Analysing the Role of Financial Inclusion in Regional Development: An Approach Based on PLS-SEM and Multigroup Analysis (MGA)

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Abstract

This study analyzes the impact of financial inclusion on regional development using Partial Least Squares Structural Equation Modeling (PLS-SEM) and Multigroup Analysis (MGA). The empirical analysis is based on municipal-level data derived from the 2020 Economic Census and administrative records from the National Banking and Securities Commission (CNBV) in Mexico. The results reveal a positive and significant relationship between financial inclusion and regional development, indicating that territories with greater access to financial services tend to exhibit more dynamic economic and social outcomes. However, important heterogeneities emerge between urban and rural contexts, where the relationship is notably stronger in urban areas. These findings highlight the importance of strengthening financial infrastructure in underserved regions to foster the expansion of banking services, promote savings, consumption, and investment, and reduce spatial inequalities. Overall, the study contributes to the understanding of how financial inclusion can support more balanced territorial development.

Keywords: financial inclusion, regional development, structural equations, multigroup analysis

JEL Classification: G21, O16, R11

1. Introduction

Financial inclusion has emerged as an essential pillar to drive both economic and social progress, especially in developing economies (Villareal, 2017). In the context of Mexico, the diversity and disparity among municipalities represent a significant challenge for the implementation of public policies that promote balanced regional growth. In academia and science, there is a clear consensus in recognizing financial inclusion as a complex and multifaceted phenomenon that plays a crucial role in creating opportunities for growth and improvement in the quality of life for diverse individuals and communities. When people have access to adequate financial services, such as bank accounts, credit, insurance and other financial instruments, they have the ability to make investments in key areas such as education, health, housing and entrepreneurship (National Council for the Evaluation of Social Development Policy – CONEVAL by its Spanish acronym, 2019). This capacity not only boosts local economic activity, generating employment and encouraging innovation, but also contributes to reducing poverty and social inequality.

While it is true that there is currently a growing interest on the part of international organizations to address these issues, there is still a need to develop research that deepens the understanding of financial inclusion and its connection with regional development, particularly in specific contexts such as the case of Mexican municipalities (National Council for Financial Inclusion - CONAIF by its Spanish acronym, 2020).

Given the intrinsic complexity of the subject, this study proposes two main objectives. First, it seeks to evaluate the impact of financial inclusion on the regional development of Mexican municipalities using the Partial Least Squares Structural Equations (PLS-SEM) analysis technique. Second, it focuses on identifying whether there are statistically significant differences in this impact between urban and rural localities, using the multigroup analysis (MGA) technique within the PLS-SEM framework. The combination of both approaches aims to contribute to the debate on the impacts of financial inclusion on regional development in Mexico, through the presentation of empirical evidence. This integration seeks to establish meeting points between academics and relevant actors in society, in order to strengthen the collective understanding of the issue and foster the generation of innovative solutions.

2. Literature Review

2.1 Rationale and Empirical Evidence on Financial Inclusion and Its Relation to Regional Development

Financial inclusion has been defined from the approaches proposed by the scientific community, international organizations and public policy makers, which in turn complement each other to postulate a multidimensional conceptualization. Internationally, financial inclusion has been part of the work agendas of the main organizations and institutions that make up the networks that address sustainable development issues, such as the World Bank (2024), which states that financial inclusion is considered a fundamental element for reducing extreme poverty and promoting shared prosperity. This is achieved by increasing the access of individuals and companies to useful and affordable financial products and services, including transactions, payments, credits and insurance, which are provided in a responsible and sustainable manner.

Similarly, financial inclusion has been identified as a mechanism to generate positive impacts on the levels of well-being of the population. The ECLAC (CEPAL, 2018) defines it as a public good that favors the possibilities of saving, consumption and investment for individuals and companies, contributing to the development of economic activity and therefore to the development of localities. For its part, the United Nations (ONU, 2020) reinforces the conceptualization of including not only the population but also the business sector, particularly small and medium-sized enterprises. It emphasizes that financial inclusion comprises public and private initiatives to provide access to financial services to households and small and medium-sized enterprises that have traditionally been excluded from the formal financial sector while seeking to improve and perfect the use of the financial system for those actors that are already part of the formal circuit.

