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Article

Exploring resilience: a Bayesian study of psychological and financial factors across gender

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Exploring resilience: a Bayesian study of psychological and financial factors across gender

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ABSTRACT

The study aims to demonstrate gender differences in financial health indicators, assessed through perceptions, lived experiences, and actions to deal with financial crises. The scale used is a composite instrument that includes the eight financial health indicators from BBVA and the Center for Financial Services Innovation (CFSI), together with a scale designed to measure lived experiences and actions to manage financial crises. The sample consisted of 951 participants, 394 (41.4%) men, 504 (53.0%) women, and 53 (5.6%) LGBTQ+. Bayesian analysis indicates that perceptions, lived experiences, and actions in managing economic crises do not differ significantly between genders. The study suggests no significant differences in financial resilience between men, women, and LGBTQ+ people. Actions to cope with economic crises also indicate that resilience does not vary significantly by gender. Despite the absence of gender differences in financial perceptions and experiences, it is inferred that participants possess an acceptable level of financial knowledge, which helps them manage unforeseen expenses and reduce dependence on loans. Financial education is a key factor in strengthening resilience and promoting financial inclusion, which is essential, especially in diverse socioeconomic contexts. The findings suggest that financial inclusion may improve household resilience, particularly in rural areas.

IMPACT STATEMENT

This study sought to explore gender differences in financial health indicators, assessed through perceptions, lived experiences, and actions to deal with financial crises. Though the study found no significant differences in financial resilience between men, women, and LGBTQ+ people, it can be inferred that participants possess an acceptable level of financial knowledge, which helps them manage unforeseen expenses and reduce dependence on loans. This underscores the importance of financial education, especially in regions with frequent economic challenges.

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1. Introduction

The concept of resilience has evolved to encompass various dimensions, including psychological, social or cultural, and financial resilience. Understanding the definition, origins, and scientific development of resilience allows for effectively addressing the challenges people face in different contexts. Educational institutions in Mexico have begun to recognize the importance of fostering psychological and financial resilience among their students. This approach responds to the growing need to prepare young people to face personal adversities and economic challenges that may arise throughout their lives.

By integrating programs that promote resilience into their curriculum, these institutions seek to equip students with skills to adapt and recover from difficult situations, creating a healthier and more productive learning environment. At the same time, institutions promote training courses for the interested population, homemakers, workers in general, officials, and executives. Thus, education becomes a

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fundamental pillar to develop these resilient capacities, contributing to individual and collective well-being and providing a better understanding of financial health indicators. Workshops and courses for financial education teach basic money management concepts and address the importance of long-term planning and informed decision-making. By developing a resilient mindset in the financial field, participants in these programs learn to face economic crises more effectively, which is especially relevant in a context where economic instability is a constant concern.

The commitment of educational institutions is also reflected in their collaboration with community and government organizations to develop initiatives that strengthen resilience at different levels. By joining forces, they seek to create an ecosystem that supports students' personal and professional development. This benefits individuals and contributes to the general well-being of communities, fostering a more resilient and sustainable future. Mexico's Ministry of Public Education (SEP, 2017) has promoted various initiatives reinforcing this approach. In addition, the SEP has worked with other organizations to implement resources such as 'Learn at Home', which include materials for developing emotional and financial skills.

Based on the above, the interest of Mexican educational institutions in fostering psychological and financial resilience is a crucial step toward training individuals capable of facing complex challenges. Through education and collaboration, the foundations are being laid for a stronger society where each person can prosper despite adversity. In this context, the review of the literature allows us to identify effective approaches and strategies, in addition to providing a theoretical framework that supports educational initiatives and facilitates the implementation of programs that make a difference in the lives of students and the entire population.

Concerning the arguments mentioned earlier, we refer to Holling's (1973, 1996) work, which describes resilience as an alternative way of thinking that leads to stability and provides a new perspective on reality. Similarly, Gunderson (2000) and Gunderson and Holling (2002) highlight that resilience applies to various contexts, including the socio-ecological, where dynamics help to understand the interactions between internal and external factors. Pioneering research by Rutter (1984) and Werner and Smith (1982) examined how children exposed to adversity achieve adaptive and successful development. Garmezy (1987) also studied both adults with schizophrenia and children vulnerable to psychopathology, as well as stress-resistant children (Garmezy et al., 1961).

Additionally, some studies have focused on identifying the characteristics and factors that promote resilience in individuals exposed to trauma and stress (Garmezy, 1987). Resilience plays an important role in vulnerability to adverse outcomes related to poverty (Garmezy, 1991a, 1991b). Research by Garmezy et al. (1984) has also emphasized the importance of adaptive systems and plasticity in fostering resilience. The works of Holling (1996) and Walker et al. (2004) refer to how resilience helps individuals manage and reorganize necessary changes in response to environmental disturbances. In summary, resilience is fundamental for understanding the impacts within the systems where people develop (Becken, 2013).

1.1. Psychological resilience

As previously mentioned, an individual's ability to handle adversities—ranging from emotional issues related to family to social and work-related challenges—is deeply connected to psychological resilience. This capacity allows the individual to make necessary adjustments in their life in response to adversities (Holling, 1996; Walker et al., 2004). These studies have been crucial in enhancing our understanding of resilience as a dynamic process involving the interaction between personal, family, social, and contextual factors. They have been essential for developing effective practices to promote resilience and designing interventions that strengthen individuals' ability to face and overcome challenges.

