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On the financial literacy, indebtedness, and wealth of Colombian households

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Abstract

In this paper we attempt to find existing linkages of financial literacy with indebtedness and wealth accumulation of households in Bogotá, the capital of Colombia. We analyze an econometric model where we regress a household's debt usage, cost of debt servicing, and wealth indicators against its financial literacy. Financial literacy is assessed according to the financial numeracy and money management skills of the head of households. Numeracy skills are found to have a positive correlation with the decision to use debt and have a mortgage and with the total number of lending sources, debt-to-income, and net worth. Money management skills decrease the household's likelihood of using all of the debt types considered in the analysis and increase with net worth. We also uncover important debt and wealth accumulation conducts closely tied to the city's economic stratification and the gender of the head of household. A number of public policy implications are derived from the results of the analysis.

KEYWORDS

Colombia, debt, financial literacy, money management, wealth

JEL CLASSIFICATION

D12; D14; E21

1 | INTRODUCTION

Financial literacy is recognized as fundamental for sound financial decision-making. Attaining financial literacy can be considered an essential asset to complement a household's financial portfolio, and a lack of it could be pervasive toward long-term financial outcomes. While financial education has been prioritized in the development agenda of many emerging economies, the effective socialization and impact of financial literacy over major micro- and macroeconomic variables continue as matters of debate for scientists and practitioners alike.

This paper focuses on financial literacy and its relationship with a household's indebtedness and wealth accumulation behaviors in Bogotá, the capital of Colombia. Bogotá is the fourth most populated city in Latin America, accounts for nearly 17% of the total population of Colombia, and has been the country's most important administrative center since its foundation. Bogotá is also the Colombian city with the longest history surveying the financial literacy skills of its inhabitants.

The recent economic history of Colombia is characterized by important advancements in capital market liberalization and financial inclusion. Examples of liberalization policies enacted by the Colombian government that are aimed at increasing the population's access to financial services include abolishing minimum deposit requirements in savings accounts, incentivizing banking institutions to establish branches in the country's most remote regions, loosening restrictions on interest rate ceilings, reducing the unbanked population's reliance on high cost (or "predatory") nonfinancial debt, and promoting initiatives advancing financial literacy (Cao-Alvira & Deidda, 2020). Among these, the most relevant to our analysis are the advancements in financial literacy. Following the enactment of Decree 1328 of 2009, it is the right of the customer to receive appropriate education when inquiring about financial products and is the obligation of the financial institutions to offer such education (Comisión Intersectorial para la Educación Económica y Financiera, 2017). Since 2005, under a national initiative involving the banking sector, the country's central bank, and regional education ministries, financial literacy is included in the instructional curricula of primary and secondary educational institutions (García Bohórquez, 2012). Nevertheless, as evidenced by cross-country studies comparing financial literacy among adults and 15-year-olds, the Colombian population ranks among the lowest in financial literacy attainment (OECD/INFE, 2020; OECD/PISA, 2014).

We aim at contributing to the existing literature on financial literacy, indebtedness, and wealth accumulation by analyzing econometric models where debt and wealth indicators for Colombian households are regressed against financial literacy estimates. Determined at the household level, we consider two aspects of financial literacy broadly adopted by the scientific literature, namely numeracy and money management skills. Numeracy skills are assessed according to the head of the household's correct answers to three questions relevant to interest rates, real rate of return, and risk diversification. Money management skills are measured according to the head of household's perception of how monthly debts compare to household's income. The regressions additionally control for whether the head of household is unemployed, the civil status, age, education attainment, household size, total household income, the gender of the head of the household, and assigned stratum of the household within a centralized system of classification of dwellings in Bogotá. The dependent variables of the analysis are the household's decision to use debt finance, have a mortgage, and use high-interest nonfinancial debt; the head of household's total amount of lenders; the household's total debt-to-income and mortgage debt-to-income ratios; and net worth.

Financial numeracy skills have a positive correlation with a household's decision to use debt and have a mortgage, the quantity of lenders, its total debt-to-income ratio, and net worth. Money management skills decrease the household's likelihood of using all of the debt types considered in the analysis and increase with net worth. An interesting finding is that financial literacy is highly correlated with

the decision to have a mortgage, but it is not significant when estimating the cost of servicing the mortgage. Having conducted our analysis controlling for the stratum of each surveyed household of the Colombian capital, we are also able to uncover far-reaching effects of economic stratification on indebtedness and wealth. Important policy implications can be derived from the results of this paper. The rest of the paper is organized as follows: Section 2 reviews the relevant scientific literature on financial literacy, Section 3 presents the data used for our analysis and includes descriptive summary statistics, Section 4 introduces the method of analysis and results, and Section 5 concludes.

