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## Abstract

This paper analyzes the effect of financial participation on consumer's financial vulnerability, which is pervasive in countries in the developing world. We suggest the need to observe the financial behavior of consumers, through financial health, to analyze the effects of such participation rather than taking into account only the narrower concept of financial inclusion. Our hypothesis is that welfare gains are not directly derived from the standalone ownership of bank accounts (i.e. financial inclusion) or having access to credit, but from their appropriate and responsible use. Firstly, we developed a stylized general framework to study the mechanisms and develop a measure to monitor financial health. Secondly, evidence on how participation in the financial system affects vulnerability is shown for five Latin American countries (Bolivia, Chile, Colombia, Ecuador, and Peru). We find that financial health has a higher impact on financial vulnerability than does financial inclusion. Human capital and financial literacy also affect financial vulnerability. The higher the level of these variables, the higher (lower) the probability of being financially safe (vulnerable). The structure of income and the environment in which individuals live affects financial vulnerability as well.

**Keywords:** financial vulnerability, financial health, resilience, consumers' welfare, financial inclusion.

# 1. Introduction

Across countries, both developed and developing, individuals share a common aspiration for financial health. Good financial health generates a comfortable lifestyle, affecting welfare and physical health, as well as making consumers less vulnerable. Many consumers and households experience moments of financial difficulty, prompted either by a personal shock, such as losing a job, or a macroeconomic shock affecting personal finance (i.e. an economic recession). People react to these stressful events in different ways. An important question is how quickly they can recover from these shocks and this recovery depends not only on being financially included, but on their past financial behavior. Financial vulnerability describes the ability to recover from sudden financial shocks, which include unexpected loss of income and/or an uncontrollable increase in expenditure. Such ability is crucial to understanding consumer welfare. Moreover, it is a critical early warning to guarantee an inclusive economic growth and prosperity. Financial systems allow households to increase their opportunities and smooth their consumption, not only over the business cycle but also over the life cycle (Dynan, 2009). However, the mechanism is not straightforward. This paper attempts to contribute to a better understanding of the role of the financial system in consumer's welfare by studying the determinants of financial health and assesses its effect on financial vulnerability.

Since the publication of the first global, demand-side database to study the usage of financial services by the World Bank in 2011, literature that studies the link between finance and economic growth, entrepreneurship, technological innovation, poverty alleviation, distribution of income or health has flourished (Agénor and Canuto, 2017; Dabla-Norris *et al*., 2015; Laeven *et al*., 2015; Trabelsi and Cherif, 2017; Hu *et al.* (2019), among others). These works try to shed some light on the mechanism through which financial systems (financial contracts, markets, and intermediaries) contribute to build more prosperous societies. Demirgüç-Kunt and Levine (2018) provide a detailed review of this literature. However, these works use a narrow definition of participation in the financial system, since they mainly try to capture such effect through access to the financial system and, in a few instances, through ownership of financial products. Only papers that use randomized control trials obtain more comprehensive information with which to assess the outcome of financial participation (Dupas and Robinson, 2013 and Prina, 2015). Our paper aims to fill this gap.

From the supply side, there is evidence demonstrating that financial inclusion benefits society in many ways, managing risk (Froot et al., 1993), fostering economic growth (e.g. Levine, 2005), alleviating poverty, reducing inequality (Beck et al., 2007), and promoting entrepreneurship (Guiso et al., 2004 and Mollica and Zingales, 2007). However, having access to the financial system is only a necessary condition for benefiting from participating in the financial system. From the demand side, the lack of use or misuse of innovative financial tools, which constitutes one of the main roots of the last global financial crisis, often prevents consumers from overcoming difficult situations and pursuing their life goals. Similarly, without health services, the person's physical health is clearly more vulnerable. In addition, the interconnection of financial markets, an insufficient level of regulation, as well as incentive and risk control mechanisms within inadequate financial institutions constituted, among other factors, triggering elements of the crisis (Financial Crisis Inquiry Commission, 2011; Crotty, 2009 and Plosser, 2009). These factors, combined with complex financial products, lead to consumer over-indebtedness (Lusardi and Mitchell, 2014 and Dimova, 2015) that had an impact on the real economy. Thus, being financially included or the mere use of financial services is not always good per se. Financial inclusion may not be sufficient to achieve improvements in consumer welfare, since it is not an end in itself, but a means to an end. We claim for the need to observe the financial behavior of consumers through its outcome in order to analyze the effects of financial participation on consumer welfare.

The aim of this paper is to create a framework for understanding the channels through which participation in the financial system, measured by financial health, impact financial welfare by minimizing financial vulnerability. Also, a measure of consumers' financial health is presented. We estimate the impact of financial health on financial

vulnerability by using microdata from surveys at individual bases for five Latin American countries (Bolivia, Chile, Colombia, Ecuador, and Peru). Financial health is a relatively new term that has emerged after the global financial crisis in the U.S. It aims to measure the impact of participating in the financial system on consumer welfare (WEF, 2018). The Consumer Financial Protection Bureau (CFPB) defines financial health, or financial well-being, as "a state of being wherein a person can fully meet current and ongoing financial obligations, can feel secure in their financial future, and is able to make choices that allow enjoyment of life" (CFPB, 2015, 2017). A way of identifying whether an individual is in this state, is by observing financial behavior through the use of financial tools to manage personal finance. In order to understand how financial outcomes affect consumer welfare through financial vulnerability, it is necessary to analyze, both theoretically and empirically, the mechanisms of such effects. Our hypothesis is that welfare gains are not only derived from the standalone ownership of bank accounts or having access to credit, but also from their appropriate and responsible use. The key findings of our paper are the following: financial health has an impact on financial vulnerability, and this impact is higher than that derived from financial inclusion. These results are robust to alternative approaches of the financial health indicator. There is a primary set of relevant factors affecting financial vulnerability, especially those associated with human capital and financial literacy. The higher the level of these variables, the higher (lower) the probability of being financially safe (vulnerable). In the case of financial literacy, the impact is more important when we focus on interest rate issues. There is a second set of variables, the effect of which is also important, albeit more complex—the structure of income and the environment in which individuals live. Finally, we also find that financial vulnerability is pervasive in the countries included in our sample.

The rest of the paper is organized as follows. Section 2 presents a simple theoretical version for the financial consumer problem in a general equilibrium model that allows consumers facing different degrees of financial participation. In addition, some stylized facts for the diagnosis of the degree of financial vulnerability of adults in Latin America are shown. Section 3 presents the composition of the index for measuring financial health and the empirical strategy. Section 4 illustrates the findings and sensitivity analysis. Section 5 concludes.

# 2. The importance of assessing financial vulnerability

## 2.1. A simple theoretical framework for consumers

One dimension of consumers' vulnerability is associated with financial circumstances. However, observing whether consumers participate in the financial system is not sufficient to understand the factors that explain the vulnerability associated with financial issues. It is essential to disentangle the results of such participation in the financial system, by analyzing individual's financial situation. Our theoretical framework focuses on consumers and the degree of vulnerability that they face based on their financial behavior. We consider the consumer problem from a standard general equilibrium model based on a two-type consumer structure.[1] We assume that the financial system is a mechanism for consumers to smooth consumption over time. Under this assumption, we distinguish between Ricardian and non-Ricardian consumers, thus justifying the existence of capital accumulation. In this model, only financially included consumers are able to borrow and save to smooth consumption in the face of income volatility, which is a source of financial vulnerability.

We assume a continuum of consumers, indexed by $i \in [0,1]$. A fraction $1 - \lambda$ of consumers are financially included (i.e. they participate in the financial system) and so have access to capital markets, which are referred as Ricardian. The remaining fraction $\lambda$ of consumers are financially excluded and do not own financial assets nor have

1: The intuition is similar to the one presented in Galí, López-Salido and Vallés (2004) but we do not consider the rest of the agents in the economy since the goal of this paper is to understand the impact of participation in the financial system to build resilience and overcome vulnerability for consumers.

any liabilities; they merely consume their current labor income. We refer to these as non-Ricardian (or rule-of-thumb) consumers. Each consumer *i* faces a differing amount of financial vulnerability (*V*):

$$V_i = f(FH_i, HK_i) \qquad (1)$$

where *FH* represents financial system participation through current individual financial conditions, referred to as financial health, and *HK* is human capital. Ricardian consumers have an associated positive level of financial health, $FH_i > 0$, and rule-of-thumb consumers have a zero associated level financial health, $FH_i = 0$.

Financial vulnerability is divided into two parts: structural and adjustable. The structural part includes factors that are either fixed or that individuals cannot change in the short run, such as human capital (i.e. representing the ability of individuals to generate income wages). The adjustable part includes financial health that can be modified by individuals in the short run, since it is determined to a large extent by their financial behavior derived from participating in the financial system. We assume that only financially included households are able to borrow and save to smooth consumption in the face of income volatility. Thus, financial health means individuals' capacity to manage resources by using formal financial tools. It measures not only whether individuals participate in the financial system or not, but also how do they do so, through their financial behavior. Good financial health implies achieving an accurate balance between consumption and saving based on income flows over the life cycle and can be inferred through individual financial behavior.

We assume that financial health is affected by income and the financial knowledge to manage such income:

$$FH_i = h(I_i, FL_i) \quad (2)$$

where *I* represents the individual income structure and *FL* is financial knowledge. This model considers two features of income:

$$I_i = g(W_i, \delta_i) \qquad (3)$$

Absolute income level *W*, that includes labor income and capital returns from renting capital holdings to firms and dividends from ownership of firms, and the complexity of income flows (δ) that measures income-expense volatility. Regardless of the level of income, individuals face different levels of complexity when it comes to smoothing at different frequencies and it depends on how synchronized income flows and consumption needs are. Under this assumption, wider spans between income flows and consumption needs make the management of resources harder than if both income and consumption have the same frequency. Financial knowledge represents the ability of individuals to manage resources and explains, to some extent, the variation in financial outcomes (Huston, 2010; Lusardi and Mitchell, 2014).