In education, significant research has explored factors that foster resilience in young people. A seminal study in this area is by Benard (1991), who provided evidence that youths facing severe risks can become confident and competent adults. Benard emphasizes the critical role of educational institutions in this developmental process. Additionally, research has shown that certain characteristics of the family, academic, and community environment can influence expected outcomes, allowing young people to demonstrate resilience despite associated risks. These studies suggest that specific features of family, school, and community settings can alter or reverse negative expected outcomes, enabling children to exhibit resilience in the face of risks (Benard, 1991).

Empirical studies on psychological and social resilience have been fundamental in understanding how some individuals can maintain healthy and adaptive functioning despite facing significant adversities. Despite the common belief that childhood neglect and abuse inevitably lead to disorders and vulnerabilities in adulthood (Levine, 2003), there is evidence that, despite childhood adversities, some individuals can become productive and stable adults (Benard, 1991; Richters & Martinez, 1993; Werner & Smith, 1992).

Based on the arguments previously presented, the question arises: How does an individual manage financial adversity, or how does an individual face a challenging financial situation, considering aspects of psychological resilience? This inquiry stems from the notion that individuals can confront various adversities, ranging from emotional and family issues to social and work-related situations, allowing them to reorganize their lives (Holling, 1996; Walker et al., 2004).

1.2. Financial resilience

As previously noted, resilience is the individual's ability to face adverse situations (Garmezy, 1991a, 1991b). This concept extends to various aspects of life, including personal finances, leading to the concept of financial resilience, which pertains to issues related to money management, such as savings, retirement planning, budgeting, and the use of credit and debit cards, among others. In financial adversities, financial resilience provides individuals with the tools to manage complex circumstances, such as unexpected and unforeseen expenses, which could lead to economic pressures. However, the strategies used to address these situations enable them to be prepared and avoid the need to seek loans (Kulshreshtha et al., 2023).

Financial resilience and psychological resilience are crucial for individuals' financial well-being (Kulshreshtha et al., 2023). At the same time, the use of digital financial services has increased (Yadav & Shaikh, 2023). The Financial Resilience Index has been developed in the United States to assess household economic capacity based on basic expenses and resources utilized (Yao & Zhang, 2023). Financial resilience contributes to financial well-being, hence the importance of financial inclusion. The literature provides evidence of this, as financial inclusion has become a global policy priority, given that almost one in four people remain financially excluded, especially in the developing world (Salignac et al., 2019).

This phenomenon is related to financial resilience, defined as an individual's ability to cope with financial adversities. Several studies highlight the fundamental role of financial literacy in this context. Chen et al. (2024) identified that the financial literacy of household heads mitigates financial fragility mediated by insurance awareness. Liu et al. (2024) also highlighted that financial literacy improves household resilience, facilitating recovery from financial shocks. Financial resilience is closely linked to individuals' well-being (Tahir et al., 2021), and financial education plays a key role in strengthening this resilience (Bialowolski et al., 2022). Both digital and financial literacy promote inclusion and financial resilience (Kass-Hanna et al., 2022; Lyons et al., 2021).

Not only households and institutions may be affected by this phenomenon. For example, Ahrens and Ferry (2020) analyzed the financial resilience of the UK government during the pandemic. Their findings suggest that the government's ability to mitigate the pandemic's effects and adapt its services was diminished. Similarly, McKnight and Rucci (2020) conducted a study across 22 countries to examine financial resilience variables and indicators. They classified countries using four indicators: financially insecure (with savings of less than three months of income), financially secure (with six months of income saved), over-indebted (with debts equal to or greater than three months of income), and severely indebted (with debts exceeding six months of income). In 15 of the 22 countries studied, they found that fewer than half of households had sufficient savings, and many were in debt. These findings reflect variations in financial resilience indicators, likely due to differences in financial institutions, social assistance, and cultural norms.

Additionally, other studies have highlighted the concern this phenomenon raises among policy-makers, underscoring the importance of addressing the issue (Bialowolski et al., 2022; Erdem & Rojahn, 2022; Klapper & Lusardi, 2020; Yadav & Shaikh, 2023). On another front, Nkundabanyanga et al. (2019) investigated financial institutions and observed that innovation and financial resilience significantly enhance the likelihood of survival. Similarly, Tahir et al. (2021) reported that effective financial planning helps improve the behavior of financial product consumers.

Financial well-being, a concept that has gained relevance following economic shocks, is considered an indicator of financial health and has been the subject of analysis by researchers and policymakers

(Kamble et al., 2024). This well-being is intrinsically linked to financial inclusion and digital literacy. Pomeroy et al. (2020) argue that lack of access to financial services limits financing options for households of persons in the fishing industry, affecting their ability to manage cash flow and make investments. By addressing barriers such as low financial capability and lack of collateral assets, the financial resilience of these families can be improved. Koomson et al. (2022) also investigated the effects of gambling-related harm on financial stress, finding that problem gambling severity is positively associated with self-reported financial stress.

Financial resilience has important implications for mental health. Essel-Gaisey et al. (2023) found a negative association between financial resilience and mental health disorders in South Africa, suggesting that higher resilience translates into a lower incidence of mental health problems, highlighting its importance in overall well-being. In cybersecurity, the study by Fatima et al. (2024) highlights the need for robust support systems and proactive risk management to improve the well-being and performance of teams in financial organizations. Their findings suggest that effective communication and adequate training are crucial to strengthening resilience in this sector.