2 | LITERATURE REVIEW

Financial literacy adopts a variety of meanings in the literature. The extensive review of works included in Remund (2010) concludes that most conceptual definitions of financial literacy fall within five categories: knowledge of financial concepts, ability to communicate about financial concepts, aptitude in the management of personal finances, skills in making financial decisions, and confidence in planning for future needs. Hastings et al. (2013) additionally identify more compartmentalized meanings used in the literature for the concept. These include knowledge of financial products (e.g., stocks or bonds), financial concepts (interest compounding, inflation, and diversification), and numeracy skills necessary for effective financial decision-making. Possessing money management skills, in the form of attention to expenses, has also been emphasized by a number of works as part of financial literacy. Money management skills are often associated with an individual's careful planning of the current financial situation, self-control, budgeting, and anticipation of bills (Ameriks et al., 2007; French & McKillop, 2016; Gathergood, 2012; Gathergood & Weber, 2017; Lea et al., 1995).

While the definition and scope of financial literacy in the literature are broad, the methodology for its measurement has converged to an international standard. Practitioner and academic studies have widely adopted an individual's answers to three questions on (1) compound interest, (2) real rates of return, and (3) risk diversification as the measure of financial numeracy skills (Atkinson & Messy, 2011; Hastings et al., 2013). These three questions, proposed in Lusardi and Mitchell (2006), were included in 2009 in the National Financial Capability Study, a survey of financial capabilities of U.S. adults, and have come to be known as "The Big Three." The adoption of these three questions as measures of financial numeracy has allowed for detailed cross-country comparisons of the competencies, for example, the OECD International Survey of Adult Financial Literacy Competencies and the PISA Consortium: Financial Literacy Skills for the 21st Century. For instance, Germany (53%) and the Netherlands (45%) are the countries with the highest percentage of the surveyed population answering correctly all three financial literacy questions. Mexico (15%), Chile (8%), and Russia (3%) are the countries with the lowest percentage of the population answering correctly these three questions (Hastings et al., 2013; Klapper & Panos, 2011).

The scientific literature has made important attempts to identify the role of financial literacy on financial behaviors and their determinants. Financial literacy has been found to be lower among women, and the youngest and the oldest populations, and has a positive correlation with education, employment, and wealth (Behrman et al., 2012; Calvet et al., 2009; Christelis et al., 2010; Dhar & Zhu, 2006; Lusardi & Mitchell, 2008). An important focus of the literature on the role of financial literacy in financial behavior has been on its impact in retirement planning and wealth, where the findings suggest a strong positive correlation of financial literacy and wealth levels during retirement (Lusardi & Mitchell, 2007; Van Rooij et al., 2012). Another robust finding is the positive relationship between financial literacy and stock market participation (Balloch et al., 2015; Clark et al., 2015) and stock market performance (Bucher-Koenen & Ziegelmeyer, 2014; Choi et al., 2009). Lower financial literacy

hinders the creation of wealth due to the inability to perform interest rate calculations, thus increasing high-cost borrowing and debt burdens (Disney & Gathergood, 2013). Consequently, financial literacy can be considered an essential asset within a household's complete financial portfolio and, by the same token, the lack of financial literacy can be pervasive on long-term financial outcomes.

Important research on financial literacy has focused on its impact on mortgage debt. A mortgage loan is the largest debt of the typical household (Gathergood & Weber, 2017). Huston (2012) finds that financially illiterate individuals tend to incur in higher cost of borrowing for mortgage loans, and Gathergood and Weber (2017) find this population to be more likely to obtain more complex and costlier mortgage products such as "interest-only" mortgages. Furthermore, Gerardi et al. (2010) find strong correlations between decreases in financial literacy and increases in mortgage delinquencies and defaults.

Empirical works have encountered instances where a relationship exists between financial literacy and high levels of debt (see, e.g., French & McKillop, 2016). The reason for this could be the result of a systematic tendency from financially literate individuals to overestimate their financial knowledge and assume excessive debt (Van Rooij et al., 2012). Yet Gathergood (2012) notes that high levels of a simple ratio like debt-to-income could mislead to an interpretation of over-indebtedness, as it could be optimal for the individual to assume relatively higher levels of debt if there is an expectation of future income growth.

The determinants of financial literacy help design policy efforts. The evidence cited indicates that financial literacy is lowest among women and the poorest, least educated, and youngest populations. Mahdavi and Horton (2014) find that low financial literacy persists even for populations of highly educated women, suggesting that traditional education is not a substitute of financial education for women. The authors call for workplaces and instructional institutions of all levels to assess the current knowledge of women they serve and carefully tailor financial education based on that assessment. These policies are particularly relevant to our analysis, as uncovered in Liu et al. (2017), due to the tendency over the past decades for Colombia and the rest of Latin American countries for increasingly more households to be headed by women. Furthermore, Lusardi and Mitchell (2014) report that women are more likely to respond "do not know" in financial literacy questionnaires, making them ideal recipients for targeted financial education programs.

Remedial actions for improving financial literacy are found to have a great impact on the population at the bottom of the wealth distribution (Lusardi, 2004). For low-educated populations, programs focused on educating financial numeracy have proven to be ineffective, while those focusing on instructing money management skills—namely budgeting—have shown success in helping households control debt (Agarwal et al., 2010). Similarly, based on the analysis of a sample of indebted and lower-educated individuals, French and McKillop (2016) propose programs that educate in money management skills and instruction in the calculation of borrowing costs in a general sense—in lieu of formal numeracy instruction.