## 2.2. Stylized facts: Understanding financial vulnerability

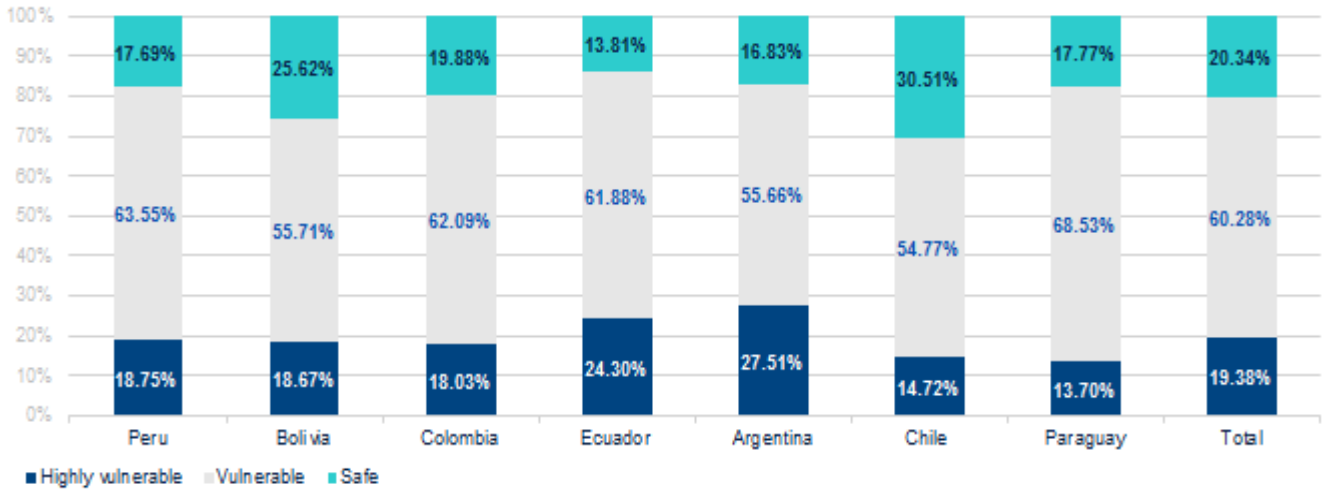
We define the degree of financial vulnerability based on the capacity that individuals have to deal with financial shocks relying solely on their own resources. Empirically, a way of measuring financial vulnerability is the length of time individuals are able to cover their costs of living in the event that they find themselves without their main income source and without asking for a loan.[2] We use nationally representative and comparable information for five Latin American countries (Bolivia, Chile, Colombia, Ecuador, and Peru) from the Measurement of Financial Capabilities survey elaborated by the Development Bank of Latin America (CAF). The sampling process considers

2: The survey contains the following question: "If you lost your main source of income today, how long would you be able to cover your cost of living without taking a loan?". The answer defines the following five time intervals or categories: less than a week, between a week and a month, between one month and three months, between three and six months, and more than six months.

the population over 18 years old (see Appendix A for further detailed information on the CAF surveys). Although the information in the survey allow us to observe five different degrees of financial vulnerability, in this section, for the sake of simplicity, we classify individuals by aggregating them into three different categories. The highly vulnerable group encompasses those that are able to cover the cost of living for less than a week. The vulnerable group comprises individuals that can cover the cost of living for more than a week but less than three months. Finally, the safe group includes all those that can cover the cost of living for more than three months.

Figure 2.1 shows that financial vulnerability is pervasive in this group of countries. Less than one-third of the population is considered safe, according to this definition.[3] Ecuador is the country with the highest financial vulnerability with less than 14 percent of individuals safe. On the opposite side, we observe that Chile (with the highest GDP per capita in the sample) and Bolivia (with the lowest GDP per capita in the sample) exhibit the highest number of individuals labeled as safe, with 30.51 percent and 25.62 percent, respectively. This points that financial vulnerability goes beyond income and to understand its causes, it is necessary to take into account other factors.

Figure 2.1 **DEGREE OF FINANCIAL VULNERABILITY IN LATIN AMERICA**
(PERCENTAGE OF ADULTS IN EACH CATEGORY)




Source: BBVA Research and CAF

Table 2.1 presents the relationship between the degree of vulnerability and certain socio-demographic characteristics of individuals. As can be observed, there is a relatively high level of heterogeneity among different levels of vulnerability. Men present a comparatively lower degree of financial vulnerability than women. In terms of age, the degree of financial vulnerability presents a non-linear behavior: middle-aged people exhibit a higher level of financial vulnerability than the rest of the age groups, particularly the youngest age group, which exhibits the lowest percentage of financial safety, and older people (who show the most relevant level of high financial vulnerability). There is an inverse relationship between education level and financial vulnerability, and the differences between primary education and university education are higher than any other variable considered. People living in rural areas exhibit better associated financial health than those who live in urban areas. Also,

3: Data from the World Bank (2018) show similar figures that may point to potential financial vulnerability since 57 percent of adults in Latin America declare that they cannot come up with emergency funds. Moreover, 22 percent of the adult population in the region receive payments and transfers (14 percent) from the government. When it comes to raising emergency funds, 33 percent of adults rely on family or friends.

people who are financially included, understood as holding accounts and debit cards from the formal financial system, show a lower degree of financial vulnerability. Finally, participation in the labor market is associated with lower levels of financial vulnerability.[4]

Table 2.1 **DEGREE OF FINANCIAL VULNERABILITY BY INDIVIDUAL CHARACTERISTICS IN LATIN AMERICA** (PERCENTAGE OF ADULTS IN EACH CATEGORY)

| | | Highly Vulnerable | Vulnerable | Safe |
|---|---|---|---|---|
| **Gender** | Male | 16.06 | 60.86 | 23.08 |
| | Female | 21.08 | 60.75 | 18.17 |
| **Age** | <25 | 18.56 | 65.88 | 15.57 |
| | 25-34 | 16.30 | 61.37 | 22.33 |
| | 35-44 | 18.28 | 58.96 | 22.76 |
| | 45-54 | 18.12 | 59.63 | 22.24 |
| | 55-64 | 20.18 | 58.58 | 21.24 |
| | >64 | 26.44 | 57.81 | 15.75 |
| **Education** | Primary | 29.22 | 59.12 | 11.67 |
| | Secondary | 17.35 | 62.87 | 19.78 |
| | University | 10.15 | 56.27 | 33.58 |
| **Residence** | Rural | 17.59 | 61.27 | 21.14 |
| | Urban | 21.09 | 59.77 | 19.13 |
| **Financial Inclusion** | No | 23.44 | 61.42 | 15.14 |
| | Yes | 11.74 | 59.17 | 29.09 |
| **Worker** | No | 22.41 | 61.62 | 15.97 |
| | Yes | 16.54 | 60.33 | 23.13 |
| **Total** | | **18.54** | **60.81** | **20.65** |

Note: The figures represent the weighted average of the percentages obtained from the five countries using the total adult population as weight.
Source: BBVA Research, CAF and World Bank

# 3. The role of financial participation for improving vulnerability

In the previous section, following the literature, we associate the definition of financial inclusion with the mere participation in the formal financial system, measured by people who hold at least a financial product such as a bank account or debit card. Although this is an important indicator, holding a financial product might not result in a welfare increase per se, since it does not provide information on how is the usage of such products. However, the way people use such financial products could be a more comprehensive indicator of the benefits of participating in the financial system. Since we have insufficient information to perfectly observe the outcomes of participation in the financial system, we identify individuals' financial behavior through the declared usage that they report when it comes to money that implies using financial services. This section provides an empirical strategy to measure financial health that is globally applicable and examines how financial behavior affects financial vulnerability.

## 3.1. Identification strategy: Measuring financial health

Our indicator of financial health takes into account attitudes and behaviors applied to the usage of financial products and services. This indicator of financial health aims to capture the financial behavior of individuals according to the desirable benchmarks proposed by Ladha et al. (2017). It combines information on individuals'

4: For most of the individuals, the main sources to get resources are either wages or public subsidies. Ideally, it would be desirable to take into account the macroeconomic factors that may affect the availability of sources of income. High unemployment rates and the lack of compensatory subsidies, provided by a welfare state, prevent households that face vulnerability from having a safety net in the event that they lose their income source. This combination is common in developing countries.

financial behavior throughout four dimensions: spending, saving, lending, and planning. Our aim is to assess how people use the financial system to overcome financial vulnerability. The financial health index relies on the following hypotheses:

**Hypothesis 1: Spending**. Whether individuals are able to pay their bills on time and in full may indicate the capacity of resilience and reaction to an unexpected financial shock. If individuals are not able to balance income and expenses, by complying fully with their financial obligations, they may face problems in bouncing back quickly from a financial shock.

**Hypothesis 2: Saving**. Individuals that can build and maintain reserves may be able to use them in case of a financial shock.

**Hypothesis 3: Lending.** Having access to potential resources increases the chances of recovering from a financial shock. Sustainability of debt levels is a necessary condition for having a good credit score.

**Hypothesis 4: Planning**. Having insurance can help individuals to ease out of a financial shock. In addition, planning and prioritizing might contain information on personal attitudes towards finance.

We represent these hypotheses through four dimensions and each dimension consists of two indicators. These eight indicators together characterize individual financial behavior, our financial health index. Given the qualitative nature of the questions in the surveys, each indicator is constructed as a dummy variable that takes two possible values: zero and one. The financial health indicator for the individual *i*, which is our variable of interest, is constructed as follows:

$$FH_i = spending_i + saving_i + credit_i + planning_i \qquad (4)$$

where $spending_i$ is the dimension of balance between income and expenditure, $saving_i$ is the short-term and long-term savings, $credit_i$ includes customer behavior in terms of credit and $planning_i$ includes planning and insurance information. Therefore, $FH_i$ is calculated as the sum of the scorings (0 or 1) in the eight considered indicators (two per hypothesis), to measure financial health. It ranges from 0 (minimum) to 8 (maximum). Appendix B shows the survey questions used to assess the eight indicators. The interpretation that we give to the values of the financial health indicator is conservative, meaning that an individual with financial health equals 4 is not twice as good as an individual with financial health equals 2, but that the former shows a better financial health than the latter.

## 3.2. Empirical strategy

We aim to estimate the effect of financial health, measured through financial behavior, on financial vulnerability. As explained in our model from the previous section, the financial vulnerability of the individual *i* ($V_i$) is determined by two parts, the structural and the adjustable part. The structural part is considered to be fixed in the short-term and is captured by the individual level of education, as a measure of the human capital. Moreover, we control for socio-demographic conditions and macroeconomic factors. The adjustable part is captured by our financial health index (Eq. (1)). Since our endogenous variable is discrete, we estimate an ordered probit model for financial vulnerability as a function of financial health and a set of covariates:

$$V_i = d_j \quad if\ and\ only\ if \quad \delta_{j-1} < \beta_{FH} FH_i + X'_i \beta_X + Y'_i \beta_Y + \varepsilon_i \leq \ \delta_j \qquad (5)$$

The effect of macroeconomic variables is captured by country fixed effects, by including country dummies ($Y'$). The structural individual characteristics ($X'$) include education and income perception frequency, as well as other controls that reflect socio-demographic features such as gender, age, labor market status, household type in terms of composition and rural/urban stratum. The transitory or adjustable part, which can be modified in the short-term (Eq. (2)) by individuals, includes financial health ($FH_i$) and captures the individual financial behavior. Such behavior

is determined by the endowment of resources (i.e. absolute income level), income and expense volatility (i.e. income frequency), financial knowledge that is captured by a set of financial literacy outcomes (see Appendix C) and other individual characteristics. Since some of the variables that affect financial health also affect financial vulnerability, endogeneity between financial vulnerability and financial health might exist. Accordingly, to overcome this problem, our empirical strategy also takes into account the relationship between financial vulnerability and our variable of interest, financial health, by considering this potential endogeneity. We specify an extended ordered probit model where financial health is an endogenous covariate in the model for financial vulnerability (Eqs. (6) and (7)):

$$V_i = d_j \quad if\ and\ only\ if \quad \delta_{j-1} < \beta_{FH} FH_i + X'_i\beta_X + W'_i\beta_W + Y'_i\beta_Y + \varepsilon_i \leq \quad \delta_j \qquad (6)$$

$$FH_i = h_k \quad if\ and\ only\ if \quad \eta_{k-1} < Z'_i\beta_Z + W'_i\beta_W + \nu_i \leq \quad \eta_k \qquad (7)$$

where *X* is a subset of individual characteristics affecting only *V*, *Z* is a second subset of individual characteristics affecting only *FH*, and *W* is a subset of individual characteristics influencing both *V* and *FH*. $d_j$ and $h_k$ are unknown real numbers, and we observe instead $\delta_j$ and $\eta_k$, $j = 0,...,5$; $\delta_0$ is taken as $-\infty$ and $\delta_5$ is taken as $\infty$, $k = 0,...,8$; $\eta_0$ is taken as $-\infty$ and $\eta_8$ is taken as $\infty$. Finally, $\boldsymbol{\varepsilon}_i$ and $\boldsymbol{\nu}_i$ are unobserved normal error terms, with mean 0 and variance-covariance matrix Σ. The results of the estimates are presented in the next section.