The International Monetary Fund (IMF) states that financial inclusion requires a balance between public policy and private sector initiatives. The role of government is paramount in providing a favorable regulatory framework, fostering competition and growth, and having strong and independent supervisory institutions. IMF studies indicate that greater equality can strengthen and prolong economic growth. Inclusive growth in turn improves life opportunities for families and communities, and access to financial services positively influences this dynamic (Lagarde, 2019). These approaches not only integrate the possibility of access, but also involve entities' participation in the regulation and improvement of the financial system in order to generate the conditions for growth and development within the regions.

In the case of Mexico, the conceptual framework of financial inclusion is expanded by incorporating 4 components to its definition: access, use, consumer protection and financial education (CONAIF, 2020). Through the National Banking and Securities Commission (CNBV, 2020) it is recognized that financial inclusion begins with the access and availability of infrastructure that allows the population to interact with financial institutions. At the same time, conditions must be guaranteed so that there is an adequate use, that is, a frequent and adequate use of financial products and services, reflecting the needs and behaviors of the demand. This process must be accompanied by consumer protection and defense to ensure that financial services operate under a regulatory framework that ensures transparency, fair treatment and protection of personal data. In turn, promoting financial education contributes to improving the financial capabilities of the population. It is intended to prepare them with the necessary skills and knowledge to manage their personal finances, evaluate financial products and services, and make informed decisions.

Following the international recognition of the financial inclusion problem, academia participated in the development of research that contributed to the diagnosis of the levels of exclusion in the countries and, at the same time, made it possible to analyze different approaches and perspectives on the effects of financial inclusion on different economic and social agents. In this sense, knowledge is enriched and common ground is found in the opinion of various authors such as Asongu and Nting, (2020); Hegerty (2016); Beck et al., (2011); Claessens (2006) and Amel et al. (2004); who define financial inclusion as the access to and use of formal financial products and services. They identify access as the availability of supply in a specific geographic area, including the physical availability of financial products and services such as branches, ATMs and banking correspondents. Regarding usage, they mention that this is related to the consumption of financial products and services that are contracted by individuals within the formal financial system.

Similarly, Cruz et al. (2017) agree that usage is measured both by the holding of a financial product or service - users with debit cards, credit cards and deposit accounts - and by the frequency of use in relation to the number of transactions carried out through the different access channels. Sarma (2008) also uses the number of deposit accounts per capita, the demographic penetration of bank branches, and the relation between the size of deposits, credit and the countries' GDP as indicators for measuring access and use. Such factors are considered decisive for the need to ensure a variety of financial services available at reasonable prices (Oliveira de Moraes and Cruz, 2023 and Adegbite

and Machethe, 2020), including both the benefits and the associated costs, which translate into interest rates and commissions (Claessens, 2006).

At the same time, in the literature review there are studies that approach financial inclusion from different perspectives based on the effects it has on other economic and social topics. Accordingly, measurements have been made to evaluate the correlation between financial inclusion and poverty, social inclusion, as well as the role of microcredit, microfinance and the performance of the banking microeconomy in the access to greater opportunities for vulnerable groups (Latin American Federation of Banks - FELABAN, 2019). Particularly relevant, however, the benefits of financial inclusion on regional development are identified as a boost to economic growth, a reduction of inequalities and a promotion of a more equitable and sustainable development among different regions (World Bank, 2018). Understanding these dynamics is essential to design strategies that promote inclusive regional development, benefiting both local communities and the economy as a whole.

As a comprehensive process, regional development seeks to promote the economic and social growth of geographic areas. It focuses on improving the living conditions of the population, so addressing social elements is essential to demonstrate the need to combine economic and social progress in order to eradicate poverty, a phenomenon that impacts an increasing number of individuals and households (Abardá and Morales, 2008). Development is recognized as a process of transition towards a state of socio-economic well-being that provides equitable and homogeneous opportunities to the population of a given territory (Sen, 1999). Several authors define it with a multidisciplinary and multidimensional nature (Becerra and Pino, 2005; Todaro, 1981; Léa, 2014), where wealth and well-being are inseparable, the latter being understood as the enabling environment for people, both individually and collectively, to develop their full potential and have a reasonable likelihood to lead productive and creative lives in accordance with their needs and interests (United Nations Development Program - UNDP, 2003), which implies access to education, income, employment, health and a clean and safe physical environment.

It is a recurrent theme in development theory studies to understand the reasons for the differences between regions and the degree to which they impact on the heterogeneities in the quality of life of the population. In this context, two approaches to the discussion of regional development are introduced. First, development is approached from the perspective of economic geography, in which space is a necessary variable to be incorporated. Secondly, regional inequalities are explored from the perspective of how development occurs according to the relations in the different territories that share an administrative entity (federal). This analysis focuses on identifying the factors that determine inequalities and how disparities are explained by the level of economic activity in the different territories (Cuervo and Morales, 2009).