Finally, the digitalization of financial services has presented both opportunities and challenges, particularly in developing countries (Tay et al., 2022). Although these countries are progressing in digital financial inclusion, significant gaps in access and use of financial services persist, especially between genders and urban and rural areas. These findings highlight the need for policies that strengthen digital infrastructure and financial education, which are essential to ensure equitable access to financial services.

1.3. *Difference by gender*

The literature provides evidence on financial resilience levels by gender. For example, studies on single parents use variables such as cognitive abilities and sociodemographic profiles (including gender, age, and education level) as control factors. The COVID-19 pandemic undoubtedly caused economic issues and reduced financial resilience, particularly affecting workers. Findings suggest that while gender does not significantly affect financial stability, factors such as age, job type, and income considerably impact financial resilience (Delia et al., 2024). Additionally, differences have been found between men and women, finding that higher levels of resilience and cognitive abilities were observed in women (Mundi & Vashisht, 2023).

Other studies have employed standardized indices of financial inclusion and financial resilience and have concluded that financial inclusion significantly enhances household financial resilience. Gender and locality analyses indicate that the impact of financial inclusion on household resilience does not vary substantially by gender or location (Sakyi-Nyarko et al., 2022). Furthermore, savings and formal account ownership have a more pronounced effect on resilience. Remittances sent and received also significantly affect financial resilience, with stronger impacts in rural areas than in urban areas, particularly for women.

In Mexico, the National Commission for the Protection and Defense of Financial Service Users (CONDUSEF), in collaboration with the National Institute of Statistics and Geography (INEGI), conducted the National Survey on Financial Health (ENSAFI-CONDUSEF, 2023). This study provides national and state statistical data on the financial health of adults aged 18 and over in Mexico. Financial health is understood as the ability of individuals to manage their finances effectively (control), allowing them to handle daily expenses (security), manage negative income fluctuations and unexpected expenses (resilience), and achieve their goals while seizing opportunities to improve their well-being and economic mobility (freedom). The data indicate that individuals often experience anxiety when facing financial problems.

Among adults over 18, 38.8% expressed significant concern about applying for a loan. Additionally, 45.4% reported considerable worry about unexpected expenses, and 48.4% were concerned about accumulating debt. Regarding financial well-being in Mexico, 17.8% of the population achieved a high level, 31.4% reached a moderately high level, and 50.8% fell into the categories of moderately low or low levels. Gender analysis revealed that women with a high level of financial well-being were at a disadvantage compared to men by 5.6 percentage points. Furthermore, 36.9% of the population reported high levels of financial stress, 34.6% described their stress as moderate, and 28.5% considered their stress

level to be low or non-existent (ENSAFI-CONDUSEF, 2023). These findings lead to the following research questions, objectives and hypotheses:

1.3.1. Research questions

- Is there a gender difference in relation to financial health indicators? If so, which hypothesis (H0/H1) is better supported by the data?

1.3.2. Dimensions of financial resilience

- Perception toward Financial Health Indicators (PFHI)
- Lived Experiences toward Financial Health Indicators (LEFHI)
- Actions to Address Financial Crises (AAFC)

1.3.3. Objectives

- To demonstrate the existence of gender differences regarding financial health indicators in PFHI, LEFHI and AAFC.
- To identify which hypothesis is better supported by the data.

1.3.4. Null hypotheses

H01: The means of the perception financial health indicators are equal across all gender groups.

H02: The mean of financial health experiences is the same across all gender groups.

H03: The mean of financial health indicators under adverse conditions does not differ across gender groups.

1.3.5. Alternative hypotheses

HA1: The means of the perception of financial health indicators differ across gender groups.

HA2: The mean of financial health differs across gender groups.

HA3: The means of financial health indicators under adverse conditions differ across gender groups.

Based on these arguments, the conceptual model for the empirical study is as shown in Figure 1.

2. Method

Specific objectives were defined for the development of the empirical study, and the hypotheses to be evaluated were established. A methodological design was implemented that included data collection through structured surveys, ensuring the validity and reliability of the instruments used. Participants were recruited through digital and in-person communication channels, allowing for a diverse sample in terms of age, gender, and socioeconomic status, among other factors. Using a non-experimental, quantitative, and cross-sectional design, the database was analyzed to determine whether financial resilience differs by gender.

2.1. Participants and sample

The study population is diverse and multifaceted, comprising workers from various sectors, students from different fields, and general community members. This blend of individuals reflects a wide range of experiences and perspectives and includes significant variations in age, gender, and socioeconomic

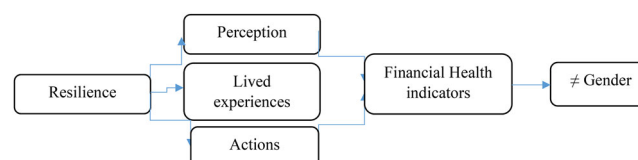


Figure 1. Conceptual model for the empirical study.

status. Including workers provides insights into labor dynamics and economic challenges while students contribute fresh and innovative perspectives on current and future trends. This population represents a microcosm of society, enabling a thorough analysis of the interactions and relationships that shape their realities.