# 4. Results

This section presents the estimates of the effects described in the previous section. First, we consider a narrow definition of financial participation, such as financial inclusion, to illustrate whether the mere decision of holding a financial product has an effect on financial vulnerability. Second, we build on the concept of financial participation by incorporating a more comprehensive definition that includes the outcome and individual behavior associated with the usage of financial products (i.e. financial health), as described and calculated in the previous section. Finally, we perform robustness checks to prove the soundness of our aggregation strategy regarding the construction of the financial health index.

## 4.1. Main results

As a baseline analysis, we quantify the effect of participation in the financial system on financial vulnerability through financial inclusion. Table 4.1 shows the results obtained from the estimation of Eqs. (5), (6), and (7) using financial inclusion, as a measurement of the financial participation, instead of financial health as our variable of interest. Columns (1) to (3) in Table 4.1 present the estimates for Eq. (5). Columns (4) to (6) in Tables 4.1 and 4.2 show the estimates from Eqs. (6) and (7), for the extended ordered probit. Column (1) points out that financial inclusion has a positive and significant effect on reducing financial vulnerability. Figure 4.1 presents the marginal effects of financial inclusion on financial vulnerability, together with the 95 percent confidence interval. A financially included individual reduces the probability of being in extreme financial vulnerability (below a week) by above 30 percentage points with respect to other individuals with the same characteristics and financial vulnerability level, but who are financially excluded. This probability decreases nearly 3 percentage points for the vulnerability category 'between 1 week and 1 month'. The impact of financial inclusion for the rest of the categories of financial vulnerability is similar and increases the respective probability by around 3 percentage points.

Table 4.1 **ESTIMATE RESULTS. VARIABLE OF INTEREST: FINANCIAL VULNERABILITY**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| **Dependent variable: Financial vulnerability** | | | | | | |
| **Financial inclusion (Base: Excluded)** | | | | | | |
| Included | 0.4105*** | 0.2528*** | 0.2888*** | 1.3591*** | 1.0794*** | 1.2137*** |
| **Gender (Base: Man)** | | | | | | |
| Woman | - | -0.1072*** | -0.1138*** | - | -0.0659** | -0.0647** |
| Age | - | 0.0049*** | 0.0036*** | - | 0.0044*** | 0.0031*** |
| **Education level (Base: Primary Education)** | | | | | | |
| Secondary Education | - | 0.3525*** | 0.3250*** | - | 0.2766*** | 0.2335*** |
| University Education | - | 0.6407*** | 0.6337*** | - | 0.4482*** | 0.4059*** |
| **Employment status (Base: Employed)** | | | | | | |
| Unemployed | - | -0.2037** | -0.1963** | - | -0.1142 | -0.0871 |
| Homemakers | - | -0.0839* | -0.0610 | - | 0.0387 | 0.0768 |
| Disabled | - | -0.1703 | -0.1724 | - | 0.0130 | 0.0414 |
| Retired | - | -0.0425 | -0.0597 | - | -0.0417 | -0.0596 |
| Students | - | -0.2348*** | -0.2495*** | - | -0.1448** | -0.1428** |
| Others | - | -0.0811 | -0.0961 | - | 0.0206 | 0.0187 |
| **Household composition (Base: Single person)** | | | | | | |
| With partner | - | 0.0716 | 0.0830 | - | 0.0972 | 0.1105 |
| With children | - | -0.0707 | -0.0870 | - | -0.0658 | -0.0794 |
| With partner and children | - | -0.0438 | -0.0330 | - | -0.0342 | -0.0219 |
| **Regular household income (Base: No)** | | | | | | |
| Regular income | - | 0.3048*** | 0.2545*** | - | 0.1665*** | 0.0969*** |
| Unknown | - | 0.2444* | 0.2034 | - | 0.2374* | 0.1915 |
| **Household location (Base: Urban)** | | | | | | |
| Rural | - | -0.0033 | 0.0172 | - | 0.0770** | 0.1053*** |
| **Country (Base: Peru)** | | | | | | |
| Bolivia | - | - | 0.0369 | - | - | 0.0287 |
| Colombia | - | - | -0.0418 | - | - | -0.0729* |
| Ecuador | - | - | -0.3337*** | - | - | -0.3355*** |
| Chile | - | - | 0.1293** | - | - | 0.1207*** |
| | | | | | | |
| Corr(ε,ν) | - | - | - | -0.7160*** | -0.5513*** | -0.6206*** |
| Log-likelihood | -7,436.00 | -7,265.70 | -7,213.11 | -10,356.87 | -10,290.56 | -10,225.86 |
| Observations | 4,954 | 4,954 | 4,954 | 4,954 | 4,954 | 4,954 |

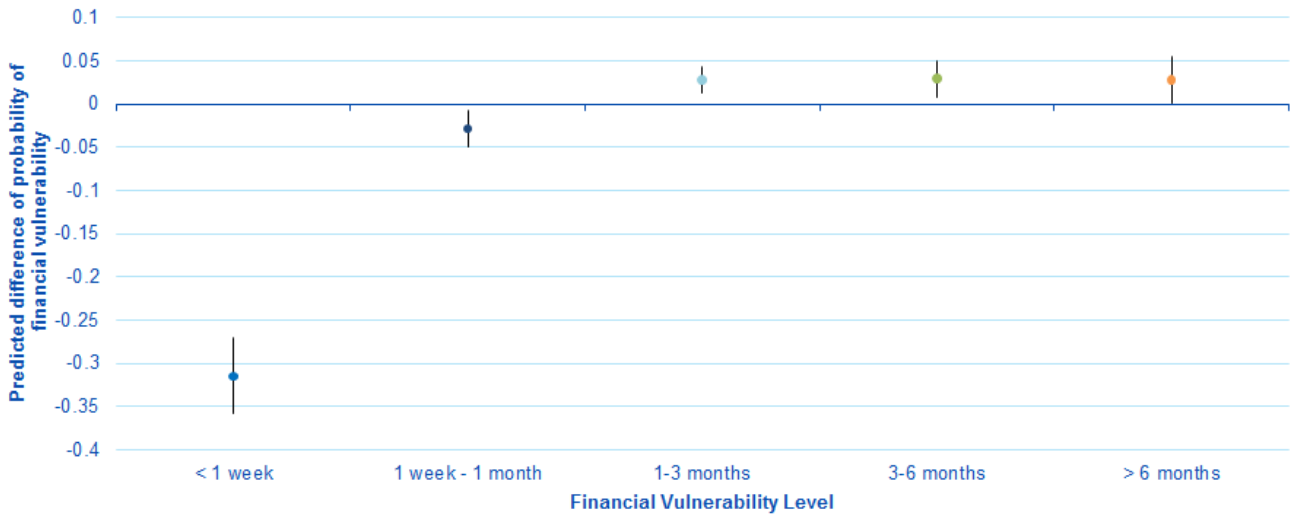
Note: The estimates are controlled by robust standard errors and we have included weights for individuals in the estimation process. * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.
Source: BBVA Research

Table 4.2 **ESTIMATE RESULTS. VARIABLE OF INTEREST: FINANCIAL INCLUSION**

| | (4) | (5) | (6) |
|---|---|---|---|
| **Dependent variable: Financial inclusion** | | | |
| **Household income level (Base: Lowest level)** | | | |
| Low level | 0.1833*** | 0.1565** | 0.1671** |
| Low-medium level | 0.3477*** | 0.3458*** | 0.3877*** |
| Medium level | 0.6644*** | 0.6834*** | 0.7151*** |
| High-medium level | 1.0267*** | 1.0418*** | 1.0802*** |
| High level | 0.9998*** | 0.9519*** | 0.9867*** |
| Highest level | 1.9728*** | 1.9641*** | 1.9264*** |
| Unknown level | 0.5179*** | 0.4910*** | 0.4894*** |
| **Regular household income (Base: No)** | | | |
| Regular income | 0.3353*** | 0.2439*** | 0.2443*** |
| Unknown | 0.1156 | -0.0409 | -0.0186 |
| **Financial literacy (Base: 0 = Wrong answer)** | | | |
| Numeracy | 0.0905** | 0.0957** | 0.0951** |
| Inflation | 0.0194 | -0.0078 | 0.0116 |
| Lending interest rate | 0.1572*** | 0.1778*** | 0.1457** |
| Saving interest rate | 0.3475*** | 0.3708*** | 0.3548*** |
| Compound interest rate | 0.1415*** | 0.1431*** | 0.1356*** |
| **Employment status (Base: Employed)** | | | |
| Unemployed | -0.1718** | -0.1117 | -0.1104 |
| Homemakers | -0.3062*** | -0.3390*** | -0.3343*** |
| Disabled | -0.3367* | -0.3911* | -0.3753* |
| Retired | 0.0857 | 0.0601 | 0.0623 |
| Students | -0.2352*** | -0.1681** | -0.1695** |
| Others | -0.2326 | -0.2645 | -0.2617 |
| **Household composition (Base: Single person)** | | | |
| With partner | -0.1157 | -0.1908 | 0.01977* |
| With children | -0.1567** | -0.1131 | -0.1138 |
| With partner and children | -0.2207*** | -0.2002** | -0.2040** |
| **Household location (Base: Urban)** | | | |
| Rural | -0.0935** | -0.1305*** | -0.1257*** |
| | | | |
| Log-likelihood | -10,356.87 | -10,290.56 | -10,225.86 |
| Observations | 4,954 | 4,954 | 4,954 |

Note: The estimates are controlled by robust standard errors and we have included weights for individuals in the estimation process.
* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.
Source: BBVA Research

Figure 4.1 **MARGINAL EFFECTS OF FINANCIAL INCLUSION ON FINANCIAL VULNERABILITY**




Note: The figure shows the estimated marginal effects from column (6) in Table 4.1 in dots and 95% confidence interval in solid line controlled by robust standard errors.
Source: BBVA Research and CAF

Since our goal is to test if the added value of participating in the financial system derives from financial behavior rather than from merely the fact of being financially included, we run the estimates for financial health as a proxy of financial participation. We find that financial health has a positive and significant impact on financial vulnerability. Columns (1) to (3) in Table 4.3 present the estimates for Eq. (5). As we observe in the first column, higher levels of financial health (from 0 to 8) are associated with a higher probability of being better off in terms of financial vulnerability (five categories). People who exhibit a better financial behavior (i.e. those who are able to pay their bills, have savings lined up, are in a position to receive a loan, or have insurance) are less vulnerable, so they are expected to rebound from a shock at a faster pace. These effects remain stable after controlling for socio-demographic individual conditions and the macroeconomic environment (Columns (2) and (3) in Table 4.3). Our alternative specification accounts for a potential source of endogeneity between financial vulnerability and financial health in columns (4) to (6) of Table 4.3, which correspond to the estimates for Eqs. (6) and (7). The estimated correlations of the error terms of all these models are negative and statistically significant. Thus, unobserved factors, which increase the likelihood of having a higher financial health, tend to occur with unobserved factors that decrease the likelihood of having a lower financial vulnerability. Therefore, after controlling for endogeneity, individuals who are more likely to reduce their financial vulnerability are less likely to have a high financial health. These models also show a stronger effect of our variable of interest on financial vulnerability. The magnitude of the estimated coefficients is approximately double.