Financial education at an early age has shown to be effective influencing long-term financial outcomes (Kaiser & Menkhoff, 2020) more so when compared to a low demand and efficacy of voluntary financial education later in the life cycle. For instance, in Colombia, Giné et al. (2017) encountered that most customers of banking institutions forego the instruction on lending costs that they are entitled to when inquiring about financial products, and Bruhn et al. (2014) find negligible demand and trivial improvements from adults attending a large-scale financial literacy course in Mexico. Policy strategies aimed at improving the financial literacy of children with parents who may have poor financial literacy themselves (e.g., with limited financial experience or are not college educated) have shown promising results, as it has been shown that the first source of financial literacy for young adults is their parents (Luhrmann et al., 2018; Lusardi et al., 2010).

3 | DATA

The data sources are the Comprehensive Household Survey and the Survey of Financial Burden and Literacy of Bogotá, Colombia, for the period 2011–2015.[1] Both surveys are administered annually by the National Administrative Department of Statistics of Colombia (Departamento Administrativo Nacional de Estadística, 2015a, 2015b). Combined, these include information at the individual and the household levels on financial literacy, debt, income, assets, employment, civil status, age, and education. For a randomly chosen household to be included in the survey, the self-reported head of household must be at least 18 years of age currently using a financial instrument. If these criteria are met, then the household is included in the surveys, and all individuals 18 years of age or older living within the household are surveyed as well. All financial data are in Colombian pesos. These data cover a yearly cross-section of financial and economic information for 83,100 individuals living in Bogotá across 33,459 households.

The measures of financial literacy extracted from the surveys follow closely those broadly adopted by the scientific literature; see, for instance, Atkinson and Messy (2011), Hastings et al. (2013), Lusardi and Mitchell (2014), and French and McKillop (2016). This feature allows for a comparison of our findings with others in the literature. Financial literacy is gaged according to the numeracy and money management skills of the head of household. We estimate numeracy skills according to the answers to three questions relevant to interest rates, real rate of return, and risk diversification. The three questions, often referred as "The Big Three," are the following:

1. Interest rate. Assume you have $100,000 in a savings account, and the interest rate on those savings is 2%. If you keep the money for 5 years in the account, how much will you have at the end of those 5 years? Choose one answer: (a) more than $102,000; (b) exactly $102,000; (c) less than $102,000; and (d) do not know or no answer.
2. Real rate of return. Assume you have $100,000 in a savings account that pays an annual interest of 1%. You know that the annual inflation rate is 2%. After 1 year, you will be able to buy _____. Choose one answer: (a) more than $100,000; (b) exactly $100,000; (c) less than $100,000; and (d) do not know or no answer.
3. Risk diversification. Purchasing the stock of one corporation is less risky than, for the same amount of money, purchasing the stock of multiple companies. Choose one answer: (a) true; (b) false; and (c) do not know or no answer.

Money management skills are measured according to the head of household's perception of the household's budgeting skills. The estimate of money management skills is binary and refers to the head of household's perceived ability to cover monthly expenses with current income; it is equal to one if the head of household considers that income is greater than or equal to expenses and zero otherwise.

The sources of debt included in the data are mortgage debt, credit card debt, consumer bank loans, vehicle loans, high-cost nonfinancial debt from "predatory" sources, loans from pawn shops, and loans from family members. Data from each debt source include the monthly debt payment and balance outstanding. The information on asset-backed debt from financial institutions is presented at the household level. Non-collateralized debt and monthly income are presented at the individual level. Data on assets are presented at the household level and include the disaggregated values of owned real estate, vehicle, and savings and retirement and brokerage accounts. The surveys include data for each individual on sex, the role in the household, employment, civil status, age, and education attainment.

Households are further identified by their stratum classification. Bogotá is organized into 20 municipal districts, with its households divided into 6 strata according to their geographical location and physical characteristics (Skinner, 2004). The classification of a household within a stratum is determined by the National Planning Department. The stratum classification of a household in Bogotá has important implications on the quality and cost of utilities and services (Lozano-Gracia & Anselin, 2012). The stratum is used in Bogotá to determine eligibility for subsidies, facilitate the administration of social programs, and determine property taxes (Trujillo et al., 2010). Strata one and two are the most heavily subsidized by the local government; three and four are the middle strata, arguably formed by the city's middle class; and five and six are the highest strata.

All financial variables for our analysis are expressed at the household level. The household's income, indebtedness, and wealth measures are computed as the sum of their respective values for the individuals within the household. From the original 33,459 households in the sample, 207 were eliminated as the survey failed to identify a head of household. In addition, we use total income to winsorize by year at the 2.5th and 97.5th percentiles. The final sample consists of 31,598 households, representing 78,780 individuals.

