Determinants and Impacts of Financial Literacy in the Lao PDR[1,2]

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Abstract: Financial literacy is gaining increasing importance as a policy objective in many countries. However, internationally comparable information on financial literacy is still scarce. The OECD/INFE survey of adult financial literacy is a standardized survey instrument, but so far has mainly been implemented in higher-income countries outside of Asia. Our paper extends the literature by conducting the survey in a relatively low-income Asian economy—the Lao PDR—and analyzing the determinants of financial literacy and the effects of financial literacy on other behaviors. We also compare these results with those of our earlier study of financial literacy in Cambodia and Viet Nam. This study of the Lao PDR extends our research in the CLMV region, and the survey was broadened to include more variables that could be used as effective instrumental variables for financial literacy to deal with possible endogeneity problems. This increases our confidence in our findings that financial literacy positively affects both savings and financial inclusion.

Generally, our study corroborates the findings of studies of other countries, but uncovers some differences as well. The average financial literacy score in the Lao PDR is found to be 12.5, slightly below that of Viet Nam (12.7) and higher than that of Cambodia (11.8). These scores are at the lower end of the range seen in a sample of 30 countries that have implemented the OECD/INFE survey, but they can be considered normal in view of the low levels of per capita income in these countries. The main determinants of financial literacy are found to be educational level, income, age, and occupational status. Both financial literacy and general education levels are found to be positively and significantly related to savings behavior and financial inclusion, and these results hold even when correcting for possible endogeneity of financial literacy.

Keywords: financial literacy, financial behavior, financial inclusion, household saving, Cambodia, Lao PDR, Viet Nam

JEL classification codes: D14, G11, J26

I. Introduction

In the literature, there are several widely used definitions of financial literacy. In their review article, Lusardi and Mitchell (2014:6) define financial literacy as "…peoples' ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions." OECD/INFE (2016:47) defines financial literacy as "… [a] combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately

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[2] This study is an extension of our previous study of the determinants and impacts of financial literacy in Cambodia and Viet Nam (Morgan and Trinh 2017). Furthermore, in this study, we have updated our calculation of financial literacy score for Viet Nam and Cambodia documented in the previous study (Morgan and Trinh 2017)

achieve individual financial wellbeing." Thus, this concept of financial literacy is multi-dimensional, reflecting not only knowledge but also skills, attitudes and actual behavior.

Financial literacy has gained an important position in the policy agenda of many countries and the importance of collecting informative, reliable data on the levels of financial literacy across the adult population has been widely recognized (OECD/INFE 2015b). At their Summit in Los Cabos in 2012, G20 Leaders endorsed the High-Level Principles on National Strategies for Financial Education developed by the Organization for Economic Cooperation and Development International Network on Financial Education (OECD/INFE), thereby acknowledging the importance of co-ordinated policy approaches to financial education (G20 2012)). At the same time, surveys consistently show that the level of financial literacy is relatively low even in advanced economies (OECD/INFE 2016). Given the increasing need for individuals to manage their own retirement savings and pensions, resulting mainly from the trend of switching to defined-contribution from defined-benefit pension plans, this indicates that the need for high levels of financial literacy is rising.

Data on financial literacy provides information on the need for financial education or other supportive policies, and indicates which groups have the greatest needs. Preferably, the survey should be repeated to identify where improvements have been made and what more needs to be done. Use of a standardized survey instrument provides the additional benefit of being able to make cross-country comparisons on key measures of financial literacy and related variables to help identify those countries with successful financial education policies and their applicability to other countries.

To this end, OECD/INFE developed a standard survey instrument for gathering information on financial literacy and financial inclusion.[3] OECD/INFE (2016) provides a summary of the results of these surveys for 30 countries, including four Asian economies—Hong Kong, China; Republic of Korea; Malaysia and Thailand. Additional survey results for the People's Republic of China, India, Indonesia, and Japan are reported in OECD (2017) and OECD (2018a). Our earlier study of adult financial literacy in Cambodia and Viet Nam (Morgan and Trinh 2017) broke new ground in two ways: (i) it marked the first implementation of the OECD/INFE survey in the so-called CLMV countries (Cambodia, Lao PDR, Myanmar and Viet Nam); and (ii) Cambodia and Viet Nam have considerably lower levels of per capita income than did the other countries in OECD/INFE (2016) although data for India was obtained later.[4] This study of the Lao PDR extends our research in the CLMV region, and the survey was broadened to include more variables that could be used as effective instruments for financial literacy to deal with possible endogeneity. This increases our confidence in our findings that financial literacy positively affects both savings and financial inclusion.

In the survey, financial literacy is divided into three related aspects: financial knowledge; financial behavior; and attitudes to longer-term financial planning.

Financial knowledge helps individuals to compare financial products and services and make appropriate, well-informed financial decisions. A basic knowledge of financial concepts, and the ability to apply numeracy skills in a financial context, ensures that consumers can manage their financial affairs independently and respond appropriately to news and events that may have implications for their financial well-being. Financial literacy can be measured both objectively

[3] While a new version of questionnaire has been developed (OECD 2018b), to ensure consistency with our surveys in Cambodia and in Viet Nam, we used the 2015 questionnaire (OECD/INFE 2015c)

[4] In 2015 nominal per capita GDP in Cambodia was $1,144, in the Lao PDR was $2,059 and in Viet Nam was $2,088, compared with $3,754 for Georgia and $3,954 for Albania, the lowest among countries previously sampled (IMF World Economic Outlook database).

(through survey questions) and subjectively, i.e., by asking respondents to rate their own literacy compared with that of their peers.

Financial behavior (or financial "savvy") means taking (or not taking) financial actions. Some types of behavior, such as putting off bill payments, failing to plan future expenditures or choosing financial products without shopping around, may have an adverse effect on an individual's financial situation and well-being. Financial behavior may thus differ from financial knowledge, and it is important to identify their relationship.

Attitudes regarding longer-term financial planning include aspects such as individuals' time preference and willingness to make planned savings. For example, one question asks about preferences for the short term through 'living for today' and spending money. Such preferences are likely to hinder behaviors that could lead to improved financial resilience and well-being.

This paper is organized as follows. Section 2 briefly discusses the literature on determinants of financial literacy and its effects. The data collection and empirical approach is presented in Section 3. Sections 4 and 5 presents the descriptive analyses and empirical results, followed by conclusions and policy implications in Section 6.

II. Literature survey

The literature on financial literacy focuses on two main areas: (i) the determinants of financial literacy, including age, gender, level of education, occupation; and (ii) the effects of financial knowledge on financial behavior, including saving, use of credit, and preparation for retirement.

There is already a long history of efforts to develop quantifiable measures of financial literacy based on surveys that can be subjected to empirical testing. One of the earliest examples was that of the Jump$tart Coalition for Personal Financial Literacy program for high school and college students in the US in 1997 described in Mandell (2009). Lusardi & Mitchell (2006) added a set of financial literacy questions to the 2004 Health and Retirement Study (HRS), a survey of US households ages 50 and older, which have served as a model for later surveys. The three core questions in the original survey were designed to assess understanding of some key financial concepts: compound interest, real rates of return, and risk diversification. Later surveys, including the OECD/INFE survey, have built on this base, but also added questions about financial attitudes, financial behavior and financial experience. The methodology for calculating scores from the survey responses is described below in section III.2.

Lusardi and Mitchell (2014) provide an extensive review of the literature on factors related to financial literacy. Financial literacy tends to follow a hump-shaped pattern with respect to age, first rising and then declining in old age. Interestingly, elderly persons' confidence in their financial literacy shows no similar decline. Women generally score lower than men in financial literacy, and the reasons for this are still debated. However, women tend to be more willing to admit that they don't know an answer than men are. Higher levels of education and higher levels of parents' education are positively correlated with financial literacy. These findings were generally confirmed in the analysis of the results of the OECD/INFE survey in the above-mentioned sample of 30 countries in OECD/INFE (2016).