Figure 4.2 shows the marginal effects of the financial health indicator on financial vulnerability and the 95 percent confidence interval estimated in Column (6) of Table 4.3. The impact of financial health on financial vulnerability is higher than that obtained for financial inclusion. The results suggest a highly significant reduction of the estimated probability of being in high financial vulnerability status (below a week) as financial health increases. The estimated probability reduces from 0.61 when the individual indicates the lowest level of financial health to 0.016 when the individual shows the highest level. Moreover, the marginal effect of financial health on financial vulnerability shows a convex shape, suggesting the remarkable potential gains of increasing financial health to overcome high financial vulnerability, especially for those who are labeled as highly vulnerable. Figure 4.2a shows that increasing the

financial health indicator from 0 to 1 implies a reduction of the estimated probability of being highly vulnerable of above 20 percentage points (below 0.4). A change in the indicator from 0 to 5 represents a more than 50 percentage points decrease in the aforementioned probability (up to 0.08).

For those consumers with financial vulnerability (between one week and three months), the results confirm the beneficial effects of financial health in two different ways. Focusing on the probability of covering the cost of living 'between one week and a month', the marginal effects behaves in the same way as in the highly vulnerable type. In this case, the estimated probability of being in this situation decreases from 0.34 for the lowest financial health level to 0.22-0.25 for the highest levels. Such a probability reduction seems to show a linear trend. Considering the probability of covering the cost of living 'between 1 and 3 months' (Figure 4.2b), it grows from 0.24 to 0.34, and the increase exhibits a concave shape. Therefore, our results share similar qualitative conclusion about the potential gains of improving financial health for those with very low levels, as for the most vulnerable group.

The safe group (those who cover the cost of living above three months) presents a growing pattern of the marginal effect of financial health on financial vulnerability for the two categories considered, 'between 3 and 6 months' and 'above 6 months'. These effects seem to be linear and they are exhausted as we approach the highest level of financial health (Figure 4.2b). We observe that the confidence intervals also increase with the financial health level. This is due to the smaller number of observations when it comes to the highest level of financial health. In spite of these limitations, using the maximum difference of estimated probability of covering the cost of living, the comparative impact of financial health on financial vulnerability is significantly higher for the latter period than the previous one. This result, together with those of the other stages of financial vulnerability, suggests the relevant scale economies of financial health with respect to financial vulnerability.

Comparing the marginal effects of financial health with those of financial inclusion, the latter shows a more asymmetric behavior in terms of its effects on financial vulnerability. Financial inclusion has a greater effect on individuals in the highly vulnerable category than for those who are better off in terms of vulnerability. However, its impact represents only around 53 percent of the effect of financial health. [5] Being financially included is only a first stage in the financial participation process of individuals. Our results confirm that financial health is a more comprehensive factor in order to mitigate financial vulnerability and captures a greater benefit of participating in the financial system.

Another variable affecting financial vulnerability is level of education, which measures the individual's capacity to generate income. It has a positive and significant effect that increases with the educational level attained. The probability of being less vulnerable is higher for the best-educated consumers compared to those with lower levels of education and its effect remains stable after controlling for other socio-demographic variables and different specifications. Figure 4.3 presents the difference in the marginal effect and the 95 percent confidence interval of education on financial vulnerability, for estimates of Column (6) in Table 4.3. The primary level of education is considered as reference group. The results, by vulnerability categories, suggest a lower estimated probability of being in high financial vulnerability (less than 1 week) as the level of education increases. For individuals with a secondary (university) level of education, compared to primary education, the estimated probability of being highly vulnerable reduces by around 6 (10) percentage points. For individuals who can afford their living cost between a week and a month, the estimated probability of being in this category of vulnerability is reduced by 2 percentage points for secondary education and above 4 percentage points for university education. However, for individuals who can afford the cost of living between one and three months, the effect increases nearly 2 percentage points for secondary education and 3 percentage points for tertiary education. With regard to the safe group, we also observe a growing pattern of the effect of higher education on financial vulnerability for the two categories considered ('3 to 6 months' and 'more than 6 months'), that ranges between 2.8 and 5.5 percentage points. The effects of the level of

5: This effect is 26 percent for the financially safe category.

education, in this group, are not statistically different from those in the category 'between one and three months'. Confidence intervals show a similar pattern as that for the case of financial health. We observe wider confidence intervals for university education than for secondary education, because the university education category includes fewer observations than the secondary one. This interval is higher for the most financially vulnerable type of individuals.

Among the control variables related to the household, we use information of the environment in which the individual lives (i.e. rural or urban) and household composition. Household composition does not generate statistically significant (marginal) effects on financial vulnerability (Figure 4.4). However, household location affects vulnerability both directly and indirectly. While living in a rural environment affects financial health negatively (Columns (4) to (6) in Table 4.4), the effect turns into a positive when it comes to financial vulnerability (Columns (4) to (6) in Table 4.3). Figure 4.5 shows the difference in the marginal effects and the 95 percent confidence interval of household location on financial vulnerability, taking as reference group people living in urban areas. The reduction of the predicted probability is nearly 3 percentage points for individuals living in rural areas who claim that they are able to cover the cost of living less than a week. The decrease is nearly 1 percentage point for the category 'between a week and a month'. For remaining three categories of financial vulnerability (over a month), the increase of the predicted probability grows from 0.6 to 1.1 percentage points. This result may be capturing the poorer conditions to access the financial system (i.e. supply deficit of financial access points) in rural environments compared to urban areas. On the other hand, when it comes to vulnerability, rural areas tend to create stronger social networks that might possibly help in facing difficult financial situations or shocks. Social networks can be an important option outside the formal financial system for individuals to create resilience and overcome financial shocks.[6]

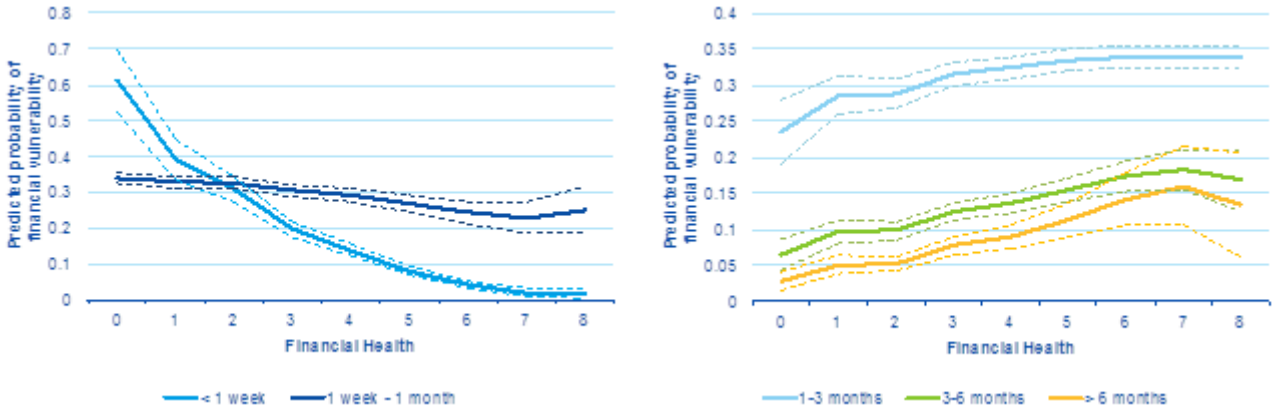
Finally, we disentangle the effect of other covariates affecting financial vulnerability through financial health. Estimates in Eq. (7), shown in Table 4.4, suggest that income structure (i.e. income level and frequency) positively and increasingly affects financial health. Although both regularity of income perception and income level affect financial health, we observe only significant indirect effects.[7] In terms of marginal effects (Figure 4.6), regularity of income does not generate a statistically significant effect on financial vulnerability for those with the highest financial vulnerability status (less than one week). Having a regular income yields a probability reduction of being vulnerable that is significantly different from zero (1.8 percentage points for the category 'between a week and a month'). The effects in probability for the rest of financial vulnerability categories and the marginal effects of having a regular income grow from 1.6 to 2.2 percentage points. The marginal effect of household income level follows a similar pattern as financial health that can be observed by comparing Figures 4.2 and 4.7. The probability of being in a high level of financial vulnerability (between a week and a month) decreases as the household income level increases. The accumulated reduction of the probability of being in this level is nearly 9 percentage points between the lowest and the highest income category. For those individuals categorized as safe (over 3 months), the higher the household income, the higher the probability of being in this category of financial vulnerability. The accumulated increase in probability is 3.5 percentage points for the category 'between 1 and 3 months', above 7.3 percentage points for the category 'between 3 and 6 months', and nearly 11 points for the category of 'more than 6 months'.

When it comes to financial literacy, which represents the skills to manage personal resources by making more appropriate financial choices, a knowledge of basic financial terms is important (Lusardi and Mitchell, 2007, 2014). We find that financial literacy variables exhibit a positive and significant effect on financial health in all its forms, except for inflation, which appears as non-significant (column (6) in Table 4.3). Knowledge of interest rates appears as the most important factor among financial literacy skills affecting financial health. Appendix C presents a detailed

6: Financially excluded consumers, who are very numerous in developing countries, earn only wage income and consume all of their income each period. For this type of consumers, social networks and the informal financial system are the only strategies to manage personal finance (i.e. borrowing from family or friends, alternative asset purchases, use of informal lenders).
7: We include in the financial vulnerability equation income regularity but the coefficient is not significant after controlling for the potential endogeneity. A similar argument may apply to income level. However, since educational level should be a proxy of the individual income level, we only include income in the financial health specification that has an obvious direct effect and not for the specification of financial vulnerability.

explanation of the five financial literacy questions used in our analysis. Figure 4.8 reflects the different effects on financial vulnerability between an individual who provided the right answer to the respective question and others who did not. Estimates and the 95 percent confidence interval are shown in column (6) of Table 4.3. Among individuals who answer the five questions correctly, the accumulated reduction of the predicted probability of financial vulnerability is above 3.2 percentage points for individuals belonging to the financial vulnerability category 'between a week and a month'. For those who could cover the cost of living 'between 1 and 3 months', the predicted probability accumulated increase is above 2.4 percentage points. For the category 'between 3 and 6 months', the aggregated effect increases over 3.1 percentage points. Finally, the effect is nearly 4 percentage points for people who can afford the living cost for more than 6 months.[8]

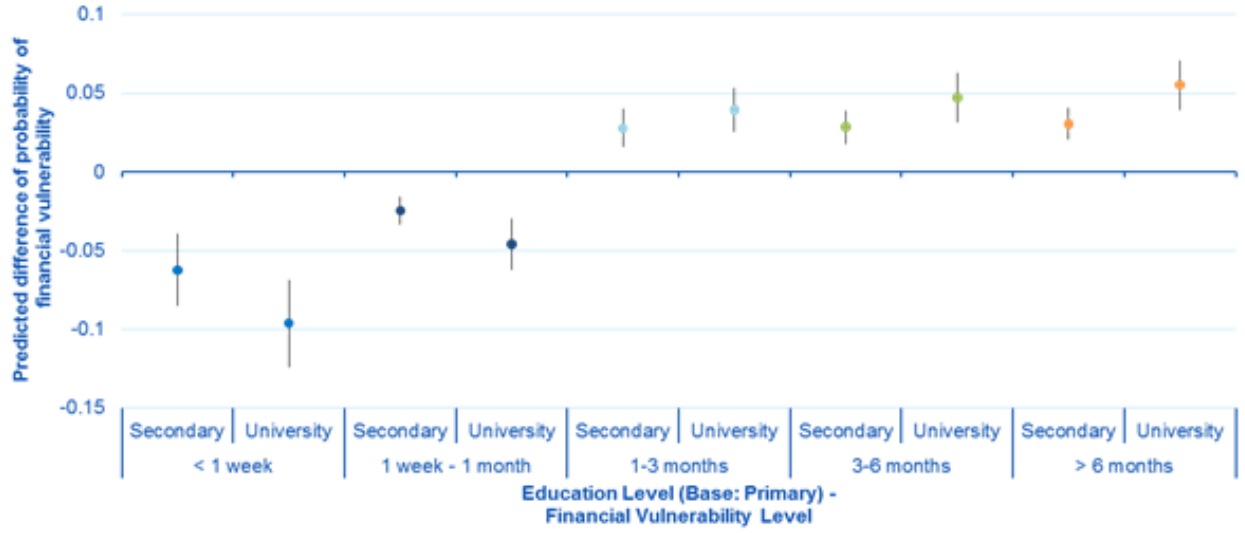
Figure 4.2 **MARGINAL EFFECTS OF FINANCIAL HEALTH ON FINANCIAL VULNERABILITY**