For each household, we construct seven financial indicators on indebtedness and wealth accumulation: (1) usage of debt, (2) the total number of different lenders to the head of the household, (3) usage of a mortgage loan, (4) use of high-interest nonfinancial debt, (5) debt payments to income, (6) mortgage debt payment to income, and (7) net worth. Usage of debt indicates if any member of the household uses any type of debt financing. Total number of different lenders refers to the sum of all distinct lending sources used by the head of the household. The literature has associated the use of multiple borrowers with poor financial outcomes as multiple lenders likely imply multiple payment schedules, increased probability of missing payments, and increased debt servicing costs (French & McKillop, 2016). The usage of a mortgage by a household indicates if any member of the household has an active mortgage on his or her dwelling. High-interest financing corresponds to the usage of "predatory" loans and loans issued by pawn shops by any individual in the household. A household's debt payments to income ratio are calculated as the sum of all debt payments from all credit sources for all household members over the sum of the incomes from all individuals in the household. Mortgage debt payment to income refers to the ratio between the household's mortgage debt payments and its total income. Net worth is defined as the sum of the value of all assets held by members of the household minus the total balance outstanding.

Table 1 presents the mean, median, standard deviation, and skewness measure for our main variables. While the members of 67% of the households hold some source of debt, most heads of households do not use debt financing themselves. Most households do not have a mortgage and do not use high-interest nonfinancial debt. Noteworthy is the right-skewedness of the debt-to-income ratio and net worth distributions. Considering how much more symmetric is the distribution of income, one might deduce that the source of skewness on the debt-to-income ratio is the asymmetry in the distribution of debt across households, with a disproportionate amount of debt-servicing payments accumulated among the higher-income households. Most heads of households are not unemployed, not married, and below 50 years of age. The highest educational attainment for 44% of head of households is a high school diploma or technical degree, and for 19%, it is college education. Most households answered only one question correctly measuring numeracy skills, and only a fifth of the households perceive that their income is sufficient to cover monthly expenses; 14% of the households answered correctly all three questions on numeracy skills. This percentage is close to that of Mexico (15%) and higher than that of Chile (8%) and Russia (3%) (Atkinson & Messy, 2011; Hastings et al., 2013). Table 2 presents the cross-correlations between the statistics.

TABLE 1 Summary statistics

	N	Median	Mean	Standard deviation	Skewness
1 Uses debt finance	31,598	1	0.67	0.47	–0.7
2 Quantity of lenders	31,598	0	0.62	0.73	1.0
3 Uses mortgage finance	31,598	0	0.07	0.26	3.3
4 Uses high-interest nonfinancial debt	31,598	0	0.03	0.17	5.5
5 Debt/income	31,598	0.08	0.27	2.48	80.1
6 Mortgage debt/income	31,598	0	0.04	2.08	119.6
7 Net worth (×1,000 COL pesos)	31,598	999	68,526	392,134	117.5
8 Unemployed	31,598	0	0.02	0.14	7.0
9 Married	31,598	0	0.31	0.46	0.8
10 Widowed	31,598	0	0.07	0.26	3.2
11 Age	31,598	47	47.5	15.16	0.4
12 Age> 50 years	31,598	0	0.43	0.50	0.3
13 High school and technical	31,598	0	0.44	0.50	0.3
14 Higher education	31,598	0	0.16	0.37	1.8
15 Household size	31,598	2	2.50	1.13	1
16 Income (×1,000 COL pesos)	31,598	2,000	2,646	2,110	1.9
17 Numeracy	31,598	1	1.42	0.95	0.0
18 Money management skills	31,598	0	0.22	0.41	1.4

Notes: This table presents the mean, median, standard deviation, and skewness for our main variables: a dichotomous variable indicating the usage of debt in a household, the total number of different lenders, a dichotomous variable indicating the use of a home loan mortgage, a dichotomous variable indicating the use of high-interest nonfinancial debt, the ratio of debt payments to income, the ratio of mortgage debt payment to income, and the net worth, and also whether the head of household is unemployed or not, civil status, age, and dichotomous variables indicating if the head of household is more than 50 years, and indicating if the highest education attainment was high school or higher education. The household size and the total income are also included. The main explanatory variables are numeracy and money management skills. We estimate numeracy skills as the sum of correct answers to three questions relevant to interest rates, real rate of return, and risk diversification. The estimate of money management skills is binary, and it is equal to one if the head of household considers that income is greater than or equal to expenses and zero otherwise. The data sources are the Comprehensive Household Survey and the Survey of Financial Burden and Literacy of Bogotá, Colombia, for the period 2011–2015. All variables are defined in the "Data" section.

Table 3 presents the mean value of the calculated statistics disaggregated by stratum and by female head of households. We report the statistical significance of the difference in means. Strata are aggregated into three groups: lowest- {no stratum, 1, 2}, middle- {3,4}, and highest strata {5,6}. These, respectively, represent 50.5%, 46.6%, and 2.9% of the total sample. At the highest strata, the households have higher usage of debt financing, quantity of lenders, usage of mortgage, both debt-to-income ratios, net worth, income and both financial literacy skills, and lesser usage of high-interest debt. While the size of households and the proportion of unemployed heads of households decrease, college-level education attainment, marriage, and age are higher in the upper strata. We report mean comparisons of the lowest and highest strata, taking the middle strata as the basis for the statistical tests. With respect to debt-to-income ratio, we find no statistical difference between the middle and lowest strata, but there is statistical difference between the middle and highest strata. The differences between the mean values of all the remaining financial and literacy statistics among strata are statistically significant.