A key question is whether financial education programs can improve financial literacy. A large number of studies have been conducted, but the results are inconclusive, and are affected by many specific aspects of the programs studied, including course content, knowledge of the teachers, target groups, etc. Fernandes, Lynch and Netemeyer (2014) perform a meta-analysis of 188 studies and find that financial education has a significant but very small effect of only 0.1% on downstream economic behaviors. Lusardi and Mitchell (2014) cite one study by Walstad, Rebeck, and MacDonald (2010) as an example of a careful piece of research that found significant impacts of a study program on financial literacy. However, they recognize that much further research is

needed in this area. Hastings, Madrian and Skimmyhorn (2013:359) argue that the evidence on the effectiveness of financial education programs on financial literacy, not to mention their cost-effectiveness, is "…at best contradictory." They suggest other kinds of interventions such as designing pension plan or savings plan default enrolment options to address observed behavioral biases; strict regulation; simplified disclosure about product fees, terms, or characteristics; and incentives to take action. Kaiser and Mankhoff (2017) carried out a meta-analysis of 126 impact evaluation studies and found that financial education significantly impacts financial behavior and, to an even larger extent, financial literacy. But the results also suggest the intervention effects vary by income level. Financial education seems ineffective (in improving financial literacy) among lower income groups and residents in low and lower-middle income economies. They also find that some specific components of financial literacy are easier to improve through intervention than others. Amagir et al. (2018) suggest in their meta-analysis of financial literacy education programs and interventions for children and adolescents that school-based financial-education programs can improve children's and adolescents' financial knowledge and attitudes, but do not have any effects on financial behavior.

There is a well-developed literature trying to link measures of financial literacy with other economic and financial behaviors, going back to Bernheim (1995, 1998) in the US, in response to the increasing shift toward defined-contribution pension plans. This area of research got a further boost after the global financial crisis of 2008-2009, which drew attention to numerous scams inflected on individual borrowers and investors in the US and other countries. Hilgert, Hogarth, and Beverly (2003) found a strong correlation between financial literacy and daily financial management skills, while other studies found that the more numerate and financially literate are more likely to participate in financial markets and invest in stocks and make precautionary savings (Christelis, Jappelli, and Padula 2010; van Rooij, Lusardi, and Alessie 2011; and de Bassa Scheresberg 2013). The more financially savvy are also more likely to undertake retirement planning, and those who plan also accumulate more wealth (Lusardi and Mitchell 2011). These results have been corroborated in a number of countries. Mahdzan and Tabiani (2013) is an example of this kind of research in Malaysia.

On the liability side of the household balance sheet, Moore (2003) found that the least financially literate are more likely to have more expensive mortgages. Campbell (2006) showed that those with lower income and less education were less likely to refinance their mortgages during periods of falling interest rates. Stango and Zinman (2009) found that those unable to correctly calculate interest rates generally borrowed more and accumulated less wealth.

III. Data and methodology

III.1 Data collection

We used the harmonized OECD/INFE questionnaire of adult financial literacy (OECD 2015c) to ensure comparability with studies of other countries. The questionnaire includes questions about individual information (such as gender, age, income, occupation and other socio-demographic information) and questions about financial literacy as well as financial inclusion. Financial literacy questions are designed to capture financial behavior, attitudes and knowledge of adult people in a wide range of finance including making ends meet, long-term financial planning and financial product selection. In addition, we included a number of questions related to the respondent's parents' education, school performance, distance from the nearest bank, household experience of financial shocks, and use of financial technology (fintech) products. We had the questionnaire translated into Lao, and the translation was checked by the Bank of Lao PDR (BoL).

The survey was conducted by Indochina Research Ltd under the direction of the Asian Development Bank Institute. Data collection was conducted from June to August 2018. Multi-level stratification was used. Eight provinces out of 18 were selected, including Vientiane Capital,

Oudomxay, Luangprabang, Bolikhamxay, Khammuane, Savannakhet, Sekong, and Champasack. In each province, we selected districts and communes in each district to ensure that the sample reflected the actual distribution of rural and urban population. In each commune, 10 households were randomly selected. Overall, there were 1,000 respondents from 100 communes in 29 districts of 8 cities/provinces (Please refer to Appendix for sample distribution).[5]

III.2 Construction of financial literacy and financial inclusion scores

In this paper, we follow the methodology in OECD/INFE (2015a) to calculate scores for the various indicators of financial literacy and financial inclusion.

The score for **financial knowledge** is calculated from responses to survey questions reflecting the subject's understanding of basic knowledge (or awareness) of relating to finance such as calculating interest rates, compound interest rates, risk and return evaluation, and understanding of inflation and financial diversification. This indicator ranges between 0 and 7.

Financial behavior captures "financially savvy" behavior. The score is calculated from eight questions relating to household budgeting, saving, considered purchases, bill payments, care about financial affairs, long-term financial goals, and borrowing, and ranges between 0 and 9.

The score for **financial attitude** measures the respondent's perceptions about money, saving and spending, and ranges from 1 to 5. A higher score represents more conservative and considered behavior.

The **overall score for financial literacy** is the sum of three scores, and hence takes values between 1 and 21.

The score for **financial inclusion** is calculated from 7 indicators, including holdings of payment products, savings, insurance, credit products, product choice and family financial support in case of emergency. This indicator ranges from 0 to 7.

III.3 Methodology

Determinants of financial literacy

To identify the determinants of financial literacy, we estimate the following equation for indices related to financial literacy:

$$FL_i = \alpha_0 + \alpha_1 Income_i + X_i\alpha_2 + \epsilon_i \quad (1)$$

Where FL_i alternatively indicates the score for financial literacy, financial knowledge, financial behavior or financial attitude of individual i; $Income_i$ is the natural logarithm of individual i's household income; X_i is a vector of control variables and ϵ_i is the identically and independently distributed (i.i.d.) error term. The control variables include individual age, education level, gender, occupation, rural versus urban residence, and province. With regards to individual age, we divide the sample into three age groups: those under 30 years old, those between 30 years and 60 years old, and those over 60 years old. We use the group of over 60 years old individual as the base group. For educational level, we combine the categories into three groups: (i) those with some primary education or completed primary school (called "some primary education" group)[6]; (ii) those with some secondary education or completed secondary school (called "some secondary education" group); and (iii) those with at least some technical education beyond secondary education or university-level education (called "tertiary education" group). The last group is used as the base group. With regards to occupations, we combine those who are homemakers, retired

[5] 1,000 is the minimum sample size recommended by the OECD (OECD 2015). Because 11 respondents did not report their income and/or education level, our sample for empirical analysis is only 989 observations.

[6] None of the respondents had no primary education.

and disabled people and voluntarily unemployed persons into one group and use this as the base group in this study. The remaining groups are self-employed people; salaried employees and apprentices/students.[7]

For ease of interpretation, in our empirical analyses we converted all indicator scores into z-score values:

$$score_z = \frac{(score - \overline{score})}{score_{sd}} \quad (2)$$

where $score_z$ is the converted z-score; $\overline{score}$ is the mean score and $score_{sd}$ is the standard deviation of the score.

Effect of financial literacy on saving behavior

To quantify the effect of financial literacy on saving behavior, the following equation is estimated:

$$Save_i = \beta_0 + \beta_1 FL_i + \beta_2 Income_i + X_i\beta_3 + \eta_i \quad (3)$$

Where $Save_i$ is a dummy variable, taking the value of one if the individual has any types of saving products and zero otherwise.[8] FL_i is the financial literacy score, and β_1 measures the effects of financial literacy on saving behavior. Other variables are defined the same as in equation (1) and η_i is the i.i.d. error term.

Effect of financial literacy on financial inclusion

To quantify the effect of financial literacy on financial inclusion, the following equation is estimated:

$$FI_i = \gamma_0 + \gamma_1 FL_i + \gamma_2 Income_i + X_i\gamma_3 + \omega_i \quad (4)$$

Where FI_i is the financial inclusion score, FL_i is financial literacy score, and γ_1 measures the effects of financial literacy on financial inclusion. Other variables are defined the same as in equation (1) and ω_i is the i.i.d. error term.

IV. Descriptive statistics[9,10]

[7] We were not able to adopt the same occupation categorizations we used in the case of Cambodia and Viet Nam (Morgan and Trinh 2017) due to the small number of observations for several occupations.

[8] The score for savings behavior in this section is identified through questions on whether the respondents hold any types of saving accounts or participate in saving clubs or not (so-called formal way to save). Savings, however, could take many other forms such as holding cash at home or in wallet, building up a balance in a bank account, giving money to family member to save, buying gold, property or livestock, etc.