2.1.1. Sample size

The sample consisted of 951 participants, of whom 394 (41.4%) were male, 504 (53.0%) were female and 53 (5.6%) identified as LGBTQ+. Participants' ages ranged from 18 to over 40 years: 27.8% ($n = 264$) were between 18 and 20 years old, 24% ($n = 228$) were between 21 and 25 years, 22.3% ($n = 212$) were between 30 and 40 years, 12.3% ($n = 117$) were between 26 and 30 years, and 13.7% ($n = 130$) were over 40 years old. Regarding marital status, 62.6% (595) of participants were single, 18.6% (177) were married, 13.8% (131) lived in a common-law partnership, and a small percentage identified as follows: 2.9% (28) separated, 1.1% (10) divorced, and 1.1% (10) widowed. Concerning current employment status, 56.2% (534) worked full-time, 39.3% (374) were students engaged in sporadic work to generate income, and 4.5% (43) had completed their studies and were seeking employment.

Work experience data showed that 22.9% (218) had between 1 and 3 years of experience, followed by 22.7% (216) with less than a year in their current job, 7.4% (70) with between 5 and 10 years, 6.3% (60) with over 10 years, 5.2% (49) with between 3 and 5 years, and 35.0% (338) indicated that they were not employed. This may be related to the percentage of participants studying and engaging in sporadic work to generate income.

Finally, regarding average monthly income (in Mexican pesos), it was observed that 35.4% (337) had no income, followed by 17.5% (166) earning between \$8,000.00 and \$12,999.00 pesos, 16.2% (154) earning in the range of \$3,000.00 to \$4,999.00, 10.9% (104) earning between \$5,000.00 and \$7,999.00, and a small percentage of 7.4% (70) earning between \$13,000.00 and \$20,000.00. Only 4.7% (45) exceeded \$20,000.00 pesos in monthly income.

2.2. Ethics

The study adhered to the principles outlined in the Declaration of Helsinki and received ethical approval from the Ethics Committee of the UCC Business School at Universidad Cristóbal Colón under project ID = P-10/2024. The project details and objectives were communicated during the administration of the instrument, ensuring a statement of complete confidentiality and anonymity regarding participant identities. Informed consent was properly obtained following the review of the instructions and declarations.

2.3. Instrument

The scale used is the test employed by Flores Bañuelos et al. (2024), which includes indicators of participants' sociodemographic profiles and 24 items on a 5-point Likert scale: eight items measure perceptions of financial health indicators, eight assess lived experiences related to these indicators, and eight evaluate the actions taken to address adverse economic and financial situations concerning the financial health indicators. The eight items measuring perceptions of financial health indicators are derived from the BBVA (2020) proposal and the Center for Financial Services Innovation (CFSI).

2.4. Procedure

Bayesian analysis is used to test the hypotheses. This involves estimating Bayesian parameters. When estimating parameters, our prior beliefs are reflected in the prior distribution. These beliefs are then updated through the predictive updating factor, resulting in the posterior distribution.

$$P(\theta|data) = \frac{P(data|\theta)}{P(data)} * P(\theta)$$

Posterior = Predictive Updating Factor * Prior

The global representation is as follows:

Null Hypothesis: $H_0: \mu = \text{FHI}$

The level of financial health does not differ by the participants' gender.

Alternative Hypothesis: $H_a: \mu \neq \text{FHI}$

The level of financial health differs by the gender of the participants.

To test the Bayesian hypothesis:

$$\frac{P(H_1|data)}{P(H_0|data)} = \frac{P(data|H_1)}{P(data|H_0)} * \frac{P(H_1)}{P(H_0)}$$

Posterior model odds = Bayes factor * prior model odds $\frac{P(data|H_1)}{P(data|H_0)} : \frac{P(data|H_1)}{P(data|H_0)}$

Interpretation of the Bayes factor:

If $BF > 1$: The data favor the alternative hypothesis H_1 over the null hypothesis H_0 .

If $BF < 1$: The data favor the null hypothesis H_0 over the alternative hypothesis H_1 .

$BF = 1$: The data do not favor either hypothesis specifically, as the evidence is equal for both.

In short, the Bayes factor offers a numerical gauge of how much stronger the evidence is for one hypothesis over another. This information can be presented in two formats (as shown in [Table 1](#)), yet both formats deliver the same insight into how the data probabilities compare between the two hypotheses.

3. Results

To address the central research question and to test the hypotheses related to gender and how these differ concerning financial health indicators, the study focuses on Bayesian inference, specifically the Bayesian ANOVA procedure. Therefore, in [Table 2](#), the comparison model is presented.

To test: H_{01} : The means of the perception financial health indicators are equal across all gender groups.

The first column presents the available models, in this case, two models: one alternative and one null. The models are ordered based on their predictive performance relative to the best model, indicated in the BF01 column, showing the Bayes factor relative to the best model, which includes only the gender factor. The prior probability of the model $P(M)$ is 0.5 for both models, and the resulting posterior model probabilities are given as $P(M|data)$. The BFM column shows the change from before posterior probabilities for each model. The best model, using gender as a predictor, shows a probability change calculated as $(0.980/1-.980) * (1-.5/0.5) = 48.268$, which matches the result in [Table 2](#). The BF01 column displays the Bayes factors of the models compared to the best model. The Bayes factor for the null model versus the gender model is obtained by dividing their Bayes factors by the best model: $48.268/1 = 48.268$, favoring the null hypothesis. Column 6 provides an error percentage indicating the accuracy of the numerical approximations, which should not be too large.

[Table 3](#) summarizes the posterior distributions averaged by the model for each level (β_j), using four statistics: the posterior mean, posterior standard deviation, and the lower and upper bounds of the 95% central credibility interval. After identifying the relevant predictors, the magnitude of the relationships analyzing these posterior distributions is shown. [Table 3](#) compiles the averaged posterior distributions

Table 1. Quantifiable values of the Bayes factor, according to Jeffreys.