Myrdal (1959) and Hirschman (1961) agree in their studies by identifying the main reasons why development tends to concentrate in a limited set of urbanized regions. The authors define driving and restraining factors as starting points for the geographic diffusion of development. In addition, they claim that market forces lead to the intensification of regional inequalities given that, in agglomeration economies, growth favors the more developed economies to the detriment of the more backward ones. In this analytical context, space is not considered simply as a variable or a complementary element, but as an essential component of economic behavior (Asuad, 2018).

Additionally, Storper's (1997) Local Development Theory argues that regional economies thrive by leveraging relational assets, such as social and economic networks, that foster innovation and economic activity. He further emphasizes the critical role of learning, technological advancement, and strong local institutions in regional development. From this perspective, financial institutions influence investment in local projects through the supply of and access to financial products and services targeted at consumers and small businesses. This is accompanied by the implementation of technologies and financial education programs, resulting in better use of credit and savings for job creation, which, in turn, benefit and improve the living conditions of the community.

Within this framework of understanding, there is a need to address the contribution made by the specialized literature based on empirical studies that have analyzed financial inclusion and its impact on regional development. In this regard, Leyshon and Thrift (1995) show the significant geographic dimension of financial exclusion, especially affecting rural and less developed areas, and argue that financial exclusion is not only a problem of lack of access to banking services, but also amplifies existing economic and social inequalities. Their main findings show that the poorest and rural areas are the most affected by financial exclusion due to the closure of bank branches and the lack of financial infrastructure. This situation contributes to the marginalization of already disadvantaged groups, limiting their ability to participate fully in the modern economy. At the same time, they suggest that government policies and financial regulation should be adapted to address these inequalities, promoting greater financial inclusion and more even economic development.

In the same vein, Beck et al. (2007) investigated the relation between financial development and income inequality in 72 countries over the period from 1960 to 2005, where they found that countries with more developed financial systems tend to have a more equitable income distribution. Approximately 40% of the impact of financial development on the income growth of the poorest quintile is attributed to the reduction in income inequality, while the remaining 60% is attributed to the effect of financial development on aggregate economic growth. Similarly, it has been shown that as financial services become more accessible, low-income people have more opportunities to invest in education and start businesses, which has a direct impact on their well-being.

The analysis of the use of financial services in rural and urban households, as well as the impact of sociodemographic variables on these patterns, has been another area of significant interest. Al-Hussainy et al. (2008) found in a seven-country study that urban residents are more likely to have an account at a formal financial institution and to borrow from such institutions. From a regional perspective, financial inclusion can also be analyzed in terms of its impact on economic growth, given that this is an integral component of regional development. Along these lines, it has been empirically identified that increased access to and use of financial services favors economic growth in developing countries (Banco Mundial, 2018). Indicators such as Gross Domestic Product (GDP) and poverty have been used as variables to measure this relation. Boukhatem (2016) developed research in 67 low- and middle-income countries during the period of 1986-2012 where it was found that increased financial development directly influences poverty reduction. This conclusion is supported by studies by Alvarez et al. (2021); Grados (2021), Beck, et al. (2004); Honohan (2004); who agree that financial inclusion contributes to the reduction of poverty levels and income inequality among individuals and households.

In the context of Mexico, the study by Góngora et al. (2023) links economic growth to financial inclusion using panel data methodology with fixed effects, incorporating the analysis of temporality and spatiality. Economic growth was measured using the Quarterly Index of State Economic Activity (ITAEE, for its Spanish acronym). On the other hand, the increase in available technological infrastructure was related to the access to financial inclusion. Thus, it is concluded that the improvement in financial inclusion is significantly related to the increase in technological access points, and therefore it is recommended to promote its expansion, given that it is a relevant factor in the increase of financial inclusion and economic growth.

Economic theories together with empirical studies provide a solid theoretical framework to understand how geographic distribution and financial inclusion are interrelated. Likewise, the multidimensional nature of the problem of financial inclusion at the international level shows as a common denominator the characteristics of universal access, availability of diversified and reliable financial services, adapted to the requirements and demands of vulnerable groups with the objective of promoting economic and social well-being not only at the individual level but also at the family, household, business and marginalized locality levels, with a framework of regulation and sustainability by financial and governmental entities. The relations found in the studies conducted show that improving access to financial products and services in various regions can play a crucial role in promoting a more balanced and sustainable economic development.