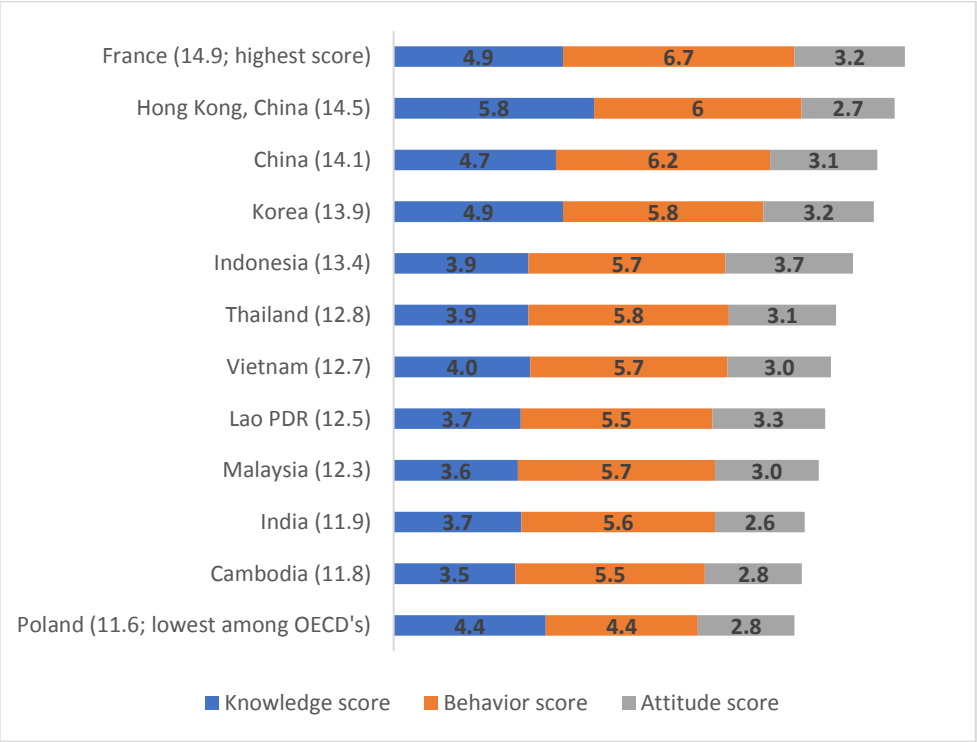
[9] This section is updated from Morgan and Trinh (2017). We not only included data collected from Lao Financial Literacy Survey, but also revised our calculations of financial literacy and its components, financial savings and financial inclusion for Cambodia and Viet Nam. In Morgan and Trinh (2017), a variable used to calculate financial knowledge and a variable used to calculate financial behavior was miscoded. After revising our calculations, the score of financial knowledge, financial behavior and financial literacy were revised up somewhat.

[10] In this section, for the case of Cambodia and Viet Nam, we use a weighted sample to adjust our samples to reflect the true population distribution, especially the distribution of rural and urban populations. While using the weighted sample had some effects on our calculations and estimations for Viet Nam, the calculation and estimation results for Cambodia using weighted sample were only slightly changed (Please refer to Appendix 2 in Morgan and Trinh (2017) for further explanation.) For the case of Laos PDR, we do not use a weighted sample because the sample in this survey reflects the population distribution across the provinces and between rural and urban areas quite well.

IV. Financial literacy and financial inclusion in Cambodia, Lao PDR and Viet Nam: Stylized facts

Table 1 presents the average values of the scores of financial literacy and financial inclusion in Cambodia, the Lao PDR and Viet Nam, including breakdowns by various categories.[11] The financial literacy scores are 11.8 for Cambodia, 12.5 for the Lao PDR and 12.7 for Viet Nam, out of a total possible score of 21. These scores are lower than the 30-country average score of 13.3 and those of some other developing Asian economies such as the People's Republic of China (PRC) (14.1), Indonesia (13.4) and Thailand (12.8). On the other hand, the financial literacy scores in the Lao PDR and Viet Nam are slightly higher than those of Malaysia (12.3) and India (11.9) (see Figure 1). These results may be taken as neutral to positive, given that the levels of per capita income in Cambodia, the Lao PDR and Viet Nam are considerably lower than any of the other 30 countries in OECD/INFE (2016). Figure 2 shows there is a fairly high correlation between the average financial literacy score and per capita GDP (0.63), although there is still wide variation relative to the trend line. The scores of the Lao PDR and Viet Nam lie above the trend line while that of Cambodia lies slightly below the trend line. Except for Malaysia, the scores of all other Asian economies (including the PRC; Hong Kong, China; India; Indonesia; Republic of Korea and Thailand) lie either above or close to the trend line.

Figure 1 Financial literacy scores in selected countries



* Note: Highest and lowest scores relative to the sample of 30 countries in OECD/INFE (2016).
Source: OECD (2016) and authors' compilation from survey data

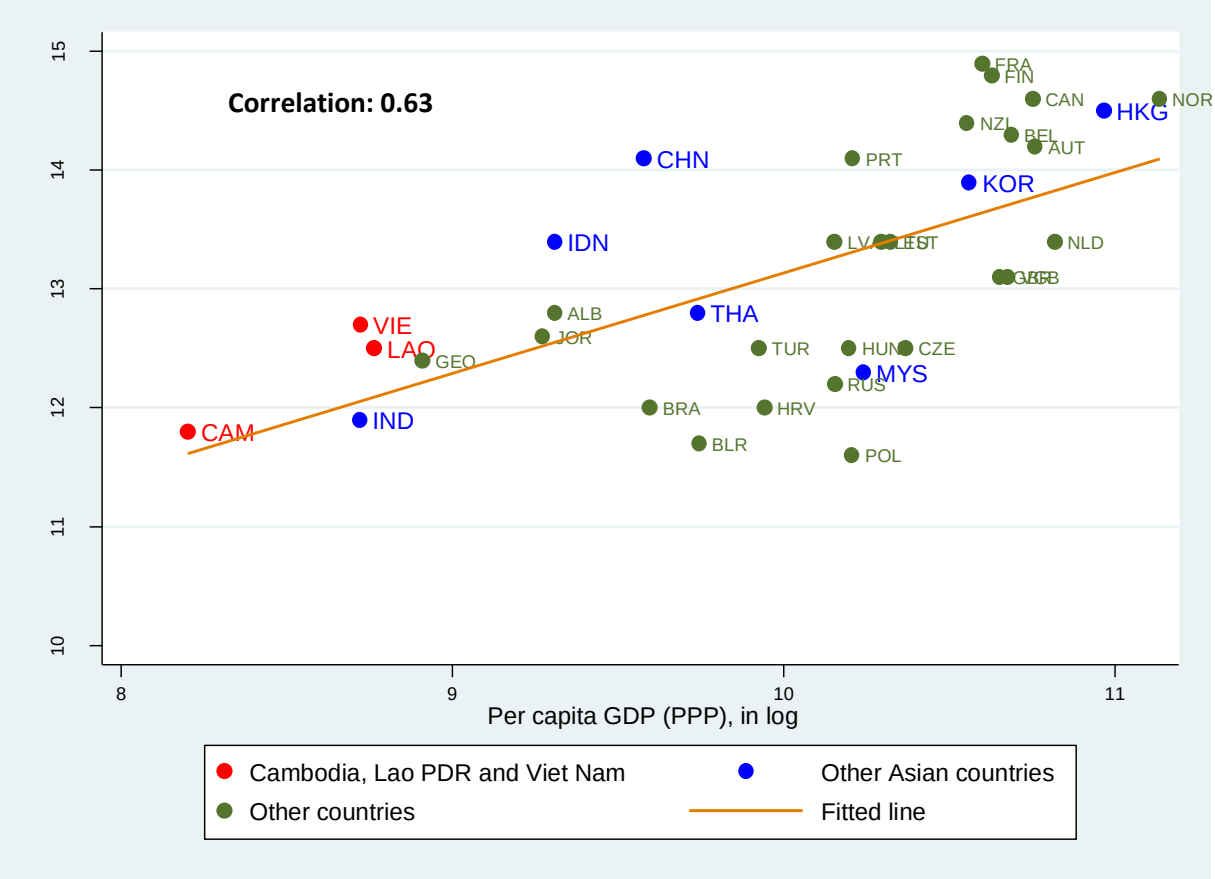
[11] We use the original scores, i.e. they have not been standardized, in this section.