TABLE 2 Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 Uses debt finance	1																	
2 Quantity of lenders	0.55*	1																
3 Uses mortgage finance	0.19*	0.43*	1															
4 Uses high-interest nonfinancial debt	0.12*	0.19*	0	1														
5 Debt/income	0.08*	0.1*	0.07*	0.04*	1													
6 Mortgage debt/income	0.01*	0.03*	0.07*	0.01	0.84*	1												
7 Net worth (×1,000 COL pesos)	0.04*	0.04*	0.05*	–0.02*	0.03*	0.01*	1											
8 Unemployed	0	0	–0.01	0.02*	0	0	–0.01	1										
9 Married	0.11*	0.07*	0.07*	–0.02*	0.02*	0	0.05*	0	1									
10 Widowed	–0.04*	–0.09*	–0.04*	–0.02*	–0.01*	0	0.03*	–0.04*	–0.19*	1								
11 Age	–0.02*	–0.13*	–0.02*	–0.02*	0	0	0.11*	–0.04*	0.2*	0.35*	1							
12 Age> 50 years	–0.01*	–0.12*	–0.04*	–0.02*	0	0	0.09*	–0.02*	0.17*	0.26*	0.82*	1						
13 High school and technical	0.02*	0.05*	0	–0.01*	0.01	0.01	–0.04*	0.02*	–0.04*	–0.11*	–0.3*	–0.24*	1					
14 Higher education	0.08*	0.16*	0.08*	–0.05*	0.01*	0	0.08*	0	0.08*	–0.07*	–0.03*	–0.02*	–0.39*	1				
15 Household size	0.14*	–0.03*	0.02*	0.02*	0.01	0	0.04*	0	0.28*	0.02*	0.31*	0.3*	–0.11*	–0.12*	1			
16 Income (×1,000 COL pesos)	0.2*	0.18*	0.11*	–0.05*	–0.02*	0	0.12*	–0.06*	0.21*	0.01	0.13*	0.13*	–0.11*	0.42*	0.29*	1		
17 Numeracy	0.12*	0.14*	0.05*	0	0.01*	0	0.04*	0.01*	0.06*	–0.07*	–0.09*	–0.08*	0.07*	0.16*	0	0.15*	1	
18 Money management skills	–0.03	–0.01	0	–0.05	0	0	0.05	–0.02	0.01	–0.02	–0.08	–0.06	0	0.17	–0.01	0.17	0.05	1

Notes: This table presents Pearson's correlations for the variables used in our analysis. All variables are defined in the "Data" section.

*denotes a significance level less than or equal to 10%.

Table 3 also presents statistical tests comparing female heads of households with the full sample and within each stratum. Female heads of households represent a third of the total sample. Compared to the full sample, female-led households use less debt financing, are indebted to fewer quantity of lenders, and use mortgage and high-interest debt to a lesser degree. In addition, female-led households have lower estimates for both proxies of financial literacy. There is no statistically significant difference between the full sample and female-led households for the mean values of the debt-to-income ratios and net worth. Compared to the full sample of households, female-led households have lower income and are smaller in size, and a smaller proportion of these are unemployed and are married. Female heads of households on average are older than those in the full sample. Some distinctive qualities of female-led households change with strata. Within the highest strata, there is no statistical difference for female-led households in the usage of debt, quantity of lenders, usage of nonfinancial debt, debt-to-income ratios, age, and money management skills. However, there is a difference within the highest strata in the usage of mortgage debt and net worth for female-led households. Moreover, when compared to households within their strata, households led by females within the lowest and the middle strata have a lower usage of debt, quantity of lenders, and mortgage debt. Female-led households within the middle strata have a lower debt-to-income ratio.

4 | METHODOLOGY AND RESULTS

Our empirical research is modeled following the previous works on financial literacy, indebtedness, and wealth accumulation of Gerardi et al. (2010), Huston (2012), Disney and Gathergood (2013), and French and McKillop (2016). The econometric model regresses the Colombian household's indebtedness and wealth indicators against their financial literacy measures, and economic, financial, and demographic controls, as represented in Equation 1.

$$\begin{aligned} y_i^s = \alpha + \beta_1 X_{NUM,i} + \beta_2 X_{MMS,i} + \beta_3 D_{Unempl,i} + \beta_4 D_{Married,i} \\ + \beta_5 D_{Widowed,i} + \beta_6 X_{Age,i} + \beta_7 D_{Age>50,i} + \beta_8 D_{Educ:HS,i} + \beta_9 D_{Educ:Univ,i} \\ + \beta_{10} X_{Size,i} + \beta_{11} \log X_{Income,i} + \beta_{12} D_{Fem,i} + \beta_{13} D_{Mid,i} + \beta_{14} D_{Fem,i} D_{Mid,i} \\ + \beta_{15} D_{Hi,i} + \beta_{16} D_{Fem,i} D_{Hi,i} + \theta_t + \varepsilon_i \end{aligned} \tag{1}$$

The main dependent variables y_i^s for $s = \{1, 2, 3, 4, 5, 6, 7\}$ are household i's indebtedness and wealth indicators characterized by (1) a dichotomous variable indicating the usage of debt in a household, (2) the total number of different lenders, (3) a dichotomous variable indicating the usage of a home loan mortgage, (4) a dichotomous variable indicating the use of high-interest nonfinancial debt, (5) the log of debt payments to income, (6) the log of mortgage debt payment to income, and (7) the log of net worth. Financial literacy estimates, for example, numeracy skills $X_{NUM,i}$ and money management skills $X_{MMS,i}$, are the model's main regressors. We control for whether the head of household is unemployed or not, civil status, age, education attainment, the household size, the log of total household income, and the gender of the head of the household. The regression additionally controls for the household strata classification (middle strata {3 or 4} or the highest strata {5 or 6}) and interaction terms for gender and strata. Finally, we have a constant term α and year time effects θ_t.