Note: The figures show the marginal effects estimated from column (6) in Table 4.3 in solid line and 95% confidence interval in dash line controlled by robust standard errors. The increase of the confidence interval from the highest level of financial health (level 8) in some cases is due to the limited number of observations.
Source: BBVA Research and CAF

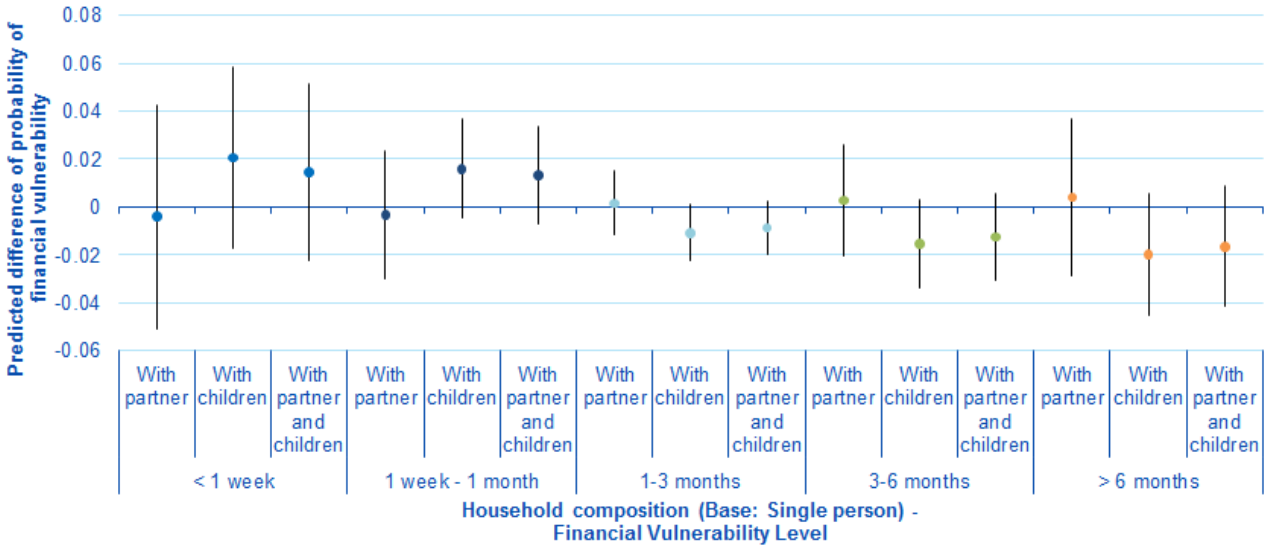
8: By financial literacy question, the composition of the aggregated effects is stable, regardless of the financial vulnerability level. Above 40 percent of the contribution comes from the saving interest rate question, around 25 percent comes from the lending interest rate, near 23 percent from the compound interest rate question, below 10 percent from numeracy question and below one percent from the inflation question.

Figure 4.3 **DIFFERENCE OF MARGINAL EFFECTS OF EDUCATION ON FINANCIAL VULNERABILITY**



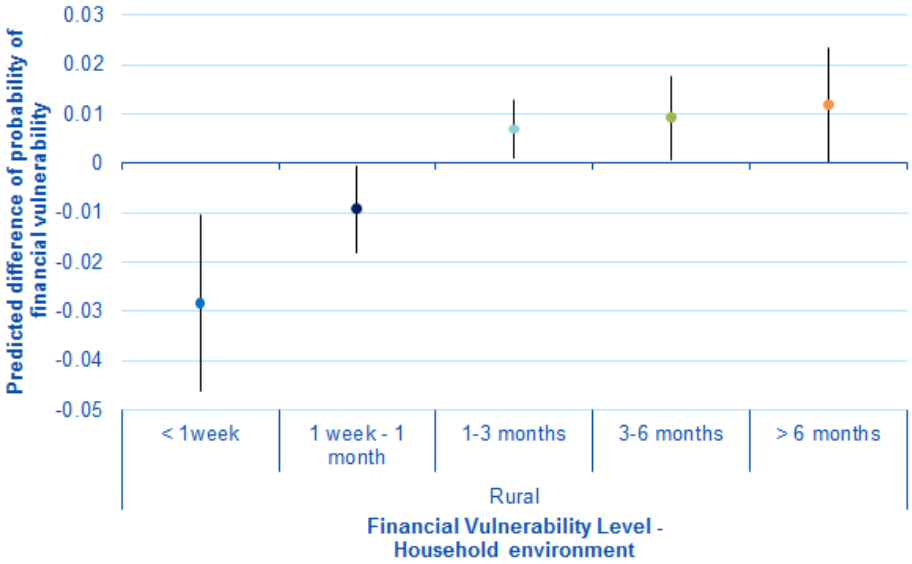

Note: The figure shows the estimated marginal effects from column (6) in Table 4.3 in dots and 95% confidence interval in solid line controlled by robust standard errors.
Source: BBVA Research and CAF

Figure 4.4 **DIFFERENCE OF MARGINAL EFFECTS OF HOUSEHOLD COMPOSITION ON FINANCIAL VULNERABILITY**



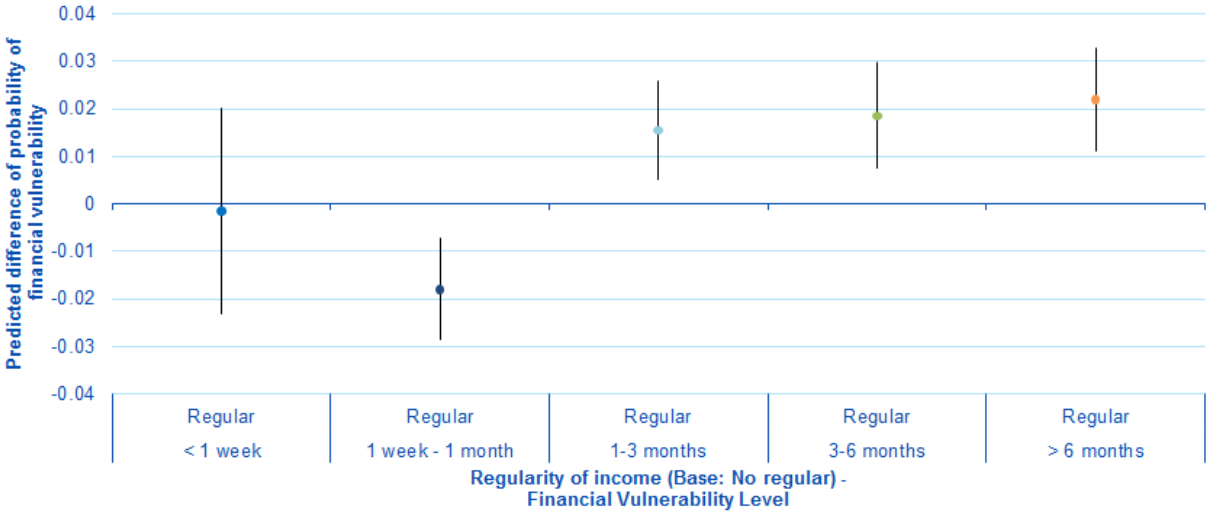

Note: The figure shows the estimated marginal effects from columns (6) in Table 4.3 in dots and 95% confidence interval in solid line controlled by robust standard errors.
Source: BBVA Research and CAF

Figure 4.5 **DIFFERENCE OF MARGINAL EFFECTS OF HOUSEHOLD LOCATION ON FINANCIAL VULNERABILITY**



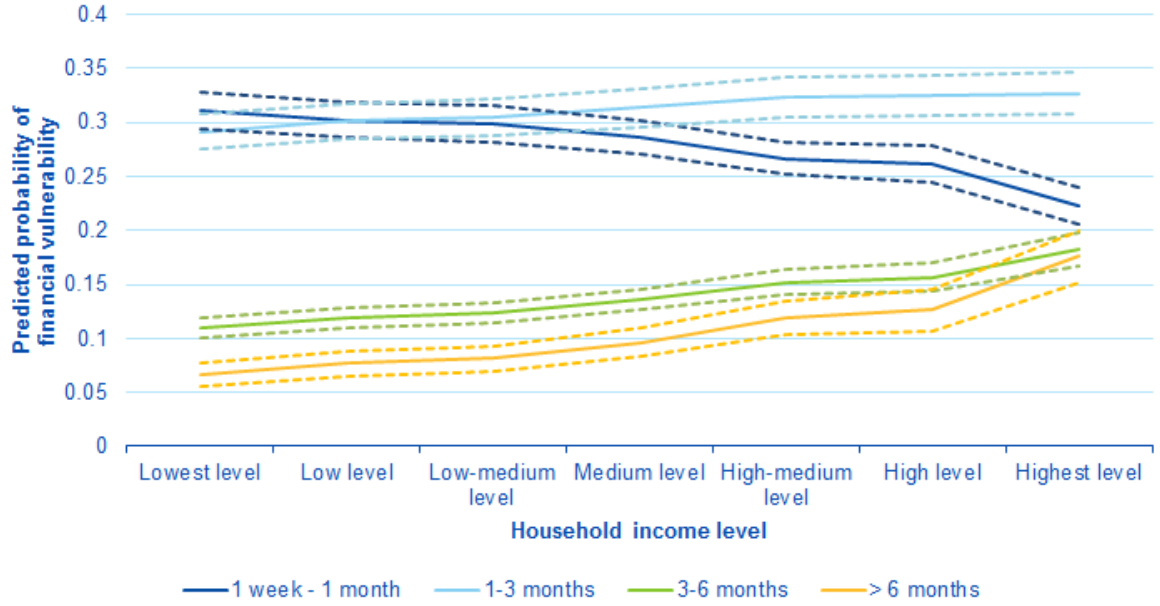

Note: The figure shows the estimated marginal effects from column (6) in Table 4.3 in dots and 95% confidence interval in solid line controlled by robust standard errors.
Source: BBVA Research and CAF