In the context of Mexico, the study of the dynamics of financial inclusion and regional development acquires special relevance due to the territorial diversity and significant regional inequalities present in the country. Mexico's vast geographic extension is home to regions with different levels of access to financial services, which directly impacts their economic and social development. Despite the challenges, there are considerable opportunities to strengthen financial systems and promote more equitable development.

Given the above arguments, this study is based on the postulate that financial inclusion has a positive and significant impact on regional development in Mexico. However, it is expected that there are significant differences in the impact observed between the country's urban and rural municipalities. In this framework, the established postulates seek to identify how financial inclusion can act as a driver for regional development, considering the particularities of each area and providing a basis for designing effective public policies that reduce inequalities and foster inclusive growth at a national level.

3. Methodology

The methodology used is a quantitative research study whose primary purpose is to validate the relation between financial inclusion and regional development in Mexico. It is worth mentioning that Mexico's 2465 municipalities are examined at the end of 2020, providing a broad and complete geographic coverage for the analysis. For a comprehensive understanding of the socioeconomic and financial landscape at the municipal level in Mexico, multiple sources of information are used. On the one hand, we use data from the 2020 Economic Census, which offers a detailed overview of socioeconomic and demographic variables. These data are fundamental for

understanding the specific socioeconomic context of each municipality. Additionally, data provided by the National Banking and Securities Commission (CNBV, for its Spanish acronym) on financial inclusion in Mexico during the same year are used to analyze access to financial services and the use of financial instruments at the municipal level, providing a complete perspective of financial inclusion in the country.

3.1 Theoretical Model and Variable Selection

Financial inclusion, defined as the access and use of financial services by the entire population, is a crucial component for economic and social development. Analyzing the effects of financial inclusion on regional development is complex due to the multitude of interrelated factors that must be considered. To address this complexity, the use of a Structural Equation Model is proposed. In its theoretical conceptualization, the model is organized into two major constructs, an exogenous one representing financial inclusion and an endogenous one related to regional development, both of which are represented by a total of 11 and 5 indicators respectively (see Table 1).

Table 1. Operationalization of Variables

Construct	Dimension	Indicator	Source
Financial Inclusion (FI)	Access	Total branches per 10000 adults	CNBV 2020
		Total correspondents per 10000 adults	
		Total ATMs per 10000 adults	
		Total point-of-sale terminals per 10000 adults	
		Total number of establishments with point-of-sale terminals per 10000 adults	
		Total number of contracts using mobile banking per 10 10000 adults	
	Use	Total traditional transactional accounts per 10000 adults	CNBV 2020
		Total debit cards per 10000 adults	
		Total credit cards per 10000 adults	
		Total transactions at point-of-sale terminals per 10000 adults	
		Total number of ATM transactions per 10000 adults	
Regional Development (RD)	Socioeconomic	% of population 25 years old and over with higher education (EDU)	Economic Census-Censo Económico 2020
		% of households with computers (HWC)	
		% of homes with landline telephone (HWLT)	
		% of homes with Internet access (HINT)	
		% of population above the poverty line (POV)	

To summarize the information on the exogenous variable, two synthetic indexes were constructed: one to measure the use of financial services and the other to measure access to these services. These indices were developed using the Principal Component Analysis (PCA) method, which reduces the dimensionality of the data, preserving as much of the variability as possible. Accordingly, and to ensure comparability of the indicators, the data were normalized using the following standardization formula:

$$\text{Zij} = \frac{x_{ij} - \mu_{ij}}{\sigma_j} \quad (1)$$

Where Z_{ij} is the normalized value of variable j for observation i, x_{ij} is the original value, μij is the mean of variable j and σj the standard deviation of variable j. Each index is constructed as a linear combination of the original variables weighted by the coefficients of the principal components selected from the following equation:

$$I_i = \sum_{j=1}^{k} \alpha_j Z_{ij} \quad (2)$$

Where Ii is the index for observation i, αj are the coefficients corresponding to the principal components, and Zij are the normalized variables.

Once the synthetic indices have been determined and based on a reflexive logic (see Figure 1), the aim is to empirically validate the identification and quantification of the direct effects of financial inclusion on regional development. At the same time, the aim is to corroborate, through a multigroup analysis, whether the relations between the defined constructs are equivalent or differ between the different localities in the country (urban and rural). In summary, and returning to what was discussed in the previous section, the theoretical model articulates two research hypotheses:

H1 = Financial inclusion, measured through the dimensions of access to and use of financial services, has a positive and significant impact on the regional development of Mexico's municipalities.