Table 4 presents the coefficient estimates for the regressions on the seven dependent variables. The analysis shows important linkages between financial literacy and patterns of household indebtedness and wealth accumulation. Regarding indebtedness, increases in numeracy are linked with increases in the likelihood of using debt financing, mortgage debt, multiple lenders, and higher debt-to-income ratio. All debt usage and debt cost measures have a negative correlation with a household's ability to

maintain income above expenses (or possessing money management skills). Gains in both numeracy and money management skills have strong correlations with increases in wealth accumulation.

The usage of debt, loan mortgage, and nonfinancial high-interest debt are estimated using logit regressions on the full sample of households. The head of households' total amount of lending sources is estimated using least squares on the subsample of households' holding debt. The four dependent variables are negatively correlated with money management skills, suggesting the usage of debt to cover monthly expenses in excess of income. Numeracy skills of a head of household increase the household's likelihood of using debt and having a mortgage, and are positively correlated with increases in the number of lenders. Numeracy has no significant correlation with the usage of high-interest nonfinancial debt.

The probability of having debt and having a mortgage and the number of lenders increase with the head of household being married, education attainment, and the household's cumulative income. These three regressors correlate in the opposite direction with the household's likelihood of using high-interest nonfinancial debt. The usage of nonfinancial debt increases with the size of the household. Female-led households have a lower likelihood of using debt finance—including mortgage and high-interest nonfinancial debt—and are associated with a lower amount of lending sources. Middle-strata households have lower likelihoods of using debt finance and mortgage debt. Highest-strata households have the lowest propensity of using debt finance.

Debt-to-income ratio is estimated using least squares on the subsample of households holding debt, and mortgage debt-to-income ratio is estimated on the subsample of households with mortgage debt. The debt-to-income ratio is negatively correlated with money management skills and positively correlated with numeracy. Households with a perception that their income is above expenses are associated, on average, with a 5.6% (=exp(–0.058) – 1) lower debt-to-income ratio. The impact of numeracy skills on a household's debt-to-income ratio is superior in magnitude and in the opposite direction; for example, a unit increase in this estimate is tied with an average increase of 13.7% in the debt-to-income ratio. This is an important finding, as it associates increases in numeracy skills with higher ratios of debt service to income and appears discordant with other works associating higher numeracy levels with lower borrowing costs (Huston, 2012; Lusardi & Mitchell, 2014). This finding is consistent with Van Rooij, et al. (2012) and French and McKillop (2016), where the authors argue for the possibility that individuals with numeracy skills could be overestimating their financial knowledge and consequently assume excessive levels of debt. The analysis of Gathergood (2012) offers an alternative assessment of this result where financially literate households behave optimally by holding higher debt-to-income ratios if a rational expectation exists of higher future income. The latter conjecture is consistent with the estimated coefficients for age, where debt-to-income ratio increases with the age of the head of household and starts decreasing after he or she attains 50 years of age. The proxies for financial literacy hold no statistically significant correlation with mortgage debt-to-income ratio. This is seemingly at odds with the findings of Huston (2012), where financially literate individuals are more likely to pay lower mortgage interest rate. Mortgage debt-to-income ratio is instead strongly driven by the household's stratum.

The debt-to-income ratio increases with the head of household being married and with increasing education attainment. The ratio decreases with income. Total debt-to-income ratio is significantly lower for female-led households. No correlation is found between female-led households and the mortgage debt-to-income ratio. When compared to lowest-strata households, middle-strata households are associated with 10% higher debt-to-income ratios.

The net worth is estimated via least squares on the full sample of households. Net worth is positively correlated with numeracy and money management skills, consistent with the findings of Disney and Gathergood (2013). Net worth is the dependent variable most significantly impacted by the financial literacy estimates. This finding is consistent with the revised literature. Net worth is increasing with age, education attainment, and income and increasing if the head is married or widowed and