Figure 4.6 **DIFFERENCE OF MARGINAL EFFECTS OF REGULARITY OF INCOME ON FINANCIAL VULNERABILITY**



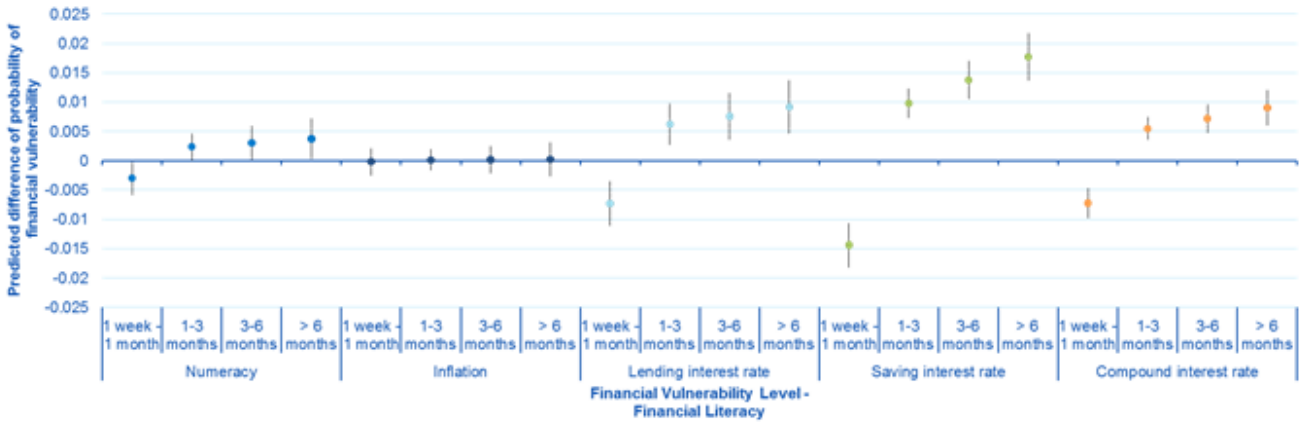

Note: The figure shows the estimated marginal effects from column (6) in Table 4.3 in dots and 95% confidence interval in solid line controlled by robust standard errors.
Source: BBVA Research and CAF

Figure 4.7 **MARGINAL EFFECTS OF HOUSEHOLD INCOME LEVEL ON FINANCIAL VULNERABILITY**




Note: The figures show the marginal effects estimated from column (6) in Table 4.3 in solid line and 95% confidence interval in dash line controlled by robust standard errors. The increase of the confidence interval from the highest level of financial health (level 8) in some cases is due to the limited number of observations.
Source: BBVA Research and CAF

Figure 4.8 **DIFFERENCE OF MARGINAL EFFECTS OF FINANCIAL LITERACY ON FINANCIAL VULNERABILITY**




Note: The figure shows the estimated marginal effects from column (6) in Table 4.3 in dots and 95% confidence interval in solid line controlled by robust standard errors.
Source: BBVA Research and CAF

Table 4.3 **ESTIMATE RESULTS. VARIABLE OF INTEREST: FINANCIAL VULNERABILITY**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| **Dependent variable: Financial vulnerability** | | | | | | |
| **Financial health (Base: 0 = Lowest level)** | | | | | | |
| 1 | 0.3153*** | 0.2719*** | 0.2805*** | 0.5967*** | 0.5236*** | 0.5640*** |
| 2 | 0.3799*** | 0.2869*** | 0.3004*** | 0.8546*** | 0.7160*** | 0.7843*** |
| 3 | 0.6541*** | 0.5097*** | 0.5203*** | 1.2482*** | 1.0682*** | 1.1488*** |
| Medium level | 0.7851*** | 0.6114*** | 0.6277*** | 1.5046*** | 1.2851*** | 1.3873*** |
| 5 | 0.9854*** | 0.7778*** | 0.7944*** | 1.8291*** | 1.5690*** | 1.6861*** |
| 6 | 1.1838*** | 0.9374*** | 0.9487*** | 2.1906*** | 1.8812*** | 2.0103*** |
| 7 | 1.3602*** | 1.0559*** | 1.0591*** | 2.5405*** | 2.1663*** | 2.3105*** |
| Highest level | 1.3306*** | 0.9916*** | 0.9935*** | 2.7352*** | 2.2899*** | 2.4567*** |
| **Gender (Base: Man)** | | | | | | |
| Woman | - | -0.0955*** | -0.1001*** | - | -0.0707** | -0.0711** |
| Age | - | 0.0045*** | 0.0033** | - | 0.0042*** | 0.0030** |
| **Education level (Base: Primary Education)** | | | | | | |
| Secondary Education | - | 0.3005*** | 0.2790*** | - | 0.2538*** | 0.2234*** |
| University Education | - | 0.4994*** | 0.5089*** | - | 0.3773*** | 0.3665*** |
| **Employment status (Base: Employed)** | | | | | | |
| Unemployed | - | -0.1243 | -0.1365* | - | -0.0175 | -0.0063 |
| Homemakers | - | -0.0391 | -0.0241 | - | 0.0630 | 0.0921* |
| Disabled | - | -0.0370 | -0.0602 | - | 0.1875 | 0.2024 |
| Retired | - | -0.0531 | -0.0682 | - | -0.0690 | -0.0854 |
| Students | - | -0.1957*** | -0.2146*** | - | -0.1355** | -0.1441** |
| Others | - | 0.0051 | -0.0161 | - | 0.1109 | 0.1028 |
| **Household composition (Base: Single person)** | | | | | | |
| With partner | - | 0.0372 | 0.0453 | - | 0.0116 | 0.0163 |
| With children | - | -0.0698 | -0.0872 | - | -0.0660 | -0.0816 |
| With partner and children | - | -0.0586 | -0.0501 | - | -0.0659 | -0.059 |
| **Regular household income (Base: No)** | | | | | | |
| Regular income | - | 0.2232*** | 0.1806*** | - | 0.0683 | 0.0055 |
| Unknown | - | 0.1375 | 0.1062 | - | 0.0012 | -0.0537 |
| **Household location (Base: Urban)** | | | | | | |
| Rural | - | 0.0218 | 0.0453 | - | 0.0845** | 0.1128*** |
| **Country (Base: Peru)** | | | | | | |
| Bolivia | - | - | 0.0241 | - | - | 0.0180 |
| Colombia | - | - | 0.0448 | - | - | -0.0020 |
| Ecuador | - | - | -0.2883*** | - | - | -0.3119*** |
| Chile | - | - | 0.1134** | - | - | 0.0961** |
| | | | | | | |
| Corr(ε,ν) | - | - | - | -0.3724*** | -0.2926*** | -0.3333*** |
| Log-likelihood | -7,248.61 | -7,156.87 | -7,115.56 | -16,744.58 | -16,705.10 | -16,658.19 |
| Observations | 4,954 | 4,954 | 4,954 | 4,954 | 4,954 | 4,954 |

Note: The estimates are controlled by robust standard errors and we have included weights for individuals in the estimation process.
* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.
Source: BBVA Research

Table 4.4 **ESTIMATE RESULTS. VARIABLE OF INTEREST: FINANCIAL HEALTH**

| | (4) | (5) | (6) |
|---|---|---|---|
| **Dependent variable: Financial health** | | | |
| **Household income level (Base: Lowest level)** | | | |
| Low level | 0.2420*** | 0.2320*** | 0.2379*** |
| Low-medium level | 0.3217*** | 0.3153*** | 0.3363*** |
| Medium level | 0.6209*** | 0.6172*** | 0.6352*** |
| High-medium level | 1.0081*** | 0.9994*** | 1.0225*** |
| High level | 1.1377*** | 1.1185*** | 1.1299*** |
| Highest level | 1.8324*** | 1.8189*** | 1.8052*** |
| Unknown level | 0.5416*** | 0.5309*** | 0.5274*** |
| **Regular household income (Base: No)** | | | |
| Regular income | 0.4522*** | 0.4368*** | 0.4361*** |
| Unknown | 0.4190*** | 0.4345*** | 0.4402*** |
| **Financial literacy (Base: 0 = Wrong answer)** | | | |
| Numeracy | 0.0761** | 0.0790** | 0.0749** |
| Inflation | 0.0071 | -0.0046 | 0.0043 |
| Lending interest rate | 0.1893*** | 0.1970*** | 0.1869*** |
| Saving interest rate | 0.3345*** | 0.3394*** | 0.3368*** |
| Compound interest rate | 0.1791*** | 0.1796*** | 0.1772*** |
| **Employment status (Base: Employed)** | | | |
| Unemployed | -0.2944*** | -0.2998*** | -0.2979*** |
| Homemakers | -0.3230*** | -0.3370*** | -0.3363*** |
| Disabled | -0.6486*** | -0.7394*** | -0.7365*** |
| Retired | 0.1194* | 0.1207 | 0.1220 |
| Students | -0.1803*** | -0.1423** | -0.1427** |
| Others | -0.2752** | -0.3260** | -0.3262** |
| **Household composition (Base: Single person)** | | | |
| With partner | 0.0272 | 0.0202 | 0.0187 |
| With children | -0.1466** | -0.1202 | -0.1208 |
| With partner and children | -0.1473** | -0.1200 | -0.1225 |
| **Household location (Base: Urban)** | | | |
| Rural | -0.1042*** | -0.1234*** | -0.1220*** |
| Log-likelihood | -16,744.58 | -16,705.10 | -16,658.19 |
| Observations | 4,954 | 4,954 | 4,954 |

Note: The estimates are controlled by robust standard errors and we have included weights for individuals in the estimation process.
* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.
Source: BBVA Research

## 4.2. Sensitivity and robustness: The financial health indicator

In order to check the sensitivity of our results to different aggregation strategies when computing the financial health indicator, we perform some robustness checks. We build two alternative indicators to measure financial health, relying on more sophisticated frameworks.

The first alternative is based on the idea that financial health is a matter of achieving different objectives that are interconnected. This is associated with the idea of relative utility presented by Maslow (1943) when defining his theory of human motivation, using a list of the basic needs of adults. Based on Maslow's pyramid structure, the balance of income and expenses forms the base of the pyramid. Once income surpasses expenditures, saving

needs come to the fore on a second level of the pyramid. The creation of wealth also allows one to increase their expectations with a third level related to credit, which allows for intertemporal consumption transfer. A fourth level in the financial hierarchy is represented by a higher sophistication through planning and insurance products. This theoretical interpretation poses that the fulfillment of the dimensions or hypothesis described in Section 3.1 should have a sequential and cumulative structure. Thus, a consumer who satisfies Hypothesis 2 (i.e. saving) should previously satisfy Hypothesis 1 (i.e. spending) to some extent, because the saving dimension should contain information that is at the same time contained in the expenditure dimension. Analogously, a similar argument can be applied to the lending and planning hypotheses. Given this process, we consider that there may be a potential redundancy of information among dimensions. Therefore, we regress each dimension on the ones in previous stages (i.e. we regress saving on spending, lending on saving and spending, and so on). In order to eliminate the multiple accounting through dimensions, we take the residuals of each regression and add them up to build our financial health indicator, which now has a continuous nature. In this context, the ordered probit model for financial health (Eq. (7)) is substituted by Eq. (8) that follows a general linear model:

$$FH_i = Z'_i\beta_Z + W'_i\beta_W + \nu_i \qquad (8)$$

The second alternative consists in using a Principal Component Analysis as an alternative strategy of aggregation. This statistical multivariate procedure allows for the capture of common information contained in each dimension by using an orthogonal transformation of the factors. It creates a set of eight uncorrelated, orthogonal components where the first component retains the maximum variability from the data, the second component retains the second maximum variability of the data, and so on. We use the information in the first five components that have larger associated eigenvalues, or eigenvalues close to one. These five components account for 82 percent of the total variability in the data. The construction of this indicator is presented in Eq. (9):

$$FH_i = \sum_j \quad (w_j c_j) + u_i\,;\ \ j = 1,\ldots,5 \qquad (9)$$

where $w$ is the eigenvalue, $c$ is the component, and $u$ is an error term. Once the indicator is created, we also use the Eq. (8) structure to include it in the model for financial vulnerability.