H2 = There are significant differences in the impact of financial inclusion on regional development between urban and rural municipalities in Mexico.

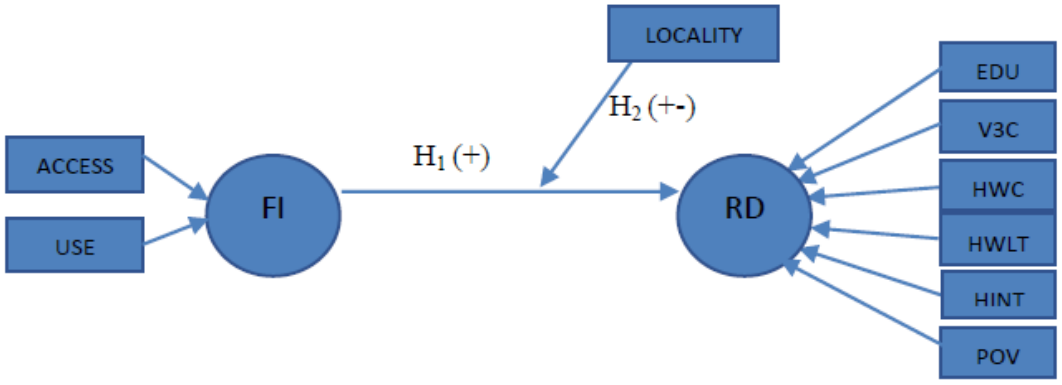

Figure 1. Theoretical Model

3.2 Data Analysis

The theoretical research model is tested with the Partial Least Squares Structural Equation Modeling (PLS-SEM) estimation technique and SMARTPLS software, version 3.2.9. According to Henseler (2016) this statistical technique allows maximizing the explained variance of the dependent (endogenous) variables in complex multivariate models and is also recommended for data that do not fit a normal probability distribution.

4. Results and Discussion

This section presents the results of the structural equation model based on partial least squares (SEM-PLS). The analysis was carried out in several stages. First, a Principal Component Analysis was performed to reduce the dimensionality of the data and generate synthetic indexes of financial access and use, representing the financial inclusion construct. Next, the reliability and validity of the measurement model was evaluated using various indicators. Then, the structural model was analyzed using bootstrapping to determine the significance of the relations between the constructs. Based on these results, a multigroup analysis was performed to compare the impact of financial inclusion in urban and rural localities, verifying the invariance of the constructs and analyzing the differences in the observed effects. Finally, the results are discussed in the context of the existing literature, exploring their implications for the design of public policies.

4.1 Obtaining Synthetic Indexes by Principal Component Analysis

To begin the data analysis, two essential tests were carried out to validate the adequacy of the Principal Component Analysis model. It started with Barlett's test of sphericity and continued with the evaluation of the Kaiser-Meyer-Olkin (KMO) measure. The results of these tests confirmed the adequacy of the model: Bartlett' test of sphericity showed a p-value of 0.000, which validates the relevance of the analysis, and the KMO value was 0.899, higher than the minimum threshold of 0.500, which supports the viability of the model for obtaining synthetic indexes (see Table 2).

With the model validated, the PCA was performed. In this phase, two main components were identified. The first component groups variables related to the holding and use of financial services, such as transactional accounts, debit and credit cards, and transactions at point-of-sale terminals and ATMs, explaining 58.34% of the variance. The second component, which explains an additional 8.755%, includes variables associated with the channels of access to financial services, such as physical branches, correspondents, ATMs and the use of mobile banking. Together, both components explain 67.095% of the total variance, which is considered adequate for the purposes of the study.

Table 2. Summary of PCA results

	Component	
	1	2
Branches	0.253	**0.591**
Correspondents	0.006	**0.671**
ATMs	0.208	**0.719**
Point-of-sale terminals	0.350	**0.765**
Establishment with point-of-sale terminals	0.466	**0.746**
Contracts using mobile banking	0.383	**0.686**
Traditional transactional accounts	**0.674**	0.273
Debit cards	**0.796**	0.305
Credit cards	**0.760**	0.402
Transactions at point-of-sale terminals	**0.812**	0.076
ATM transactions	**0.729**	0.443
% Variance	58.34 %	8.755
Kaiser - Meyer -Olkin measurement	0.899	
Barlett's sphericity (sig)	0.000	

After identifying the principal components, the index of financial access and use was calculated. For this purpose, the PCA coefficient matrix was used, which assigns weights to each original variable in the linear combinations that make up the principal components (see Table 3). The scores of the 2,465 municipalities in each component were obtained by multiplying the value of each original variable by its corresponding coefficient in the matrix. This process resulted in two indexes: the access index and the usage index, which form the exogenous variable of financial inclusion.