BF0u Null hypothesis over the alternative		Value
In favor of H_0	Very strong	>30
	Strong	10 to 30
	Moderate	3.1 to 10
	Anecdotal	1.1. to 3.1
No evidence		1
In favor of H_1	Anecdotal	0.3 to 0.9
	Moderate	0.29 to 0.1
	Strong	0.09 to 0.03
	Very strong	<0.03

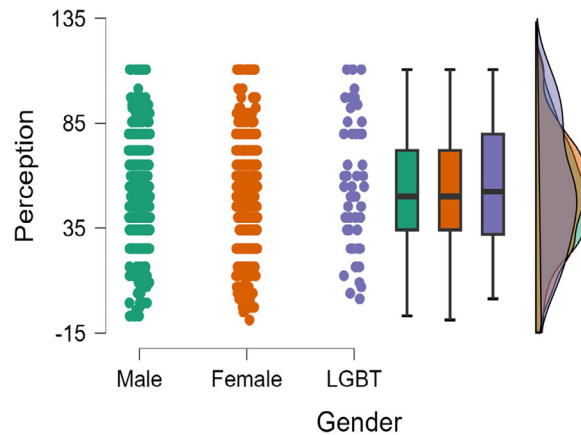
Source: Jeffreys (1948).

Table 2. Model comparison.

Models	P(M)	P(M data)	BFM	BF01	Error %
Null model	0.5	0.980	48.268	1	
Gender	0.5	0.020	0.021	48.268	0.027

Table 3. Model averaged posterior summary.

Level	Mean	Sd	95% Credible interval	
			Lower	Upper
	50.041	0.820	48.343	51.617
1	0.327	1.546	−2.756	3.427
2	−0.039	1.503	−3.067	2.946
3	−0.289	2.445	−5.183	4.620

**Figure 2.** Distribution of financial health across three different groups. The intervals around the means represent 95% confidence intervals.

for each level, showing the posterior mean, posterior standard deviation, and the 95% central confidence interval bounds. The relationship associated with the gender level for men is obtained by summing the posterior mean of the intersection with the posterior mean of the male attribute ($50.041 + 0.327$), resulting in 50.368. For the female attribute, the result is 50.002, and for LGBTIQ+, it is 49.752. These results suggest that the contribution of the levels is very similar.

Figure 2 displays a raincloud plot with raw data points (representing the rain) and a half-violin plot showing the probability density (representing the cloud). The plot also features key summary statistics presented with a box plot. Alternatively, the mean with a confidence interval can be shown instead of the box plot. The data reveal that financial health does not vary significantly by gender.

Figure 2 shows that for both men and women, as well as for LGBT individuals, the perception scores for health indicators range from −18 to 117, with a higher concentration between 28 and 93. For LGBT individuals, the concentration falls between 19 and 93. The box plot indicates that the means for men and women are quite similar, whereas there is a notable difference in means for LGBT individuals.

To test: H_{02} : The mean of financial health experiences is the same across all gender groups.

Bayesian inference, specifically through ANOVA, was applied to address the hypothesis. Table 4 displays the comparison model. The prior model probabilities for both models are 0.5; The posterior probabilities $P(M|data)$ increase for the null model, while they decrease for the alternative model. The change in probabilities (BFM) for the null model is 1.597 times higher than the alternative model (0.626). The Bayes factor (BF₀₁) for the null model versus the model with a single variable -gender- is obtained by dividing the Bayes factor of the best model by the Bayes factor of the null model: $1.597/1 = 1.597$, favoring the null hypothesis. The error percentage is small, with a recommended value of less than 20%.

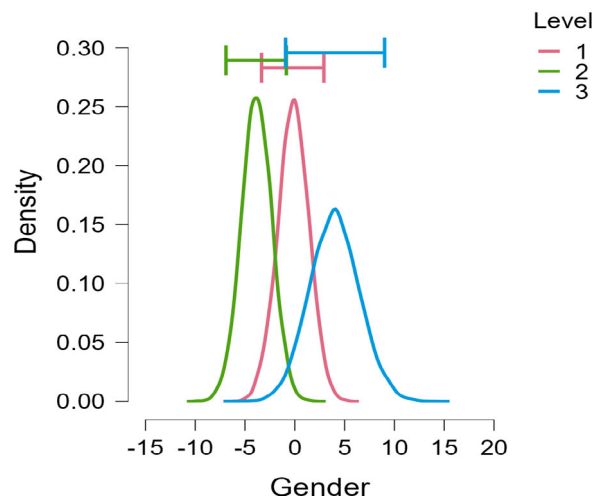
Table 5 summarizes the averaged posterior distributions by model for each level (β_j), using four statistics: the posterior mean, posterior standard deviation, and the lower and upper bounds of the 95% central credibility interval. The table shows the averaged posterior distributions for each level, including the

Table 4. Comparison model: gender—financial health experience.

Models	P(M)	P(M data)	BF _M	BF ₀₁	Error %
Null model	0.5	0.615	1.597	1	
Gender	0.5	0.385	0.626	1.597	0.024

Table 5. Averaged posterior distributions.