We find that these two alternative indicators for financial health are highly correlated to the simpler indicator proposed in Section 3.1 (0.93 and 0.96, respectively). Moreover, estimations obtained for the models of financial vulnerability and financial health show similar results when using these two alternative measures of financial health. Tables 4.5 and 4.6 show the estimates of the extended ordered probit model for financial vulnerability using these two alternatives.[9]

9: Further results about other models are available upon request.

Table 4.5 **ESTIMATE RESULTS. VARIABLE OF INTEREST: FINANCIAL VULNERABILITY**

| | Alternative 1 | Alternative 2 |
|---|---|---|
| **Dependent variable: Financial vulnerability** | | |
| Financial health | 0.4338*** | 0.6979*** |
| **Gender (Base: Man)** | | |
| Woman | -0.0666** | -0.0686** |
| Age | 0.0027** | 0.0027** |
| **Education level (Base: Primary Education)** | | |
| Secondary Education | 0.2303*** | 0.2332*** |
| University Education | 0.3840*** | 0.3812*** |
| **Employment status (Base: Employed)** | | |
| Unemployed | -0.0270 | 0.0056 |
| Homemakers | 0.0822* | 0.0721 |
| Disabled | 0.1304 | 0.1691 |
| Retired | -0.0246 | -0.1031 |
| Students | -0.1477** | -0.1799*** |
| Others | 0.1193 | 0.0915 |
| **Household composition (Base: Single person)** | | |
| With partner | -0.0042 | 0.0028 |
| With children | -0.1011 | -0.0696 |
| With partner and children | -0.0806 | -0.0496 |
| **Regular household income (Base: No)** | | |
| Regular income | 0.0424 | -0.0357 |
| Unknown | -0.0462 | -0.1079 |
| **Household location (Base: Urban)** | | |
| Rural | 0.0842** | 0.0985*** |
| **Country (Base: Peru)** | | |
| Bolivia | 0.0562 | 0.0402 |
| Colombia | -0.0758 | 0.0195 |
| Ecuador | -0.2928*** | -0.2638*** |
| Chile | 0.2001*** | 0.1078** |
| | | |
| Corr($\varepsilon$,$\nu$) | -0.3640*** | -0.3605*** |
| Log-likelihood | -15,344.38 | -13,008.93 |
| Observations | 4,954 | 4,954 |

Note: The estimates are controlled by robust standard errors and we have included weights for individuals in the estimation process.
* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.
Source: BBVA Research

Table 4.6 **ESTIMATE RESULTS. VARIABLE OF INTEREST: FINANCIAL HEALTH**

| | Alternative 1 | Alternative 2 |
|---|---|---|
| **Dependent variable: Financial health** | | |
| **Household income level (Base: Lowest level)** | | |
| Low level | 0.3313*** | 0.1761*** |
| Low-medium level | 0.5472*** | 0.2334*** |
| Medium level | 0.9125*** | 0.4364*** |
| High-medium level | 1.4334*** | 0.7581*** |
| High level | 1.5050*** | 0.8417*** |
| Highest level | 2.0831*** | 1.3664*** |
| Unknown level | 0.7587*** | 0.4093*** |
| **Regular household income (Base: No)** | | |
| Regular income | 0.4375*** | 0.3784*** |
| Unknown | 0.4742*** | 0.3860*** |
| **Financial literacy (Base: 0 = Wrong answer)** | | |
| Numeracy | 0.1728*** | 0.0341 |
| Inflation | 0.0793** | -0.0037 |
| Lending interest rate | 0.1050* | 0.1194*** |
| Saving interest rate | 0.2969*** | 0.2268*** |
| Compound interest rate | 0.1576*** | 0.1401*** |
| **Employment status (Base: Employed)** | | |
| Unemployed | -0.2526*** | -0.2524*** |
| Homemakers | -0.3309*** | -0.2227*** |
| Disabled | -0.6920*** | -0.4929*** |
| Retired | 0.0441 | 0.1274** |
| Students | -0.1503** | -0.0576 |
| Others | -0.3740** | -0.2376** |
| **Household composition (Base: Single person)** | | |
| With partner | 0.0816 | 0.0342 |
| With children | -0.1562* | -0.1091* |
| With partner and children | -0.1114 | -0.1035* |
| **Household location (Base: Urban)** | | |
| Rural | -0.1330*** | -0.0798*** |
| Log-likelihood | -15,344.38 | -13,008.93 |
| Observations | 4,954 | 4,954 |

Note: The estimates are controlled by robust standard errors and we have included weights for individuals in the estimation process.
* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.
Source: BBVA Research

## 5. Conclusions and discussion

Financial health is a topic of concern among researchers and policymakers. Individuals in emerging countries are usually more exposed to financial shocks, in part, due to the lack of a welfare state and effective consumer protection laws. For those individuals who face financial vulnerability, the negative effects of this situation can be immediately transferred to the household, and therefore requires attention. This paper studies the effect of financial health on vulnerability. It relies on a simple theoretical framework that extends mainstream theoretical models to account for the effect of different degrees of participation in the financial system, measured through financial health (i.e. financial behavior). Our approach goes beyond financial inclusion, since it defines the participation in the formal financial system not only taking into account the possession of financial products (single binary response) but also the financial behavior related to such products. This framework enables us to build tangible measures of consumer financial health, and estimate to what extent financial health affects financial vulnerability for adults in five Latin American countries. According to their capacity to face a financial shock with their own resources, we find that the vast majority of the population, in our sample, is financially vulnerable. When it comes to financial health, our estimates show that higher levels of financial health are associated with a higher probability of being better off in terms of financial vulnerability. Consumers who are able to pay their bills, have savings lined up, are in a position to receive a loan, or have insurance, are less vulnerable. The probability of being less vulnerable is higher for the best-educated consumers compared to those with lower education levels. Moreover, we find that financial literacy exhibits a positive and significant effect on financial health in all its forms except for knowledge about inflation. Financial education programs are essential to increasing financial knowledge and improving financial behavior and awareness.

The effect of income flows on financial vulnerability is not straightforward. Regularity of income and income level affect vulnerability only indirectly through financial health. We do not observe a direct effect of income regularity on financial vulnerability, after controlling for endogeneity. Rural areas, exhibit a poorer financial health but better financial resilience compared to urban areas. It may be reflecting the weaker engagement of these areas with the financial system. At the same time, the stronger role of social networks in rural areas might eventually help in facing difficult financial situations or shocks. Social networks may be an important option outside the formal financial system for individuals to create financial resilience or overcome financial shocks. Further research includes studying the role of the informal financial system and social networks to overcome vulnerability. Formal financial system and informal options are the two channels for financially included consumers, and informal options (i.e. family and friends, informal lenders, etc.) mean an additional support. For rule-of-thumb consumers, informal networks are the only option.

Finally, although we do not find a significant effect of the household composition, more research is needed to understand the mechanism. Topics for further research include incorporating a temporal dimension. Family factors can affect financial health, especially those relating to past history. The existence of persistence in terms of financial attitudes and financial behavior may constitute important factors. Almenberg et al. (2018) point out that there is evidence that social norms have an influential effect on borrowing decisions and that this can discourage debt, one of the main reasons for this being the intergenerational transmission of behavior and attitudes toward debt.

Although some of the factors behind financial health have been disentangled, how to promote healthy financial behavior is not straightforward. The global increase in longevity will rise the need of individuals for smoothing consumption. Moreover, form the supply side, the capacity to analyze new and huge amounts of data, as well as new ways of daily interaction with the financial system, make consumers more engaged with the financial system and able to face more financial opportunities and challenges. Great opportunities are arising for improving financial health in the digital age. All processes that can be automatized such as implementing a system for employees to automatically make a minimum monthly contribution toward their savings account are immediate options to improve

vulnerability. Simple commands and rules provided to an algorithm might be able to improve financial resilience. Algorithms lack the emotional element associated with spending behavior that may lead to irrational choices in terms of consumption and savings. Innovations brought by digitalization can also improve the transparency of financial institutions and, in particular, facilitate access to customize financial information that improves the level of financial literacy and awareness, especially for the most vulnerable (as currently occurs in healthcare). For researchers and financial industry, digitization is enabling the generation of metrics that provide a better diagnosis and understanding of financial health thanks to the analysis of microdata. The detailed knowledge provided by these microdata of a client's financial situation is a cornerstone for improving knowledge and for the design of the new financial services. In addition, this process will drive better financial inclusion as consumers and small and medium-sized enterprises will be more aware and have better information to determine which financial products best fit their needs. The customization of financial products and services that can be provided by a bank employee in-branch could mimic customized treatment that a family doctor can offer a patient, and the role of the personal financial adviser could be associated with that of a specialized doctor. This analogy may also be applied to requirements, especially ethics. Just as the World Medical Association published an International Code of Medical Ethics in 1949, following bad practices seen during the Second World War, it is not unlikely that there will be a demand for a similar code of ethics for professionals in the financial system, with the aim of improving the well-being of society. Financial advice associated with financial health objectives might mitigate the lack of financial literacy since financial advising could be viewed as having the goal of improving the financial health of customers.

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# Appendix A: Data

Random samples conducted by CAF are conditioned by gender, socio-economic level, urban and rural.[10] Stratified random sampling process for each country can be found in Table A.1.

Table A.1 **Summary table of country samples**

| Country | Total | Urban | Rural | Men | Women | Aged 18-24 | Aged 25-39 | Aged >39 |
|---|---|---|---|---|---|---|---|---|
| Argentina | 1,224 | 1,113 | 111 | 623 | 601 | 368 | 477 | 379 |
| Bolivia | 1,200 | 780 | 420 | 600 | 600 | 240 | 481 | 479 |
| Chile | 1,224 | 1,063 | 161 | 626 | 598 | 192 | 360 | 672 |
| Colombia | 1,261 | 1,001 | 260 | 586 | 675 | 206 | 410 | 645 |
| Ecuador | 1,200 | 810 | 390 | 599 | 601 | 249 | 474 | 477 |
| Paraguay | 1,203 | 963 | 240 | 572 | 631 | 473 | 483 | 247 |
| Peru | 1,210 | 937 | 273 | 603 | 607 | 245 | 483 | 482 |
| **Total** | **8,522** | **6,667** | **1,855** | **4,209** | **4,313** | **1,973** | **3,168** | **3,381** |

Source: CAF

The size of the national sample is approximately 1,200 surveys per country, with a margin of error of +/-2.8%. Surveys were carried out face-to-face and were designed to be representative at a national level, following the recommendations and measurements used by the OECD (2011 and 2015). The fieldwork was carried out from November 8 to December 5, 2013, in Bolivia, Colombia, Ecuador, and Peru; from July 4 to August 9, 2016, in Chile; from March 14 to April 19, 2017, in Argentina; and from March 4 to August 25 in Paraguay.

The survey structure includes a total of 33 to 35 questions about financial behaviors, knowledge, and attitudes, as well as other questions about financial inclusion and socio-demographic information. Nine questions were designed to measure financial behavior and gather information on financial control, covering spending, selection and use of financial products, and short- and long-term financial planning. In order to gather information on financial knowledge, the survey includes eight questions related to knowledge of simple and compound interest, inflation, the value of money over time, risk and return, and risk diversification. In the case of financial attitudes, four questions touch on respondents' saving versus spending propensities, temporary preferences, and risk profiles. For financial inclusion, surveys include questions on knowledge of financial products, holding and using products (savings, credit, and insurance), and saving habits. Finally, to identify the socio-demographic profile of individuals, surveys include information on variables such as age, gender, education, work, and income.