Table 3. Matrix of coefficients for the calculation of synthetic indexes

	Component	
	Use	Access
Branches	-0.121	0.315
Correspondents	-0.281	0.482
ATMs	-0.065	0.305
Point-of-sale terminals	-0.071	0.213
Establishment with point-of-sale terminals	-0.021	0.155
Contracts using mobile banking	-0.006	0.157
Traditional transactional accounts	0.118	-0.056
Debit cards	0.246	-0.116
Credit cards	0.146	-0.141
Transactions at point-of-sale terminals	0.416	-0.399
ATM transactions	0.399	-0.099

Note: Principal Component Extraction Method

4.2 Evaluation of the Measurement Model

The analysis of the measurement model was carried out in four stages: evaluation of the individual reliability of the indicators, construct reliability, convergent validity and discriminant validity. First, the reliability of the indicators was investigated by analyzing their factor loadings, which exceeded the recommended threshold of 0.7, as suggested in the literature (Hair et al., 2011). No factor loadings fell below the critical value of 0.4, which reinforces the internal consistency of the indicators (see Table 4).

Secondly, the reliability of the constructs was evaluated by means of Cronbach's alpha coefficient and the composite reliability (CR) index. Both values exceeded the thresholds (> 0.8) recommended in the literature (Nunnally & Bernstein, 1994), guaranteeing the internal consistency of the constructs. Thirdly, convergent validity was verified through the Analysis of Variance Average Extracted (AVE). The results showed that the AVE value was greater than 0.5 for all constructs, confirming the convergent validity of the model (Fornell & Larcker, 1981).

Table 4. Reliability and convergent validity

Construct/Indicator	Factor loadings	Cronbach *a*	CR	AVE
Financial Inclusion (FI)		0.925	0.964	0.930
Access	0.967			
Use	0.962			
Regional Development (RD)		0.878	0.911	0.674
EDU	0.767			
HWC	0.872			
HWLT	0.794			
HINT	0.862			
POV	0.803			

Finally, the discriminant validity of the model was evaluated. For this purpose, the Fornell and Larcker (1981) criterion was used, which establishes that the square root of the mean variance extracted from each construct should be greater than the correlation between the constructs. In addition, the HTMT (heterotrait-monotrait) matrix was corroborated to be below 0.900, as suggested by Henseler et al. (2015). Both tests confirmed the discriminant validity of the constructs represented in the model (see Table 5).

Table 5. Discriminant Validity

Construct	RD	FI
Fornell and Larcker's (1981)		
Regional Development	0.787	
Financial Inclusion	0.649	0.965
Heterotrait-monotrait ratio		
HTMT		
Regional Development		
Financial Inclusion	0.733	

4.3 Structural Model Analysis

With the measurement model validated, the structural model was estimated, following the approach proposed by Hair et al. (2011). The bootstrapping technique was used with 5,000 subsamples to evaluate the statistical significance of the path coefficients. This analysis allowed us to examine the relations between latent constructs using path coefficients (β), which provide information on the strength and direction of these relations. Additionally, R2 values were calculated to assess the proportion of variance explained in each construct, and f2 and Q2 values were calculated to measure the effect size and predictive relevance of the model, respectively.

The results, shown in Table 6, revealed an R2 value of 0.429, indicating that 42.9% of the variance of regional development is explained by financial inclusion. This value is considered moderate within the behavioral sciences (Rasoolimanesh et al., 2017). The effect size (f2 = 0.780) indicates that the independent variable has a strong impact on explaining the observed variance of the dependent variable, highlighting the theoretical importance of this relation. Furthermore, the value of Q2 suggests that the structural model has significant predictive ability, as it predicts 41.4% of the variance in the observed data, which exceeds the expectations of a simple benchmark model (Ali et al., 2018).

After obtaining evidence of the structural model fit criteria, the relations between the latent constructs are analyzed. For this purpose, the path coefficients (β) are used. The results, reflected in Table 6, confirm the first research hypothesis, which refers to the existence of a positive and statistically significant relation (0.662**) between financial inclusion and the regional development of municipalities in Mexico.