Level		Mean	SD	95% Credible interval	
				Lower	Upper
Intercept		51.817	1.403	48.500	53.978
Gender	1	−0.144	1.566	−3.341	2.921
	2	−3.844	1.518	−6.911	−0.854
	3	3.988	2.480	−0.926	9.016

**Figure 3.** Posterior distributions.

posterior mean, posterior standard deviation, and the lower and upper bounds of the 95% central confidence interval. The relationship associated with the gender level for men is obtained by adding the posterior mean of the intersection to the posterior mean of the male attribute ($51.817 - 0.144$), resulting in 51.673. For the female attribute, the result is 47.973, and for LGBT, it is 55.805.

These results indicate that the contribution of the levels is very similar between men and women, but there is a slight difference concerning LGBTQ+ (Figure 3).

Figure 4 illustrates a raincloud plot, which includes raw data points and a half-violin plot showing the probability density (the cloud). Additionally, key summary statistics are presented using a box plot, with the option to display the mean and a confidence interval. The plot shows that financial health varies very little concerning gender.

The intervals around the means represent 95% confidence intervals. It is observed that in the three groups, men, women, and LGBT, the score of the lived experiences varies between -15 and 120, with a higher concentration between 21 and 95 for the groups of men and LGBT, while for the group of women, the concentration is fixed between 21 and 7. In the box graph, it is observed that the average between men and women is very close, unlike LGBT; at these levels, a difference is seen between the average.

To test: H_{03} : The mean of financial health indicators under adverse conditions does not differ across gender groups.

3.1. Actions to address financial crises

For the analysis, Bayesian inference was employed using ANOVA. Table 6 presents the comparison model. The prior probabilities for both models are 0.5. The posterior probabilities $P(M|data)$ increase for

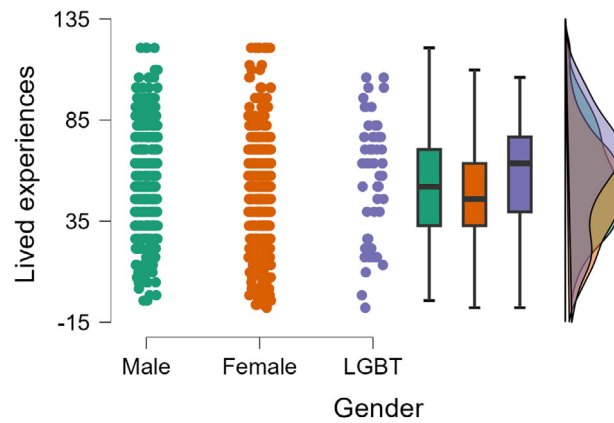


Figure 4. Distribution of experiences across three different groups.

Table 6. Model comparison gender-financial resilience.

Models	P(M)	P(M data)	BFM	BF01	Error %
Null model	0.5	0.973	31.736	1	
Genero	0.5	0.027	0.028	36.129	0.026

Table 7. Model averaged posterior summary.

Variable	Level	Mean	SD	95% Credible interval	
				Lower	Upper
Intercept		50.079	0.831	48.405	51.743
Gender	1	−1.015	1.551	−4.141	2.081
	2	−0.911	1.516	−3.958	2.061
	3	1.926	2.465	−2.924	6.901

the null model, whereas they decrease for the alternative model. The change in probabilities (BFM) for the null model is 31.736 times higher than for the alternative model (0.028). The Bayes factor (BF01) for the null model versus the model with a single variable –gender– is obtained by dividing the Bayes factor of the best model by the Bayes factor of the null model: $31.736/1 = 31.736$, favoring the null hypothesis. The error percentage is small (0.028), with a recommended value of less than 20%.

Table 7 reveals the averaged posterior distributions for each level (β_j), employing four statistics: posterior mean, posterior standard deviation, and the lower and upper bounds of the 95% central confidence interval. The relationship associated with the gender level for men is obtained by adding the posterior mean of the intersection to the posterior mean of the male attribute ($50.079 - 0.1015$), resulting 49.064 in a value of 1. For the female attribute, the result is, 49.168, and for LGTBIQ+, it is 52.005.

These results indicate that the contribution of the levels is very similar between men and women, but there is a slight difference concerning LGTBIQ+ (**Figure 5**).

Figure 6 displays a raincloud plot, which includes raw data points and a half-violin plot showing the probability density (the cloud). Additionally, key summary statistics are presented using a box plot, with the option to show the mean and a confidence interval. The plot indicates that financial resilience varies very little concerning gender.

It is observed that in the three groups, men, women and LGBT, the score of the lived experiences varies between −16 and 110. For the groups of men and women, the highest concentration is between 25 and 79 for LGBT; on the other hand, the concentration is fixed between 12 and 85. In the box graph, it is observed that the average between men and women is very close, unlike the LGBT group; at these levels, a difference is seen among the averages.

4. Discussion

From the results obtained, we can infer that in terms of financial resilience, there are no significant differences between men, women and LGBT people, as the means of the lived experience scores are quite

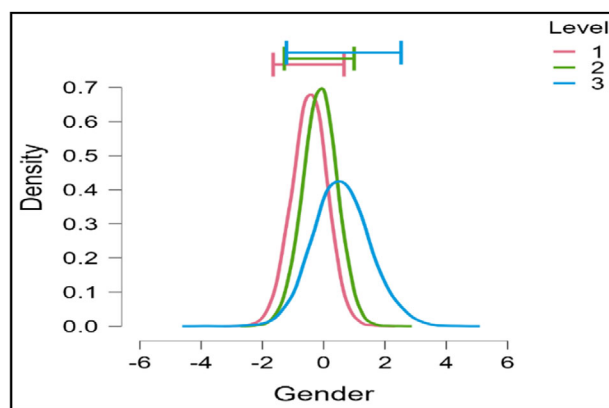


Figure 5. Posterior distribution.