We do not include the surveys of Argentina and Paraguay in this document due to differences in data availability that prevent us from calculating our financial health indicator in a homogeneous way. Appendix B provides further details.

10: The survey company Ipsos uses the same data for the seven countries monitored.

## Appendix B: Financial health dimensions

The structure of the measure of financial health is divided into four dimensions following the proposal of the Center for Financial Services Innovation (CFSI). Following Parker et al. (2016), we can identify dimension on the balance between income and expenditure, as well as the saving, lending, and planning dimensions.

Dimension on the balance between income and expenditure measures the balance between income and expenditure and constitutes a first basic approximation of financial health. This behavior focuses on the short term and consists of two factors. The first factor analyzes the strict relationship between the resources the individual obtains and the amount of money the individual needs over a short period of time (e.g., a month), in relation to the concept of liquidity. Given the first question in Table B.1, the population surveyed is divided into two groups: individuals who manage to earn more or equal than they spend, generating liquidity (in the case income and expenditure coincide there is not liquidity generation). In this case, the factor takes value one. On the other hand, in the second group, individuals spend more than they earn in the period, thereby reducing their available liquidity; for this situation, the factor takes value zero.

In the latter case, the situation may unfold according to the previous liquidity situation, resulting in the second factor, the payment of bills on time and in full. Liquidity generation takes value one in this factor, by own definition. If the individual solves the problem of higher expenses than income by meeting payment conditions on time and in full, then the indicator takes the value one; if not, the value is zero.

Table B.1 **DESCRIPTION OF DIMENSION ON BALANCE BETWEEN INCOME AND EXPENDITURE** (EXPENDITURE HYPOTHESIS)

| Factor | Question |
|---|---|
| Expenditure less than income | Sometimes people find that their income does not quite cover their expenses. In the last 12 months, has this happened to you? |
| Pay bills on time and in full | What did you do to make ends meet the last time this happened? Did you do anything else? |

Source: CAF and CFSI

The saving dimension focuses on the ability to accumulate assets, either to meet needs, to cover emergencies or for precautionary reasons (e.g., for retirement phase). Since the reasons for saving are not homogeneous, as is the case with the nature of savings products, this dimension provides a dual approach. A first factor focuses on short-term savings and the possibility that the individual will have sufficient resources and be sufficiently liquid to meet immediate needs or emergencies. The second factor focuses on the long-term and on reasons closer to life expectancy and life experiences, such as aging or (university) education of children.

We cannot determine a sufficiency level because quantitative information on savings is not available. The available information instead focuses on what kind of product the individual has, using the questions presented in Table B.2:

Table B.2 **DESCRIPTION OF SAVING DIMENSION** (SAVING HYPOTHESIS)

| Factor | Question |
|---|---|
| Have liquid savings | In the last 12 months, have you been saving money in any of the following ways (whether or not you have the money yet)? And now can you tell me if you currently hold any of these types of products (personally or jointly)? |
| Have long-term savings or assets | In the last 12 months, have you been saving money in any of the following ways (whether or not you have the money yet)? And now can you tell me if you currently hold any of these types of products (personally or jointly)? |

Source: CAF and CFSI

With regard to savings products, we consider the relevance of accepting both those that are considered formal and informal, especially for liquidity savings. In the short term, the current account, the savings account, and savings in cooperatives are considered as formal products, while savings (cash) at home, giving money to family, and informal collective funds are considered as informal products. In the long term, we include both more financial products, such as pension funds, equity, and fixed income investments, and the purchase of property and other material goods such as livestock.

For any factor of this dimension, whether the individual has one of these two types of products, the value one is assigned, and otherwise, the value is zero.

The lending dimension expands the first liquidity-centered dimension and includes the capacity to borrow and repay. This dimension distinguishes between debt sustainability at the present time and the experience that the individual already has in this type of situation, using the questions in Table B.3:

Table B.3 **DESCRIPTION OF LENDING DIMENSION (LENDING HYPOTHESIS)**

| Factor | Question |
|---|---|
| Have a sustainable debt load | And now can you tell me if you currently hold any of these types of products (personally or jointly)? |
| Have a prime credit score | And in the last two years, which of the following financial products have you chosen (personally or jointly), even if you no longer hold them today? |

Source: CAF and CFSI

For the first factor, we cannot analyze financial sustainability perfectly because we do not have quantitative information on income and debt level. We propose an instrument that takes into account the availability of formal savings (both short and long term), as well as the type of loan a person may have, distinguishing between the formal version (products such as personal loans, mortgages, cooperative loans, and credit cards) and the informal version (lenders and pawnbrokers). Table B.4 presents the options as well as the values adopted by the indicator.

Table B.4 **DISTRIBUTION OF OPTIONS IN SUSTAINABLE DEBT INDICATOR**

| Availability of formal savings? | Availability of formal lending? | Availability of informal lending? | Indicator value |
|---|---|---|---|
| Yes | No | No | 1 |
| Yes | Yes | No | 1 |
| Yes | No | Yes | 0 |
| Yes | Yes | Yes | 0 |
| No | No | No | 0 |
| No | Yes | No | 1 |
| No | No | Yes | 0 |
| No | Yes | Yes | 0 |

Source: BBVA Research

The second factor relates to the type of credit rating available to the individual. This information is not publicly available and we do not have the tools to create such a rating. As an alternative, we gather information on the individual's experience with these products over the past two years (Table B.3). The approach we follow is to evaluate whether several experiences that the individual had were positive or otherwise. The indicator takes value one if the individual chose at least one product related to loans in the formal sector. If an individual has chosen a loan product in the informal sector, or if the individual has not had any experience, the value assigned is zero.

The planning dimension is a refinement of the first two dimensions mentioned above, emphasizing the importance of organization in household finances and strengthening financial stability among states. In this context, this dimension is divided into two factors: the first factor focuses on the provision of (micro) insurance. As was the case with sufficiency, since we do not know the amount associated with these products, we will not be able to assess the degree of adequacy. We distinguish between people who have at least one of these products (value one) or not (value zero). The second factor focuses on the creation of a family budget. If a budget exists, the indicator takes value one, otherwise, it takes value zero. Table B.5 shows the relationship between the two factors and the questions used in the surveys.

Table B.5 **DESCRIPTION OF PLANNING DIMENSION (PLANNING HYPOTHESIS)**

| Factor | Question |
|---|---|
| Have insurance | And now can you tell me if you currently hold any of these types of products (personally or jointly)?. |
| Plan ahead for expenses | Does your family have a budget?. |

Source: CAF and CFSI

These are the criteria that have been followed and applied in all countries where surveys are available. However, there are limitations in the creation of some indicators. The survey of Paraguay does not include financial products related to informal lending, reducing the number of options according to Table B.4. In the case of Argentina, the list of financial products does not include insurance. Consequently, the value of the first factor of the planning dimension is zero by default for this country. For these reasons, these two countries have been excluded from the study.

## Appendix C: Financial Literacy indicators

With respect to questions related to financial literacy, surveys organized by CAF adapt the questions proposed by OECD (2016) on financial knowledge, based on those defined by Lusardi and Mitchell (2007).

We create several binary variables indicating the right answer to the corresponding question. Table C.1 shows the name of the binary variable in the tables of estimates (Tables 4.2 and 4.4) and an example of the question associated with that variable. The amounts of money stated in the questions depend on the local currency of each country.

Table C.1 **DESCRIPTION OF QUESTIONS ABOUT FINANCIAL LITERACY**

| Variable | Question |
|---|---|
| Numeracy | Imagine that five siblings receive a donation/gift of ($ XXXX). If siblings have to share the money equally, how much does each receive?. |
| Inflation | Now imagine that siblings have to wait a year to get their share of the ($ XXXX) and inflation remains at 2 percent annually. After a year, are they going to be able to buy...?. |
| Lending interest rate | Imagine that you lent $ XX to a friend one night and he returned these $ XX to you the next day. Did your friend pay any interest on this loan?. |
| Saving interest rate | Suppose you put $ XXX in a savings account with an interest rate of 2 percent per year. You do not make any other payments into this account and do not withdraw money. How much would be in the account at the end of the first year, once the interest payment is made?. |
| Compound interest rate | And with the same 2 percent interest rate, how much would the account have at the end of five years? It would be... |

Source: CAF

Table C.2 presents some descriptive statistics of these variables for the five countries analyzed. The first factor included is associated with numeracy, for which the percentage of correct results is relatively higher, between near 70 percent in Chile and 85 percent in Colombia. Skagerlund et al. (2018) point out the important roles of numeracy and attitude toward numbers in financial literacy and the process of making financial choices. They suggest that a method of improving financial literacy is enhancing knowledge of mathematics to increase numeracy.

The phenomenon of inflation is well-known in Latin America. Moore et al. (2012) show there were 31 inflation episodes between 1970 and 2006, mainly due to oil and food price shocks and political factors, especially concentrated in the 1980s and 1990s. The percentage of right answers is conditional on these contexts. These figures range between near 30 percent in Chile to above 47 percent in Colombia.

With respect to questions on the interest rate, the figures of the interest rate in terms of lending confirm that this concept is widely known in these countries, at between 83 percent in Peru and above 98 percent in Chile. However, the average results for questions on the savings interest rate do not surpass 27 percent (the maximum percentage in Bolivia, and hardly half of this figure in Colombia), and it is only relatively higher for questions on the compound interest rate (between near 30 percent in Peru and 50 percent in Chile).

We can compare some of these figures with other countries, using the information provided by Lusardi and Mitchell (2014). These authors present a compendium of statistics about financial literacy questions in other countries, with a special focus on developed countries. With respect to the question of inflation, the results of these five countries are similar to those in Romania (32 percent) and Russia (51 percent), and lower than in Italy and Sweden (below 60 percent). The difference is relevant for those countries with the highest percentage of correct answers (Germany, New Zealand, and Switzerland, with figures above 78 percent). In terms of the compound interest rate, the percentages of these five countries are similar to Italy (40 percent), Romania (34 percent), Russia (33 percent), and Sweden (35 percent), and far from Australia, Germany, the Netherlands, and New Zealand, whose percentages of correct answers lie between 82 and 86 percent.

Table C.2 **DESCRIPTIVE STATISTICS FOR FINANCIAL LITERACY IN LATIN AMERICA**
(PERCENTAGE OF ADULTS AND STANDARD DEVIATION IN EACH CATEGORY)

| | Bolivia | Chile | Colombia | Ecuador | Peru |
|---|---|---|---|---|---|
| Numeracy | **79.58%** | **69.51%** | **84.94%** | **78.33%** | **73.36%** |
| | (0.4033) | (0.4605) | (0.3578) | (0.4121) | (0.4422) |
| Inflation | **43.17%** | **29.12%** | **47.14%** | **43.58%** | **39.10%** |
| | (0.4955) | (0.4545) | (0.4994) | (0.4961) | (0.4882) |
| Lending interest rate | **88.08%** | **98.29%** | **88.62%** | **89.08%** | **83.68%** |
| | (0.3241) | (0.1295) | (0.3177) | (0.312) | (0.3697) |
| Saving interest rate | **26.83%** | **18.75%** | **13.19%** | **25.00%** | **16.44%** |
| | (0.4433) | (0.3905) | (0.3385) | (0.4332) | (0.3708) |
| Compound interest rate | **33.33%** | **49.53%** | **34.30%** | **40.67%** | **29.65%** |
| | (0.4716) | (0.5002) | (0.4749) | (0.4914) | (0.4569) |

Note: The figures represent weighted average of the values obtained from the five countries.
Source: BBVA Research and CAF

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