Table 6. Results of the structural model

	R2 =0.438	Q2=0.414	F2 =0.780		
Hypothesis	Effect	Path coefficients	t-statistic (bootstrap)	Confidence interval	Supported
FI - RD	+	0.662**	37.63	[0.613 -0.680]	Yes

4.4 Results of the Multigroup Analysis (MGA)

After obtaining evidence on the results of the structural model, a multigroup analysis (MGA) was conducted to examine the differences in the association between financial inclusion and regional development between urban (1297) and rural (1168) localities. It is assumed that urban and rural localities have significant differences in terms of

their socioeconomic, demographic and structural characteristics, which are likely to influence how financial inclusion affects the economic and social development of each municipality.

Before comparing the estimates between groups, invariance in the model constructs was checked, as suggested by (Henseler et al. 2016). To ensure that differences in the estimators were not the result of variations in the contents of the constructs, the Measurement Invariance Assessment (MICOM) procedure was used. This procedure allows confirmation of measurement invariance by assessing three types of invariances: configurational, compositional, equality of means, and composite variances (Henseler et al., 2016).

Regarding configurational invariance, it was found that the indicators that make up the financial inclusion and regional development constructs are identical in both groups, which ensures that the differences observed between localities reflect genuine disparities in these aspects, and not variations in the way in which each construct is measured. In relation to compositional invariance, the results in Table 7 indicate that the correlations between the financial inclusion and regional development constructs do not present statistically significant differences between the groups ($p > 0.05$). These findings, together with the results of the configural invariance, allow us to conclude the existence of partial measurement invariance. Finally, the assumption of independence between group means and variances was verified through the third step of the MICOM procedure. As shown in Table 8, the permutation-based confidence intervals include the original differences in the means and variances of the original model ($p > 0.05$), which allows us to state that there is complete measurement invariance.

Table 7. Compositional invariance analysis

	Original correlation	Correlation permutation mean	5%	Permutation p-value
FI	0.999	0.999	0.995	0.780
RD	0.999	0.998	0.994	0.686

Table 8. Equality of means and pooled variances

	Mean - original differences (rural-urban)	Mean – permutation mean difference (rural-urban)	[2.5%-97.5%]	Permutation p-values	Variance - original difference (rural-urban)	Variance-permutation mean difference (rurales-urbanas)	[2.5 -97.5%]	Permutation p-valores
FI	-0.134	-0.002	[-0.250 -0.247]	0.254	0.240	-0.020	[-0.655-0.580]	0.432
RD	-0.101	-0.007	[-0.278 -0.238]	0.456	0.325	-0.015	[-0.712-0.685]	0.284

After confirming measurement invariance, the results of the multigroup analysis (MGA) and hypothesis testing (H2) are analyzed. Two different approaches were used for this purpose: the MGA by bootstrapping and the permutation approach. Using both methods, the results of the MGA reveal a statistically significant difference (-0.138**) in the effect of financial inclusion on regional development between urban and rural localities (see Table 9).

Table 9. Hypothesis test results

		Path Coefficients		Confidence interval		p- value			
Hypothesis	Relations	Rural	Urban	Rural	Urban	Path Coefficient Differences	MGA	Permutations	Supported
H_2	IF - DR	0.531**	0.669**	[0.441-0.596]	[0.612-0.690]	-0.138	0.001**	0.000**	Yes

** $p < 0.05$

In urban areas, a much more robust and significant relation (0.669**) is observed between financial inclusion and regional development, suggesting that the availability and accessibility of financial services have a more direct impact on economic and social growth in urban environments. On the other hand, in rural areas, while there is still a positive relation between financial inclusion and regional development, this connection is less marked (0.531**). These differences could be attributed to disparities in infrastructure, access to resources and socioeconomic dynamics between urban and rural areas.

5. Discussion

The results of this research are in line with previous studies in the literature, most notably the work of Zulaica (2013) who examined the financial inclusion index at the municipal level in Mexico, revealing that 36% of municipalities show high financial inclusion, 35% medium inclusion and 29% low inclusion. This is complemented by the study of Salazar et al. (2017), who evaluated financial inclusion at the municipal level through the use of and access to financial services finding that both indicators have a high probability of improving social cohesion and, therefore, the life quality of Mexicans.