TABLE 3 Means of statistics by strata

	All	All × female	Lowest strata (0,1,2)	Lowest strata (0,1,2) × female	Middle strata (3,4)	Middle strata (3,4) × female	Highest strata (5,6)	Highest strata (5,6) × female
1 Uses debt finance	0.67	0.63*	0.65	0.60†	0.69ϒ,‡	0.65†	0.74	0.73
2 Quantity of lenders	0.62	0.56*	0.58	0.50†	0.66ϒ,‡	0.61†	0.84	0.82
3 Uses mortgage finance	0.07	0.06*	0.06	0.05†	0.08ϒ,‡	0.06†	0.10	0.06†
4 Uses high-interest nonfinancial debt	0.03	0.03*	0.04	0.03	0.03ϒ,‡	0.02	0.00	0.00
5 Debt/income	0.27	0.24	0.25	0.27	0.28‡	0.21†	0.43	0.37
6 Mortgage debt/income	0.04	0.05	0.04	0.07	0.04	0.02	0.10	0.10
7 Net worth (×1,000 COL)	68,526	64,663	41,385	34,362	79,884ϒ,‡	79,573	356,766	271,649†
8 Unemployed	0.02	0.01*	0.02	0.01†	0.02ϒ,‡	0.01†	0.01	0.01
9 Married	0.31	0.10*	0.27	0.09†	0.35ϒ,‡	0.11†	0.47	0.13†
10 Widowed	0.07	0.17*	0.06	0.15†	0.09ϒ,‡	0.19†	0.11	0.22†
11 Age	47.50	49.30*	45.09	46.89†	49.64ϒ,‡	51.21†	55.26	54.80
12 Age> 50 years	0.43	0.49*	0.37	0.43†	0.49ϒ,‡	0.54†	0.66	0.65
13 High school and technical	0.44	0.41*	0.43	0.39†	0.45ϒ,‡	0.42†	0.24	0.32†
14 Higher education	0.16	0.17*	0.04	0.05	0.26ϒ,‡	0.26	0.69	0.59†
15 Household size	2.50	2.31*	2.52	2.37†	2.48ϒ,‡	2.29†	2.20	1.93†
16 Income (×1,000 COL)	2,646	2,497*	1,970	1,830†	3,179ϒ,‡	2,942†	5,836	5,266†
17 Numeracy	1.42	1.34*	1.31	1.22†	1.53ϒ,‡	1.44†	1.77	1.64†
18 Money management skills	0.22	0.20*	0.17	0.15†	0.25ϒ,‡	0.23†	0.44	0.40
N	31,598	11,284	15,960	5,289	14,715	5,626	923	369

Notes: This table presents the mean of the variables used in our analysis for the sample disaggregated by the strata of the household and the gender of the head of household. Each pair of columns reports these values for the full sample and for the lowest-, middle-, and highest-strata subsamples. Lowest strata correspond to households with no stratum classification and those classified in stratum 1 or 2, middle strata are those classified in stratum 3 or 4, and the highest strata are those in 5 or 6. The first column of each pair of columns presents the means for all households in the considered subsample, and the second column of each pair presents these values for the female-led households in the subsample.

*denotes a significance level lesser than 10% for rejecting the hypothesis of equal means for all households and the female-led households.

†denotes a significance level lesser than 10% for rejecting the hypothesis of equal means for all households within specific strata and the female-led households in those strata.

ϒdenotes a significance level lesser than 10% for rejecting the hypothesis of equal means for households in the lower strata and households in the middle strata.

‡denotes a significance level lesser than 10% for rejecting the hypothesis of equal means for households in the middle strata and households in the higher strata. The variables are defined in the "Data" section.

TABLE 4 Coefficient estimates for the regressions on the indebtedness and wealth indicators

	Usage of debt finance	Quantity of lenders	Usage of mortgage finance	Usage of high-interest nonfinancial debt	Log(debt/income)	Log(debt mortgage/income)	Log(net worth)
Numeracy	0.194	0.036	0.112	0.051	0.128	–0.007	0.698
	(14.3)***	(6.9)***	(4.6)***	(1.4)	(9.7)***	(0.2)	(8.3)***
Money management skills	–0.359	–0.089	–0.279	–0.864	–0.058	0.128	2.762
	(11.5)***	(7.3)***	(4.9)***	(7.5)***	(1.9)*	(1.6)	(14.2)***
Unemployed	0.240	–0.059	–0.111	0.261	0.112	0.315	–1.357
	(2.6)***	(1.6)*	(0.6)	(1.4)	(1.6)	(3)***	(2.3)**
Married	0.256	0.060	0.318	–0.291	0.193	0.039	2.884
	(8)***	(5)***	(6.1)***	(3.5)***	(7)***	(0.5)	(14.2)***
Widowed	–0.004	–0.087	–0.473	–0.444	0.023	0.371	0.940
	(0.1)	(4.4)***	(3.7)***	(2.6)**	(0.4)	(3.4)***	(2.8)***
Age	–0.006	–0.005	0.014	–0.013	0.006	–0.008	0.273
	(3.7)***	(8.8)***	(4.9)***	(3.1)***	(4)***	(1.4)	(28.3)***
Age > 50 years	–0.056	–0.043	–0.672	–0.034	–0.070	0.098	0.805
	(1.3)	(2.5)**	(8.4)***	(0.3)	(1.7)*	(0.9)	(2.8)***
High school and technical	0.161	0.094	0.166	–0.418	0.066	–0.045	0.262
	(5.4)***	(8)***	(2.9)***	(5.5)***	(2.3)**	(0.6)	(1.4)
Higher education	0.268	0.254	0.464	–0.840	0.303	–0.010	2.854
	(5.7)***	(14.2)***	(6)***	(5.6)***	(6.7)***	(0.1)	(9.9)***
Household size	0.149	–0.069	–0.038	0.207	–0.008	0.022	–0.127
	(10.5)***	(13.3)***	(1.6)	(6.1)***	(0.7)	(0.6)	(1.5)
Log(income)	0.595	0.068	0.525	–0.357	–0.438	–0.712	2.430
	(27)***	(7.6)***	(13.1)***	(6.2)***	(19.6)***	(10.1)***	(17.6)***
Female	–0.116	–0.038	–0.153	–0.221	–0.116	–0.021	–0.711
	(3.1)***	(2.6)**	(2)**	(2.3)**	(3.3)***	(0.2)	(2.9)***

