through alternative and digital channels. Notably, interest in digital payments is also positively associated with the number of branches, suggesting that the relevance of digital payments may, surprisingly, drive physical infrastructure. However, greater interest in digital payments is negatively associated with physical correspondents, as digitalization reduces the need for in-person intermediaries. Additionally, increased searches for fintech and digital payments are positively correlated with the number of POS terminals, reflecting how these technologies enhance operability and the adoption of electronic payment methods in commerce. In contrast, searches for digital credit showed a negative relationship with POS terminals, which is consistent with the fact that such transactions do not require them.

A key and cross-cutting finding is the prominent role of per capita GDP. This variable consistently shows a positive and statistically significant relationship across all the models analysed (total credit, electronic deposits, savings accounts, microcredit, credit cards, physical and mobile/digital correspondents, branches, and POS terminals). This finding indicates that greater economic development is associated with a widespread increase in access to and use of financial services by enhancing individuals' capacity to save, invest, and obtain financing and by driving the expansion of financial infrastructure.

From an academic perspective, this research empirically validates the relationship between user preferences—measured through online searches for fintech services—and the actual behavior of the financial sector in Colombia, as reflected in key financial inclusion indicators. A positive relationship is demonstrated between the social perception of digital financial technologies and their capacity to achieve inclusion. Additionally, the findings reveal that the ability of fintech to generate financial inclusion is conditioned by the level of digital inclusion and economic development in each department, where greater demand for fintech services drives increases in access and usage indicators for formal financial products.

For future actions, it is essential to establish synergies among financial institutions, governments, the public and private sectors, and academia. This will help identify opportunities to promote access to and use financial products and services and to increase coverage nationwide. It is crucial to implement financial inclusion strategies that leverage fintech technologies, adapting to the economic, social, and productive characteristics of each region. Finally, actively promoting digital and financial literacy so that the population can improve their skills and fully benefit from the fintech ecosystem is recommended.

As a continuation of this study, the following question is proposed for future research: ¿What impact do fintech companies have on the development of the rural economy in Colombia?

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