Similarly, disparities between rural and urban areas have been consistently supported by previous research, such as the study by Castellanos et al. (2009), which reveals a correlation between the extent of banking infrastructure in Mexico and population density, as well as with higher levels of income, education and formal economic activity. These findings are also in line with the work of Al-Hussainy et al. (2008), who concluded that urban residents have a greater propensity to hold accounts in formal financial institutions. Furthermore, Cardoso et al. (2023) reinforce these observations by presenting a multidimensional index of financial inclusion in Mexico, highlighting greater inclusion in the Northeast, Northwest, and central regions (including Mexico City), as well as in areas with more than 100,000 inhabitants. These data suggest a clear trend toward greater financial inclusion in urban areas and among employed individuals.

The disparity in access to the financial system observed at the regional and territorial level reflects a dynamic that can be compared to center-periphery models and development poles (Myrdal, 1959; Higgins and Savoie, 1988; Léa, 2014) in the context of development theories. This phenomenon is manifested in the existing gap between different regions, where increased development in one region leads to immediate disparities with others (Polèse, 1998). These disparities, together with the growing income gap between regions and a North-South dualism, are characteristic of the initial stages of development, while regional convergence and the mitigation of disparities are characteristic of more mature stages of national growth (Williamson, 1965).

Another factor contributing to these regional inequalities is urban concentration, which is considered to generate differences due to the economic and social benefits it offers, derived from the size, structure and relations between the economic elements and the population in the cities (Polèse, 1998). According to this author, the explanation for these disparities lies more in the local institutional and political conditions than in the choice of the economic system.

In the Mexican context, financial inclusion, particularly access to financial services, is mostly dominated by Commercial Banking (CB). According to data from the CNBV (2023), at the end of 2022 the number of branches in the country was 16,641, of which 71% corresponds to the CB with a greater presence in urban localities. Despite an 8% growth compared to 2021, municipal coverage reports discouraging figures with only 58%. At the same time, it is observed that as municipalities increase their level of social backwardness, the number of branches decreases. Only 30% of the municipalities in this category have a branch at the national level, where the BC participates with 13%.

This territorial distribution reflects a greater interest on the part of the CB in locating in areas with better socioeconomic conditions, leaving rural communities at a disadvantage in terms of physical infrastructure coverage that would allow them affordable access to formal financial services. This type of practice responds to bank branch location strategies, which are designed to maximize accessibility and generate competitive advantages in urban areas (Birkin et al., 2002), resulting in a reduced presence and accessibility in rural areas, leading to financial exclusion for remote communities. This situation is aggravated by the diversity of products offered by bank branches, as Garrocho (2010) points out, since the financial needs of rural communities may not be adequately met due to the lack of branches and the limited availability of financial services. The relations found as part of the proposed model contribute to deepening the socioeconomic gaps between urban and rural areas, aggravating exclusion for the most remote localities in the country.

6. Conclusions

The results of this research underline the importance of SEM modeling and multigroup analysis in the study of complex phenomena such as financial inclusion and regional development. The use of SEM-PLS allows for an

in-depth understanding of the relations between financial constructs and their impact on development, while multigroup analysis offers a differentiated perspective by comparing effects across different contexts, such as urban and rural areas. This methodological combination provides a clearer picture of how financial inclusion policies can be adjusted to address regional disparities and maximize their impact.

The findings highlight the challenges Mexico faces in making financial inclusion a driving force for the country's regional development. Although Mexico has been actively participating in public policy initiatives since 2011 in the creation of the National Financial Inclusion Council and subsequently with the approval of the National Policy, progress has not had the impact required to achieve the desired levels of well-being in the population. It is clear that improving financial infrastructure in rural areas is essential to reduce economic and geographic disparities. Public policies should focus on fostering financial inclusion through the expansion of banking services, the implementation of financial technologies and educational programs that strengthen the financial capabilities of the population. Collaboration between government and financial institutions is crucial to create an enabling regulatory environment that promotes equitable access to financial services.

At this point, it is essential to highlight the crucial role of the state as a leader in promoting financial inclusion. Therefore, public policy makers should carry out comprehensive studies that provide reliable information on the disparities in socioeconomic development in Mexico. This will allow the state, in collaboration with the financial system, to implement solutions that foster levels of financial inclusion, especially in less developed regions. Financial inclusion is not only a driver of economic growth, but also a fundamental tool for achieving balanced and sustainable regional development in Mexico.

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Authors' contributions

Dr. Duniesky Feitó Madrigal was responsible for data processing and analysis. Dr. Magdelis Moreno Ortega conducted the literature review. Dr. Malena Portal Boza was responsible for the discussion and conclusions. All authors contributed to the conceptualization of the study, critically revised the manuscript, and approved the final version for publication.

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