Table 1. Financial literacy and financial inclusion scores in the Lao PDR, Cambodia and Viet Nam

	All	Urban residents	Rural residents	Women	Men	Age under 30	Age from 30-60	Age over 60	Some tertiary education	Some secondary education	Some primary education and lower	Below median income	Above median income
Lao PDR													
Financial knowledge	3.68	3.82	3.63	3.58	3.79	3.67	3.70	3.58	4.20	3.90	3.45	3.46	3.96
% knowledgeable people	30%	34%	28%	28%	32%	29%	30%	29%	44%	34%	25%	25%	36%
Financial "savvy" behavior	5.55	5.67	5.51	5.58	5.50	5.33	5.75	5.07	5.94	5.69	5.41	5.32	5.84
Financial attitude	3.26	3.34	3.24	3.25	3.28	3.38	3.26	3.04	3.53	3.31	3.18	3.17	3.39
Financial literacy	12.49	12.83	12.37	12.42	12.57	12.38	12.71	11.69	13.67	12.90	12.04	11.94	13.19
Financial inclusion	2.59	2.97	2.46	2.56	2.63	2.48	2.66	2.52	3.35	2.89	2.28	2.25	3.04
Formal savings (last 2 years)	24.0%	33.1%	20.8%	24.1%	23.9%	24.7%	22.0%	32.0%	41.8%	31.5%	16.2%	15.5%	35.0%
Cambodia													
Financial knowledge	3.52	3.52	3.52	3.57	3.47	3.61	3.50	3.24	4.62	3.64	3.35	3.37	3.68
% knowledgeable people	17%	23%	15%	19%	16%	18%	18%	13%	57%	21%	11%	13%	22%
Financial "savvy" behavior	5.49	5.57	5.45	5.35	5.61	5.39	5.66	5.05	5.50	5.61	5.40	5.31	5.67
Financial attitude	2.80	2.95	2.74	2.83	2.76	2.84	2.77	2.75	2.92	2.81	2.77	2.71	2.88
Financial literacy	11.80	12.03	11.71	11.74	11.85	11.84	11.93	11.03	13.04	12.06	11.52	11.40	12.24
Financial inclusion	1.85	2.05	1.77	1.88	1.88	1.78	2.03	1.26	2.51	2.04	1.63	1.63	2.1
Formal savings (last 2 years)	11.5%	13.5%	10.8%	11.5%	11.5%	10.9%	12.7%	8.6%	30.2%	14.7%	7.5%	7.9%	15.8%
Viet Nam													
Financial knowledge	3.96	4.35	3.73	3.89	4.05	4.06	3.94	3.52	4.15	4.15	3.66	3.90	3.99
% knowledgeable people	36%	47%	29%	35%	36%	39%	34%	26%	43%	40%	27%	34%	36%
Financial "savvy" behavior	5.70	6.22	5.38	5.88	5.50	5.44	5.83	5.64	6.39	5.68	5.27	4.93	5.96
Financial attitude	3.00	3.03	2.98	3.04	2.95	2.91	3.04	2.90	3.06	3.00	2.96	2.97	3.01
Financial literacy	12.67	13.60	12.08	12.80	12.50	12.42	12.81	12.06	13.60	12.82	11.88	11.80	12.95
Financial inclusion	2.55	2.82	2.38	2.42	2.70	2.50	2.58	2.41	3.43	2.45	2.02	2.21	2.66
Formal savings (last 2 years)	23.4%	30.1%	19.1%	23.9%	22.7%	16.5%	25.8%	40.3%	35.7%	21.0%	17.0%	13.9%	26.5%

Note: Knowledgeable people refers to those answering at least 5 out of 7 questions on financial knowledge correctly. Weighted samples (for Cambodia and Viet Nam) are used for these figures. Please refer to Appendix 2 in Morgan and Trinh (2017) for statistics using unweighted samples.
Source: Authors' compilation from survey data.

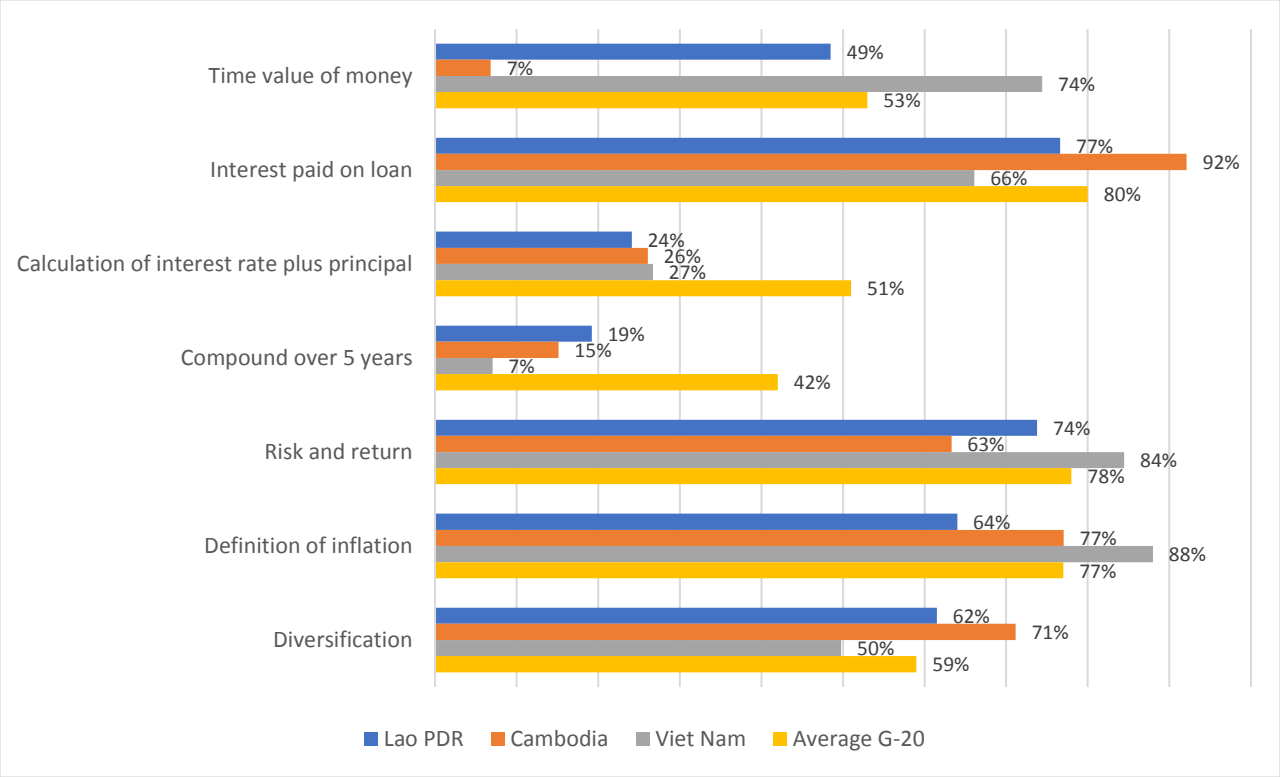
Figure 2. Financial literacy score vs. GDP per capita



Source: OECD/INFE (2016), World Bank World Development Indicator database (http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD), authors' calculation.

Figure 3 compares the percentage of correct responses to the seven financial knowledge questions in Lao PDR, Cambodia and Viet Nam with the average score for G-20 countries. There are significant variations in the share of correct responses by question. For example, while the share of people in Lao PDR and Viet Nam understanding the time value of money is rather comparable with that of the G-20 average, only 7% of Cambodians gave the correct answer. The proportion of people who could correctly calculate simple interest rate on savings in all three countries is much lower than the G-20 average (24-27% vs. 51%), and correct answers on interest compounding were also low. Most respondents understood the basic relationship between risk and return and the definition of inflation, but understanding of the concept of asset diversification was a bit weaker.

Figure 3: Financial knowledge questions: Share of correct responses (%)



Source: Authors' calculations, OECD (2017).

The proportion of respondents that could correctly answer at least 5 out of 7 of the knowledge questions, which is our definition of being "financially knowledgeable," was rather low in Cambodia (17%), the Lao PDR (30%) and Viet Nam (36%). Table 1 presents the share of financially knowledgeable respondents for various subgroups of respondents in Cambodia, Lao PDR and Viet Nam.

There are some differences according to the subcategories of the financial literacy score. The scores for **financial knowledge** (Cambodia, 3.5; the Lao PDR: 3.7 and Viet Nam: 4.0) are at the lower end of those for the previous sample. Of greater concern perhaps is the fact that the share of respondents who answered correctly 5 out of 7 financial knowledge questions, which is considered to be the minimum target level, was rather low. Based on our sample, only 30% of people in the Lao PDR answered correctly 5 or more questions. This is significantly better than in Cambodia (17%) but slightly less than in Viet Nam (36%). On average, this figure is 62% for OECD countries surveyed, and 56% for the full sample of 30 countries surveyed (OECD, 2016). Again, however, this relatively low score can be attributed to the low level of income in these countries.