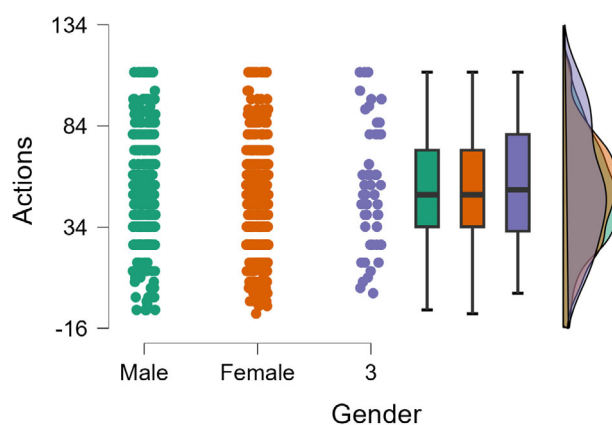


Figure 6. Gender-financial resilience distribution.

similar. It was determined that financial health does not vary by gender, which supports the decision not to reject the null hypothesis H01, which postulates that the means of the financial health indicators are equal between gender groups. Similarly, there are no significant gender differences in the experiences related to the financial health indicators, as the results show that the contributions across the levels are quite similar between men and women (H02). This finding aligns with the results reported by Delia et al. (2024) and Sakyi-Nyarko et al. (2022). However, it contrasts with Mundi and Vashisht (2023), who found higher levels of resilience in women. Regarding actions taken to cope with adverse economic situations related to financial health indicators (H03), it was found that financial resilience changes minimally with gender. This provides sufficient evidence to not reject the null hypothesis, which states that actions to address adverse economic situations do not differ by gender. This result is consistent with Delia et al. (2024) and Sakyi-Nyarko et al. (2022) but contrasts with Mundi and Vashisht (2023), who observed differences between men and women.

Despite the absence of evidence supporting gender differences in perceptions, experiences, and actions related to financial crises—elements linked to financial health indicators—it is plausible to infer that participants possess an acceptable level of financial knowledge. This knowledge can enable them to manage unexpected expenses effectively and mitigate financial stress, thereby reducing their reliance on loans, as Kulshreshtha et al. (2023) noted. Financial resilience equips individuals to manage complex situations, offering a safeguard that enhances financial inclusion, as highlighted by Salignac et al. (2019) and Hamid et al. (2023). Furthermore, the financial literacy acquired by participants can play a crucial role in their financial resilience, emphasizing the importance of financial education in strengthening resilience and promoting financial inclusion, as argued by Bialowolski et al. (2022) and Kass-Hanna et al. (2022). Although factors such as age and type of work are identified as significant influences on financial resilience, theory reinforces the importance of socioeconomic contexts and financial inclusion policies in general resilience (Klapper & Lusardi, 2020). Finally, the literature offers evidence emphasizing that

education is fundamental for developing skills necessary to face economic adversities (Benard, 1991; SEP, 2017). Regarding financial inclusion, the study's findings suggest that its relationship with resilience does not vary significantly by gender. At the same time, the theory establishes that financial inclusion is essential to improve household resilience, especially in rural areas (Sakyi-Nyarko et al., 2022). This comparison suggests that, although the study's results offer a broad view, it is crucial to further explore gender differences and how these could influence the experience of financial resilience in specific contexts.

5. Conclusion

In conclusion, the results of the Bayesian analysis reveal that perception, lived experiences, and actions related to adverse economic situations around financial health indicators do not show significant gender differences. This finding supports the null hypothesis that these dimensions of financial health are consistent across genders, which aligns with recent studies and contrasts with research reporting differences in financial resilience. The study indicates no significant differences in financial resilience between men, women, and LGBTIQ+ people, suggesting that, in the analyzed context, the ability to handle adverse economic situations is similar between these groups. This challenges some preconceived notions about the variability of financial resilience.

In addition, the decision not to reject the null hypotheses related to financial health and financial health experiences is supported, implying that interventions or policies designed to improve financial health could be equally effective for all genders. This point is particularly relevant when considering the development of educational or financial support programs, given that the results suggest that the financial education received by university students contributes to a solid knowledge base. Such a base allows them to effectively manage financial challenges, regardless of their gender, and thus reduce their dependence on loans, ultimately improving their financial well-being.

Financial education, then, plays a crucial role in strengthening resilience. Training in this area provides individuals with the necessary tools to face economic adversities and highlights the need to implement inclusive and accessible financial education programs for the entire population. Although the study concludes that financial resilience does not vary significantly by gender, factors such as age, type of work and socioeconomic context are identified in the consulted literature as relevant influences. This suggests that financial inclusion policies must consider these variables to be effective in different populations. This is where the role of educational institutions at all levels, as well as government programs from state and municipal agencies and countries in general, is vital in promoting and delivering financial education programs to the population.

Finally, although the findings indicate gender equality in financial resilience, it is necessary to further explore the underlying dynamics that may influence resilience experiences in specific contexts. This approach may reveal important nuances not captured in the overall results. In summary, the findings highlight the importance of financial education and the socioeconomic context in financial resilience, emphasizing that support strategies must be inclusive and tailored to the needs of different groups to foster greater economic well-being in the population.