(Continues)

TABLE 4 (Continued)

	Usage of debt finance	Quantity of lenders	Usage of mortgage finance	Usage of high-interest nonfinancial debt	Log(debt/income)	Log(debt mortgage/income)	Log(net worth)
Middle strata	–0.144	0.001	–0.183	0.159	0.095	0.348	–1.615
	(4.2)***	(0.1)	(3.1)***	(1.9)*	(3.1)***	(3.8)***	(7.4)***
Middle strata × female	0.074	0.037	0.131	–0.036	–0.033	–0.050	0.747
	(1.4)	(1.9)*	(1.3)	(0.2)	(0.7)	(0.4)	(2.2)**
Highest strata	–0.446	0.057	–0.244	–1.083	0.086	0.957	–0.018
	(4.1)***	(1.4)	(1.7)*	(1.5)	(0.7)	(2.7)***	(0)
Highest strata × female	0.444	0.072	–0.248	–0.258	0.221	0.229	2.198
	(2.7)***	(1.3)	(0.9)	(0.2)	(1.2)	(0.4)	(2.5)**
R^2	0.063	0.081	0.044	0.043	0.050	0.107	0.151
R^2-adj	2,533	0.080	707	376	0.049	0.099	0.150
Df	31,577	21,223	31,577	31,577	21,223	2,215	31,577

Notes: This table presents coefficient estimates from regressions on indebtedness and wealth indicators. The main dependent variables are (1) a dichotomous variable indicating the usage of debt in a household, (2) the total number of different lenders, (3) a dichotomous variable indicating the usage of a home loan mortgage, (4) a dichotomous variable indicating the use of high-interest nonfinancial debt, (5) the log of debt payments to income, (6) the log of mortgage debt payment to income, and (7) the log of net worth. Test statistics are in parenthesis. *, **, and *** denote statistical significance at the 10%, 5%, and 1%, respectively. All variables are defined in the "Data" section. The econometric model is defined in the "Methodology and Results" section.

decreasing if unemployed. Net worth is decreasing for middle-strata households. There is a significant negative correlation between a household's net worth and the household being headed by a woman. The negative effect of gender on wealth accumulation extinguishes for middle-strata households, and it becomes positive for the highest-strata households.

5 | CONCLUSIONS

By uncovering the important existing linkages of financial literacy with indebtedness and wealth accumulation in households in Bogotá, Colombia, this work contributes to the growing literature supporting financial literacy as an essential asset within a household's financial portfolio. While money management skills decrease the likelihood for a household to assume debt, numeracy skills increase the household's probability of using debt sources and increase its relative debt-servicing expenses. Combined, these findings yield policy implications similar to those suggested by French and McKillop (2016). Programs promoting financial literacy should primarily focus on money management skills, namely budgeting, financial awareness, and bill management. The positive relations of numeracy skills with total lenders and debt-to-income ratio suggest that education initiatives, in addition to instruction on budgeting techniques, should focus on properly assessing the costs of debt financing and effective methods for minimizing these. Furthermore, considering the positive impact that both measures of financial literacy have on the household's decision to have a mortgage, explicit emphasis should be placed on these education initiatives to assessing and minimizing the borrowing costs of mortgage lending.

Given the continuously increasing number of households headed by women in Colombia and Latin America (Liu et al., 2017) and the negative correlation estimated for female-led households with all the indebtedness and wealth variables, it is imperative to incentivize financial education programs that effectively target women. Successful initiatives would deliver financial education for women at a variety of places—for example, workplaces, financial institutions, and education and civic centers—and will tailor the content of the curricula after a careful assessment of their previous knowledge (Mahdavi & Horton, 2014), as well as current financial needs and aspirations. Negative coefficients for female-led households on the estimation of indebtedness and net worth suggest that the financial literacy skills emphasized in these education programs should hone on access to debt and wealth accumulation strategies. For similar reasons, middle-strata households could benefit greatly from financial education programs that focus on efficient access to debt, general evaluations of debt costs, and strategies for wealth accumulation.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in the Encuesta de Carga Financiera y Educación Financiera de los Hogares, and the Gran Encuesta Integrada de Hogares; both produced by the Departamento Administrativo Nacional de Estadística (DANE) of Colombia. These data were respectively derived from the following resources available in the public domain: http://microdatos.dane.gov.co/index.php/catalog/470/get_microdata and http://microdatos.dane.gov.co/index.php/catalog/356.

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ENDNOTE

[1] These surveys are, respectively, called in Spanish Gran Encuesta Integrada de Hogares and Encuesta de Carga Financiera y Educación Financiera.

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