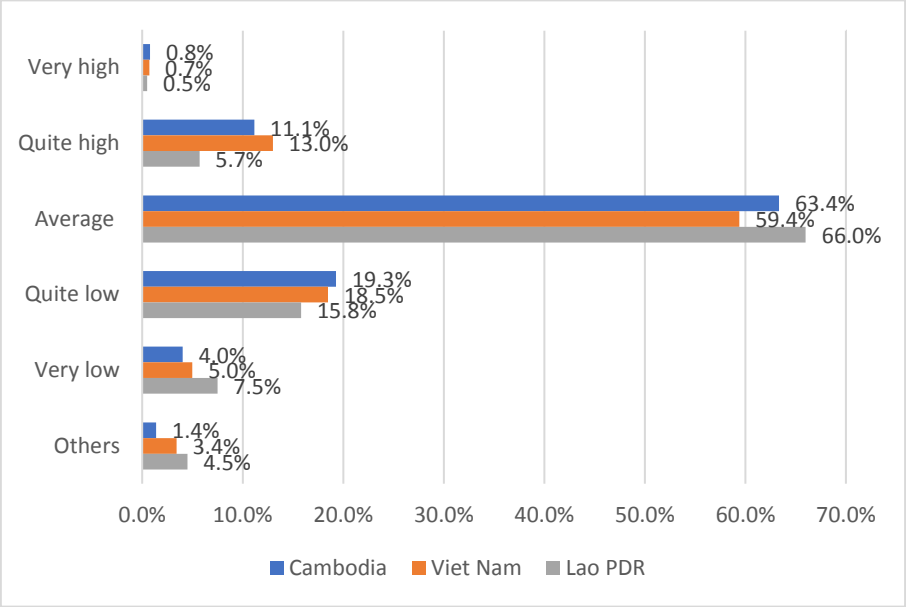
Similarly, the **financial** 'savvy' or **behavior scores** (Cambodia and the Lao PDR 5.5; Viet Nam: 5.7) are slightly lower than those of Thailand (5.8), and the PRC (6.2) but slightly higher than of India (5.0).

The **financial attitude scores** of Viet Nam and the Lao PDR are quite comparable to those of other countries (the Lao PDR, 3.3; Viet Nam, 3.0), while that of Cambodia (2.8) is at the lower end.

These average financial literacy scores are quite consistent with individuals' self-assessment of overall knowledge about financial matters compared with other adults in each country (Figure 4). Only about 6.2-14% of Cambodian, Lao and Vietnamese respondents considered themselves to have a better understanding of overall knowledge about financial matters than other adults. This is

consistent with the results for other countries with relatively low financial literacy scores. About 66% of Lao PDR respondents, 63% of Cambodian respondents and 59% of Vietnamese respondents self-assessed that they have the same level as other adults.

Figure 4. Self-assessment of overall knowledge about financial matters in the Lao PDR, Cambodia and Viet Nam



Note: For the cases of Viet Nam and Cambodia, we use weighted samples to draw this figure.
Source: Authors' compilation from survey data.

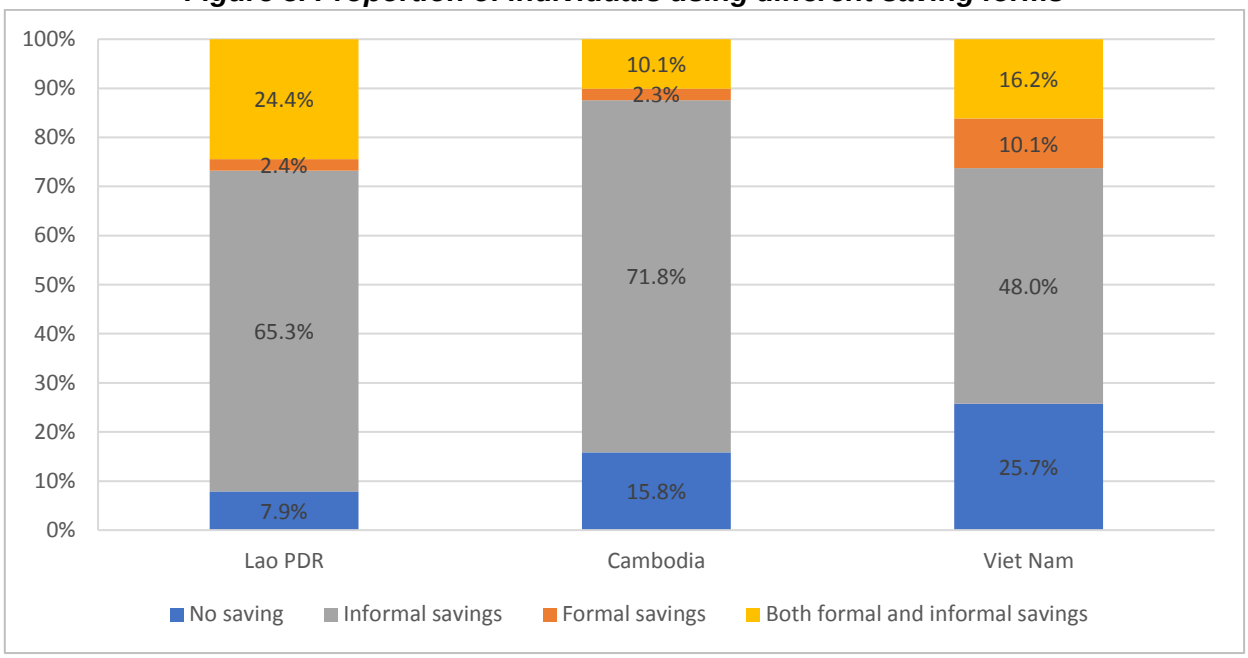
Table 1 also shows some differences among population groups in Cambodia, the Lao PDR and Viet Nam. With regards to urban-rural gaps, in all three countries urban residents have higher financial scores than do their rural counterparts. The gaps are 0.32, 0.46 and 1.52 in Cambodia, the Lao PDR and Viet Nam, respectively. The sources of difference also vary by country. In Cambodia, gaps in financial behavior and financial attitudes mainly contribute to the overall gap in financial literacy. However, the main sources of the gap in financial literacy in Viet Nam are differences in financial knowledge and financial behavior. In the Lao PDR, rural residents' scores for all three sub-indices of financial literacy are lower than those of urban residents.

The financial literacy scores of men are slightly higher than those of women in Cambodia and the Lao PDR, but lower in Viet Nam. Men have higher financial knowledge scores than women in the Lao PDR and Viet Nam while women have higher financial knowledge scores in Cambodia. This pattern also is reflected in the share of those who can answer correctly 5 out of 7 financial knowledge questions. However, the differences are not large, and in most cases the regression results described below do not show significant differences by gender when other factors are controlled for. In all three countries, younger, more highly educated and higher-income respondents have higher financial literacy and financial knowledge scores. However, financial behavior and financial attitude scores do not show a consistent pattern across different groups of respondents.

With regards to savings behavior, only 11.5% of Cambodian respondents reported have savings products, while the figures are 24% and 23.4% in the Lao PDR and Viet Nam, respectively. In all three countries, the percentages of richer, more educated and urban residents who have saving products are higher than those of poorer, less educated and rural residents, respectively. However, there are some differences in savings behavior by age group. While 40.3% and 32% of

respondents over 60 years old in Viet Nam and the Lao PDR have a savings product, respectively, this figure is only 8.6% in Cambodia. Women tend to save more than men, although the difference is rather small.

Figure 5. Proportion of individuals using different saving forms



Note: Weighted samples are used to draw this figure (see Appendix 2 in Morgan and Trinh (2017)).
Source: Authors' compilation from survey data.

While the proportion of respondents who have formal savings products is rather low, the percentage of respondents who save in some form is much higher. In fact, people have many ways to save, ranging from keeping money at home; asking friends, relatives or other family member to keep money for them (so-called informal saving); and keeping current accounts in banks or buying savings products (so-called formal savings). Figure 5 shows that only 15.8% respondents in Cambodia and 25.7% respondent in Viet Nam do not save in any form. This figure is much lower in the Lao PDR, where only 7.9% of respondents do not save in any forms. The largest group of respondents in all three countries uses only informal ways to save (71.8% in Cambodia, 65.3% in the Lao PDR and 48% in Viet Nam), while very few of them use only formal ways of saving (2.3% in Cambodia, 2.4% in the Lao PDR and 10.1% in Viet Nam). The share of respondents who save in both formal and informal ways is 24.4% in the Lao PDR, 16.2% in Viet Nam and only 10.1% in Cambodia.

IV.2. Descriptive statistics for empirical analyses

Table 2 presents the descriptive statistics of explanatory variables included in the econometric models for the Lao PDR. In our sample, 56.5% of respondents have income less than 2 million kip per month, 29.5% have income from 2 million to 3.5 million kip and 14% have income more than 3.5 million kip. 56% of respondents have only some primary education, 32.9 % have some secondary education, and 11.1% have some tertiary education. Most of the respondents (60%) are 30-60 years old. The respondents of age less than 30 (age over 60) account for 27.1% (12.8%). With regards to occupation, most of the respondents are self-employed (67.6%) while paid employees make up just 15.3%. About 74% of respondents live in rural areas and only 45.2% respondents are male.