5.1. Theoretical implications

The results indicating the absence of significant differences in financial resilience between genders suggest that existing theories on the impact of gender on financial health may need to be revised. It is important to explore whether underlying dynamics, such as financial literacy and socioeconomic context, are more relevant factors. In addition, factors such as age, type of work, and socioeconomic context influence financial resilience, so this invites reflection on the need to integrate multiple variables in theoretical models that analyze financial health. This can enrich the understanding of financial resilience beyond gender differences.

The importance of financial education in the development of resilience is unquestionable, which can lead to the inclusion of this concept in broader theories on financial inclusion and economic equity, highlighting its role in reducing economic vulnerability. This opens an important gap to continue

exploring these phenomena in Latin American contexts beyond what has already been reported in the state of the art in Asian, European and other regional contexts.

5.2. Practical implications

The findings suggest that financial education should be a key component in programs targeting university students. Implementing workshops and courses that address financial management skills can empower students and prepare them to face economic challenges. Since no significant differences in financial resilience by gender were found, financial inclusion policies should be designed in a way that is effective for all groups. This involves creating accessible programs that consider socioeconomic and educational factors and ensure that all individuals have the necessary tools to manage their financial health.

Institutions and policymakers should consider the particularities of each group and context. Conducting additional studies into the underlying dynamics could help tailor more targeted and effective strategies for different populations. Initiatives aimed at increasing awareness about financial health and resilience may be beneficial. Awareness campaigns informing the population about the importance of financial education can contribute to greater inclusion and preparedness in economic crises. These theoretical and practical implications highlight the importance of continuing to research and develop strategies that address financial resilience in diverse contexts.

5.3. Implications for institutions and policymakers from regulatory bodies

Some implications for academic institutions and regulatory bodies for the design of public policies, which are derived from the results, are first, educational institutions should focus on including comprehensive financial education programs in their curricula. This would ensure that all students, regardless of gender, acquire fundamental financial skills and knowledge. In addition, it would be beneficial for these institutions to collaborate with financial experts to create courses that address real economic problems, preparing students for possible uncertainties in the future. At the same time, outreach and training should be offered for the rest of the population, allowing them to acquire the financial knowledge needed to be more financially resilient.

On the other hand, in the development of Equitable Policies, it is essential that policymakers focus on establishing and promoting norms that facilitate equitable access to financial education resources. This could include funding for workshops, seminars, and online courses targeting diverse populations. By prioritizing financial education, people can be equipped with the tools necessary to face economic challenges. Likewise, research and obtaining data on the population is essential, considering that regulatory agencies should encourage and fund research that analyzes how financial education affects resilience in different demographic groups. Collecting and analyzing data on financial behaviors and outcomes would allow policymakers to develop evidence-based strategies that address the specific needs of each community.

Policymakers should support community-level financial education initiatives that promote inclusion. Collaborations with local organizations can facilitate outreach efforts targeting underrepresented groups, ensuring everyone has access to knowledge and financial support. Institutions and regulators should, therefore, establish effective frameworks to assess and monitor the effectiveness of financial education programs. Ongoing assessment would help identify areas for improvement and ensure that programs remain relevant and tailored to the needs of students and the community.

Awareness campaigns could help change social perceptions about financial literacy, encouraging people from all backgrounds to seek knowledge and support. Policymakers need to encourage collaboration between educational institutions and financial organizations to create mentoring programs. These partnerships can offer students and the general population practical experiences, advice from professionals and access to resources that enrich their financial understanding. On the other hand, inclusivity becomes a fundamental element for financial regulatory bodies, hence, it is crucial that regulatory bodies ensure that their frameworks are inclusive and consider the diverse needs of different populations. This implies addressing possible access barriers and ensuring that financial education initiatives are adaptable to diverse cultural contexts and learning preferences.

In the end, the practical implications suggested for academic institutions and financial regulatory bodies would be in line with the objective of achieving a more equitable and informed society where all people have the financial resilience necessary to face the economic challenges that appear regularly in Mexico.

5.4. Future research

To expand research on financial health and gender, it would be valuable to explore the influence of cultural and socioeconomic variables on financial management by gender. Additionally, longitudinal studies could examine how financial resilience develops and changes over time across different genders. Comparative studies between countries could also provide insights into how national policies and educational practices affect gender-specific financial health.

Every study has its limitations; in this case, the sample size was a constraint. Thus, it is recommended to increase sample sizes to include a broader range of educational levels, work contexts, and urban settings. Finally, given the growing importance of digital finance worldwide, researching how technological tools and financial platforms influence financial management and whether there are gender differences in their usage would be valuable.

Authors' contributions

AGS was responsible for the conceptualization, data curation, investigation, methodology, formal analysis, and original draft of this study. MEC was responsible for data curation and methodology of the study. JCS was responsible for data curation, visualization, reviewing, and editing of the study. All authors read and approved the final version of the paper.

Disclosure statement

This study is carried out in accordance with the recommendations of the Code of Ethics of the UCC Business School at Cristóbal Colón University, as well Tecnológico Nacional de México/ITSM. The Ethics Committee of the UCC Business School at Universidad Cristóbal Colón approved the protocol. In accordance with the Declaration of Helsinki, all students gave their consent for participation in the study. The authors declare no conflict of interest.

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Data availability statement

The data that support the findings of this study are openly available in Mendeley data at <http://doi.org/10.17632/gk4dspkzf2.1>

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