Table 2: Descriptive statistics for Lao PDR

	Mean	SD
Income less than 2M kip	0.565	0.496
Income from 2M to 3.5M Kip	0.295	0.456
Income more than 3.5M Kip	0.140	0.347
Some tertiary education	0.111	0.314
Some secondary education	0.329	0.470
Some primary education	0.560	0.497
Under age 30	0.271	0.445
Age 30-60	0.601	0.490
Age over 60	0.128	0.334
Males	0.452	0.498
Self-employed	0.676	0.468
Paid employee	0.153	0.360
Cannot work/student/retired	0.059	0.236
Others	0.112	0.316
Rural resident	0.740	0.439
As good as friends in mathematics	0.655	0.476
Experienced household shocks	0.449	0.498

Source: Authors' estimates.

V. Econometric results

In this section, we estimate the determinants of financial literacy, and the effects of financial literacy on the savings decision and financial inclusion in the Lao PDR, using the equations described in section III.

V.1. Determinants of financial literacy

Table 3 shows ordinary least squares (OLS) regression results for the determinants of the overall financial literacy score and scores of three sub-indices of financial literacy (i.e., financial knowledge, financial behavior and financial attitude). In columns (4) and (6), we also control for financial knowledge as a determinant of financial behavior and financial attitude. The results indicate that, in the Lao PDR, people with lower education have lower financial literacy scores. For example, those with only some primary education (some secondary education) have financial literacy scores 0.45 (0.24) points lower than those with some tertiary education, and the difference is significant at the 1% level. This corroborates the results of many other studies, including Bucher-Koenen and Lusardi (2011), OECD/INFE (2016) and Murendo and Mutsonziwa (2016). Morgan and Trinh (2017) find a similar pattern in Cambodia and Viet Nam.

Table 3. Determinants of financial literacy scores in the Lao PDR

	(1)	(2)	(3)	(4)	(5)	(6)
	Financial literacy	Financial knowledge	Financial behavior	Financial behavior	Financial attitude	Financial attitude
Financial knowledge				0.140***		-0.013
				[0.032]		[0.033]
Financial behavior						0.020
						[0.034]
Financial attitude				0.019		
				[0.033]		

Income from 2M to 3.5M Kip	0.305***	0.240***	0.192***	0.156**	0.134*	0.133*
	[0.072]	[0.074]	[0.073]	[0.072]	[0.073]	[0.074]
Income more than 3.5M Kip	0.301***	0.088	0.340***	0.326***	0.123	0.118
	[0.093]	[0.103]	[0.089]	[0.089]	[0.096]	[0.098]
Some secondary education	-0.239**	-0.141	-0.129	-0.105	-0.226**	-0.226**
	[0.101]	[0.113]	[0.097]	[0.097]	[0.106]	[0.107]
Some primary education	-0.446***	-0.324***	-0.258**	-0.208**	-0.285**	-0.284**
	[0.110]	[0.123]	[0.104]	[0.105]	[0.115]	[0.116]
Age 30-60	0.245***	0.118	0.330***	0.315***	-0.079	-0.083
	[0.074]	[0.077]	[0.076]	[0.075]	[0.079]	[0.080]
Age over 60	-0.022	0.132	0.026	0.014	-0.344***	-0.343***
	[0.124]	[0.120]	[0.124]	[0.121]	[0.119]	[0.119]
Male	-0.048	0.027	-0.116*	-0.120*	0.021	0.023
	[0.062]	[0.064]	[0.064]	[0.064]	[0.064]	[0.064]
Self employed	0.237**	0.259**	0.194*	0.160	-0.105	-0.106
	[0.104]	[0.104]	[0.110]	[0.110]	[0.123]	[0.122]
Paid Employees	0.135	0.262*	0.135	0.104	-0.303**	-0.302**
	[0.134]	[0.134]	[0.129]	[0.128]	[0.153]	[0.152]
Cannot work/Students/Retired	0.252	0.371**	0.125	0.075	-0.129	-0.126
	[0.178]	[0.172]	[0.190]	[0.186]	[0.189]	[0.188]
Rural area	0.006	0.018	0.055	0.055	-0.112	-0.113
	[0.090]	[0.099]	[0.086]	[0.084]	[0.090]	[0.090]
Distance from banks (mins)	-0.002	-0.002*	0.000	0.001	-0.002	-0.002
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Family experienced shocks	0.137**	0.087	0.161**	0.150**	-0.040	-0.042
	[0.061]	[0.064]	[0.063]	[0.063]	[0.065]	[0.065]
At least as good in math as friends	0.337***	0.267***	0.279***	0.241***	0.026	0.024
	[0.074]	[0.075]	[0.075]	[0.075]	[0.073]	[0.074]
Intercept	-0.481***	-0.434**	-0.548***	-0.493**	0.328	0.334*
	[0.184]	[0.185]	[0.197]	[0.197]	[0.202]	[0.200]
R squared	0.156	0.105	0.106	0.123	0.084	0.084
Number of observations	989	989	989	989	989	989

Note: Figures in brackets are standard deviations. ***, ** and * denote coefficients significant at 1%, 5% and 10% statistical levels, respectively. The dependent variables are: financial literacy (column 1), financial knowledge (column 2), financial behavior (columns 3 and 4) and financial attitude (columns 5 and 6). We converted all financial scores into z-scores for ease of interpretation. Province dummies are included in all estimates.
Source: Authors' estimates.

The coefficients on income are statistically significant at the 1% level, suggesting that higher income is associated with a higher financial literacy score. This relationship holds even when some indicators that determine individual income such as education and occupation have been controlled for. It should be noted that differences in the estimates between those with income more than 3.5 million kip and those with income higher than 2 million kip and less than 3.5 million kip are not statistically significant. This implies that those with income of at least 2 million kip have a financial literacy score higher than those with income lower than 2 million kip by about 0.32 standard deviations (or 0.82 points.)

Individual age is also associated with financial literacy scores. The estimation results show that individuals of age 30 to 60 have a higher financial literacy score than those under age 30 while the financial literacy score of individuals over age 60 is not statistically significant different from that of those under 30. This result is different from some previous literature such as Jappelli and Padula (2013) and OECD (2016). This, however, is consistent with the results found for Cambodia, where Morgan and Trinh (2017) show that the 30-60 age group has higher financial scores than other age groups. This pattern could be explained by the fact that financial issues may be more critical

for people in this age group since their financial responsibility is heavier than that of the other groups. They may have to decide on buying a house, how to finance their children's education carry out various family responsibilities including taking care of their parents. We also find that there is not much difference in financial literacy between women and men in the Lao PDR. This result is consistent with the results for Cambodia and Viet Nam (Morgan and Trinh, 2017) but different from results in other studies, where men typically score higher (Lusardi and Mitchell 2014).

The results also indicate that occupational status correlates with financial literacy. Similar to the case of Viet Nam, as documented in Morgan and Trinh (2017), self-employed workers have higher financial literacy scores than does the base group (those who do not want to work and those who did not report their occupation), while the scores of salaried workers, those who cannot work, students and retired people are not statistically significant different from that of the base group.[12] We also find that Lao PDR rural residents' average financial literacy score is not significantly different from their urban counterparts. This result is also found in Cambodia, but not in Viet Nam, where rural residents have a lower financial literacy score. Our results also indicate that financial literacy is not associated with the distance from one's house to the nearest bank branch.

Columns 2-6 present the regression results for the determinants of the three subcomponents of the financial literacy score: financial knowledge, financial behavior and financial attitude. In general, the estimation results show varying correlations between the covariates and each of financial literacy subcomponents. The results show that individuals with income from 2 million kip to 3.5 million kip have higher financial knowledge, financial behavior and financial attitude scores than those with income lower than 2 million kip. While the financial behavior score of those with income higher than 3.5 million kip is higher than those who have income lower than 2 million kip, the difference is not statistically significant. We also find that financial knowledge, financial behavior and financial attitude scores of individuals with some tertiary education are higher than the scores of those with some primary education but not statistically significantly higher than the scores of those with some secondary education (except for financial attitude). This result is consistent with the results reported in Morgan and Trinh (2017) for Cambodia.

With regards to age groups, we find that people age 30 to 60 have higher financial behavior scores than those under age 30. But for the other scores (financial knowledge and financial attitude) the difference with those under age 30 is not statistically significant. This result may explain the estimated coefficient on the variable for people age 30 to 60 in column 1. The financial burden of those age 30 to 60 may be heavier than for those under 30, so their financial behavior is more likely to be "savvier" than that of those under 30. This is also confirmed by the fact that the financial behavior of those age over 60 is not different from those under 30, since the financial burden of the former has lessened. However, it is interesting to note that the financial attitude score of those over age 60 is lower than that of people aged under 30, although both seem to have lighter financial burdens than those of age 30-60.

The results also indicate that occupational status correlates with different sub-scores differently. We find that self-employed individuals, paid employees and those who cannot work, students and retired people have higher financial knowledge than people who do not want to work. However, individuals' occupation is not related to financial behavior. The coefficient for self-employed loses its significance when we control for financial knowledge. This result is different from the cases of Cambodia and Viet Nam. In Cambodia, those who are either self-employed, salaried employees or housewives are savvier than those in the base group (unemployed, retired and students).[13]

[12] For the case of Cambodia, self-employed, salaried workers and housewives have significantly higher financial literacy scores than the base group (unemployed, retired people, students).

[13] Due to differences in the distribution of professions in Cambodia, Lao PDR and Viet Nam, the reference group used in this study Lao PDR is different from that used in the study of Cambodia and Viet Nam (Morgan and Trinh 2017). For

Meanwhile, Vietnamese self-employed are more likely to be savvier in their financial behavior than individuals in other occupations (Morgan and Trinh 2017). For financial attitude, paid employees have a lower score than the reference group while other groups are not statistically different from the reference group.

Our estimation results also suggest that there is no difference in the financial literacy score and its sub-scores between rural and urban residents, except for the case of financial attitude, and this relationship is rather weak, only statistically significant at the 10% level. Distance from bank branches also did not have a significant relation with financial behavior or financial attitude, although it is weakly and negatively associated with financial knowledge. We also find that individuals with parents and siblings that experienced financial shocks in the previous 12 months have higher financial literacy and financial behavior scores than do those whose parents and siblings did not experience such shocks. This suggests that financial shocks to their parents or siblings might provide him/her a learning opportunity about the importance of financial literacy. Those who self-reported that they were at least as good as their friends in mathematics in the last year of education have higher financial literacy scores, are more financially knowledgeable and behave savvier. Financial knowledge is also positively related to financial behavior, but not financial attitude. This result is consistent with results in Morgan and Trinh (2017), which found that, for both Cambodian and Vietnamese samples, higher financial knowledge is positively associated with savvier financial behavior, but not financial attitude.

V.2 Effect of financial literacy on savings behavior

Table 4 presents the regression results for the relation between financial literacy and savings behavior, using the probit estimator (columns 1-3) and the linear probability estimator (columns 4-6).[14] All three dependent variables in our estimations are binary variables indicating different types of savings. The dependent variable in columns 1 and 4 take the value of one if an individual has saved, either in the form of informal savings or formal savings, in the last 12 months. The dependent variables in columns 2 (and 5) and 3 (and 6) indicate whether an individual has saved formally in the last year, or in the last two years (regardless whether they still saved or not), respectively. The estimation results show that financial literacy is positively correlated with the decision to save, regardless of the saving form and saving period. A one-standard deviation increase in the financial literacy score (or an increase of the score by 2.56 points) is associated with an increased probability of any savings by around 5.5 (or 6.8 for the linear probability estimator) percentage points and of formal savings in the previous year and in the previous two years by 7.9 (or 7.5) and 5.3 (5.1) percentage points, respectively. This result is consistent with the results in Cambodia and Viet Nam, where the figures are about 7-10 percentage points (Morgan and Trinh 2017). Although income is not related to the decision to save, it has a positive and statistically significant effect on the decision to save formally. For example, the probability of having savings in a formal institution in the previous year among those with income from 2 million kip to 3.5 million kip (more than 3.5 million kip) is 10.2 (16.3) percentage points higher than those who have income lower than 2 million kip. The same pattern is also observed for the case of having formal savings in the previous two years (column 3).

While we do not find a correlation between the education level and the decision to save (either formal or informal savings), those with some primary education tend to have a lower probability to

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the case of Lao PDR, except for self-employed and salaried workers, other professions have a small number of observations. Therefore we categorized professions into four groups: self-employed, salaried employees, disabled people (i..e cannot work), students and retired people, and, finally, voluntarily and involuntarily unemployed people. The last group also includes those who did not answer questions about their profession. We use the last group as the reference group in this study.

[14] In Appendices 2 and 3, we further examine the role of each component of financial literacy (e.g. financial knowledge, financial behavior and financial attitude) on an individual's saving behavior.

save than those with some tertiary education (the reference group), although the difference is not significant. The correlation between education level and saving decision is also observed in Cambodia and, to some extent, Viet Nam (Morgan and Trinh 2017).

The estimation results also suggest that people over age 60 tend to save formally more than those under age 30. For example, individuals over age 60 have a higher probability of having formal savings than those under age 30 by about 15 to 18 percentage points. This result is similar to the case of Viet Nam, but not Cambodia, where age is not correlated with the savings decision. We also find that there is no difference in savings probability between men and women, while rural residents seem to have a higher probability to save (in either formal or informal forms), but not in formal saving forms only. We also did not find any correlation between the distance from the bank branch and decisions to save, even formal savings.

Occupation has a significant impact on the decision to save. While those who cannot work, students or retired people tend to save less than those who do not want to work (the reference group), self-employed and paid employees tend to have higher probability to have formal savings.

Table 4. Financial literacy and saving behavior in the Lao PDR

	Probit estimation (Marginal effects)			Linear Probability (OLS)		
	(1)	(2)	(3)	(4)	(5)	(6)
	Save (both formal and informal)	Formal save in previous year	Formal save in previous two years	Save (both formal and informal)	Formal save in previous year	Formal save in previous two years
Financial literacy	0.055***	0.079***	0.053***	0.068***	0.075***	0.051***
	[0.008]	[0.014]	[0.014]	[0.010]	[0.014]	[0.013]
Income from 2M to 3.5M Kip	0.027	0.101***	0.112***	0.025	0.108***	0.118***
	[0.018]	[0.032]	[0.032]	[0.018]	[0.035]	[0.034]
Income more than 3.5M Kip	0.031	0.162***	0.206***	0.012	0.175***	0.214***
	[0.022]	[0.045]	[0.046]	[0.023]	[0.047]	[0.047]
Some secondary education	-0.007	-0.056	-0.033	-0.016	-0.065	-0.042
	[0.025]	[0.054]	[0.052]	[0.025]	[0.057]	[0.056]
Some primary education	-0.029	-0.168***	-0.147***	-0.033	-0.176***	-0.157***
	[0.027]	[0.056]	[0.054]	[0.027]	[0.059]	[0.058]
Age 30-60	0.007	0.086***	-0.006	0.005	0.084***	-0.009
	[0.019]	[0.030]	[0.030]	[0.020]	[0.032]	[0.031]
Age over 60	0.015	0.146***	0.177***	0.015	0.144***	0.166***
	[0.025]	[0.051]	[0.051]	[0.029]	[0.050]	[0.050]
Male	-0.02	-0.039	-0.03	-0.022	-0.037	-0.028
	[0.016]	[0.027]	[0.026]	[0.017]	[0.027]	[0.027]
Self employed	0.015	0.100**	0.008	0.008	0.105***	0.023
	[0.024]	[0.041]	[0.044]	[0.030]	[0.041]	[0.045]
Paid Employee	0.029	0.096*	0.043	0.024	0.106*	0.063
	[0.028]	[0.053]	[0.055]	[0.033]	[0.056]	[0.058]
Cannot work/Students/Retired	-0.179***	0.036	0.001	-0.159***	0.025	-0.001
	[0.061]	[0.065]	[0.065]	[0.057]	[0.068]	[0.072]
Rural area	0.063***	-0.036	-0.012	0.062**	-0.033	-0.006
	[0.023]	[0.037]	[0.037]	[0.027]	[0.040]	[0.040]
Distance from banks (mins)	0.004	0.000	0.000	0.000*	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
R squared (pseudo R-square for probit)	0.2599	0.1548	0.1322	0.1481	0.1645	0.1383

Number of observations	989	989	989	989	989	989

Note: Figures in brackets are standard deviations. ***, ** and * denote coefficients significant at the 1%, 5% and 10% statistical levels, respectively. The dependent variables in columns 1 and 4 is whether the respondent has any types of savings, that in columns 2 and 5 is whether the respondent has saved formally in the previous year or not, and in columns 3 and 6 is whether he/she had savings in the previous two years or not. Province dummies are included in all estimates.
Source: Authors' estimates.

However, the above estimates may be biased due to endogeneity problems (including reverse causality or the existence of unobservable factors that affect both the savings decision and financial literacy). In order to address these potential endogeneity problems, we use an instrumental variable (IV) approach. Following Fernandes et al. (2014) and Murendo and Mutsonziwa (2016), we use the mean financial literacy score at the district level as the first instrument for individual financial literacy. One may argue that areas with a higher level of economic development may also have better financial development and thus the average financial literacy will tend to be higher in such areas. To address this issue, we control for the development of the district by the share of people who have income higher than country's median income. We also follow Grohmann (2018) and Grohmann et al. (2016) to use respondents' numerical skills when they were in school as an additional instrumental variable. This variable takes the value of one if the respondent was as good as other friends at mathematics in their last year of education and zero otherwise. The third indicator is whether their parents and siblings experienced any financial shocks in the last year or not. This type of instrumental variable is used in Van Rooji et al. (2011).[15] We expect that these instrumental variables did not directly affect the respondents' saving decision but only indirectly through their financial literacy level.

Table 5. Effects of financial literacy on decision to save in the Lao PDR (IV)

	IV probit method (Marginal effect)			IV linear probability method			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Save (both formal and informal)	Formal save in previous year	Formal save in previous two years	Save (both formal and informal)	Formal save in previous year	Formal save in previous two years	First stage
Financial Literacy	0.048*	0.094***	0.069*	0.042*	0.093**	0.072*	
	[0.026]	[0.036]	[0.037]	[0.022]	[0.041]	[0.039]	
From 2M to 3.5M Kip	0.033	0.061*	0.074**	0.036*	0.071*	0.080**	0.308***
	[0.020]	[0.035]	[0.034]	[0.020]	[0.039]	[0.038]	[0.070]
More than 3.5M Kip	0.036	0.104**	0.149***	0.023	0.128**	0.166***	0.286***
	[0.025]	[0.047]	[0.049]	[0.026]	[0.050]	[0.050]	[0.094]
Some secondary education	-0.009	-0.038	-0.017	-0.027	-0.053	-0.026	-0.174*

[15] One may argue that if other adult household members experienced a negative financial shock, they may ask the respondents to save more to offset this. This may violate the exogeneity condition of the instrumental variables (i.e., the instrumental variable may directly affect the outcome of the dependent variable). To test whether there is any correlation between financial shocks experienced by parents and/or siblings and the saving decision, we re-estimated equation 2 and controlled for our three instrumental variables. We find that, as long as the financial literacy score is controlled for, these three instrumental variables do not have any statistically significant association with the saving decision. (The results are available upon request.) Moreover, our financial literacy score is constructed from three sub-scores, including financial knowledge, financial behavior and financial attitude. Therefore. it is more plausible to argue that financial shocks experienced by other household members may not directly affect the saving decision, but indirectly through changes in financial attitude and financial behavior of respondents (i.e., through a learning process).

	[0.025]	[0.051]	[0.050]	[0.025]	[0.057]	[0.056]	[0.093]
Some primary education	-0.034	-0.140**	-0.121**	-0.052*	-0.154**	-0.132**	-0.354***
	[0.029]	[0.057]	[0.056]	[0.027]	[0.062]	[0.061]	[0.102]
Age 30-60	0.009	0.075**	-0.017	0.017	0.071**	-0.021	0.196***
	[0.021]	[0.032]	[0.032]	[0.020]	[0.033]	[0.032]	[0.072]
Age over 60	0.017	0.135***	0.163***	0.018	0.132***	0.154***	-0.025
	[0.027]	[0.049]	[0.051]	[0.029]	[0.050]	[0.049]	[0.116]
Male	-0.020	-0.033	-0.023	-0.022	-0.027	-0.019	-0.032
	[0.016]	[0.027]	[0.027]	[0.017]	[0.027]	[0.026]	[0.059]
Self employed	0.018	0.088**	-0.005	0.011	0.093**	0.014	0.215**
	[0.027]	[0.043]	[0.044]	[0.029]	[0.041]	[0.045]	[0.099]
Paid Employees	0.032	0.091*	0.035	0.020	0.099*	0.059	0.089
	[0.033]	[0.054]	[0.056]	[0.031]	[0.055]	[0.058]	[0.125]
Cannot work/Students/Retired	-0.173**	0.019	-0.019	-0.153***	0.008	-0.017	0.223
	[0.069]	[0.065]	[0.066]	[0.058]	[0.067]	[0.071]	[0.168]
Rural area	0.058**	-0.016	0.008	0.051**	-0.011	0.014	0.078
	[0.023]	[0.037]	[0.037]	[0.026]	[0.041]	[0.040]	[0.086]
% people with income at least 2M, dist-level	-0.025	0.224***	0.221***	-0.040	0.196***	0.193***	-0.504***
	[0.045]	[0.073]	[0.071]	[0.043]	[0.072]	[0.072]	[0.166]
Distance from banks (mins)	0.000	0.000	-0.000	0.000	0.000	0.000	-0.002
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
Average literacy at district level							0.898***
							[0.086]
Whether as good at math as friends							0.287***
							[0.069]
Parents/siblings experienced shocks							0.131**
							[0.057]
Intercept				0.866***	0.153*	0.069	-0.002
				[0.051]	[0.081]	[0.079]	[0.001]
Ward test of exogeneity (p-value)	0.8069	0.6248	0.6073				
Anderson canon. corr. LM statistic				99.532	99.532	99.532	
Cragg-Donald Wald F statistic				46.349	46.349	46.349	
Sargan statistics (p-value)				0.5421	0.6245	0.3587	
R-squared				0.14	0.1427	0.1696	0.2422
Number of observations	989	989	989	989	989	989	989

Note: Figures in brackets are standard deviations. ***, ** and * denote coefficients significant at the 1%, 5% and 10% statistical levels, respectively. We use province dummies in all specifications. The dependent variables are whether the respondent holds: any saving products (columns 1 and 4); formal savings product in previous year (columns 2 and 5) and formal savings in previous two years (column 3 and 6). The first stage result is reported in column 7.
Source: Authors' estimates.

Table 5 reports our estimation results. We use instrumental variable probit estimators (columns 1-3) and instrumental variable linear probability regressions (columns 4-6) for our three indicators of savings. Column 7 presents the first stage regression.[16] The first stage regression suggests that the three instrumental variables are statistically significant associated with financial literacy at the 5% level (whether parents/siblings experienced shocks) and the 1% level for the other two variables. Tests show that our instrumental variables do not suffer from weak identification or weak instrument issues. The Hansen J-statistics (p-value) indicate that our set of instrumental variables satisfies the exclusion conditions. With regards to the impact of financial literacy on individual

[16] The first stage regression is the same for all estimations since we use the same instrumental variables and control variables to estimate the financial literacy.

savings behavior, the results show a positive and significant impact of financial literacy on saving behaviors, regardless of the indicators we used, although significance levels are only 5% or 10%. Also, when we control for endogeneity of financial literacy, the coefficient estimates of financial literacy are slightly higher. For example, as reported in column 5, a one-standard-deviation increase in financial literacy score (i.e., 2.56 points) raises the likelihood of having a formal saving product by 9.3 percentage points (versus increased by 7.5 percentage points if endogeneity is not controlled for). The estimated impact for the variable indicating having saving in last two years also increased from 5.1 to 7.2 percentage points (column 6). However, controlling for endogeneity, the coefficient of the variable indicating the likelihood of having any types of savings is reduced to 4.2 from 6.8 percentage points. Also, when controlling for endogeneity, the effect of financial literacy on the saving decision (either informal or formal) and formal saving decision in the previous two years are only statistically significant at the 10% level. The results for other variables are not qualitatively different from the results presented in table 4.

Table 6. Effect of financial literacy on types of savings in the Lao PDR (Marginal effects)

	Ordered probit			Multinomial probit		
	(1)	(2)	(3)	(4)	(5)	(6)
	No saving	Either formal or informal	Both formal and informal	No saving	Informal saving	Both formal and informal saving
Financial literacy	-0.046***	-0.056***	0.103***	-0.059***	-0.026	0.084***
	[0.006]	[0.007]	[0.011]	[0.008]	[0.016]	[0.014]
Income from 2M to 3.5M Kip	-0.039***	-0.051***	0.090***	-0.027	-0.074**	0.101***
	[0.011]	[0.018]	[0.028]	[0.019]	[0.036]	[0.032]
Income more than 3.5M Kip	-0.050***	-0.079***	0.129***	-0.030	-0.136***	0.166***
	[0.013]	[0.029]	[0.041]	[0.022]	[0.048]	[0.044]
Some secondary education	0.011	0.025	-0.036	-0.003	0.037	-0.035
	[0.014]	[0.034]	[0.048]	[0.028]	[0.058]	[0.053]
Some primary education	0.046***	0.069**	-0.115**	0.017	0.122**	-0.139**
	[0.015]	[0.034]	[0.048]	[0.031]	[0.060]	[0.055]
Age 30-60	-0.035**	-0.032***	0.067***	-0.011	-0.087**	0.098***
	[0.014]	[0.011]	[0.024]	[0.019]	[0.034]	[0.030]
Age over 60	-0.050***	-0.058**	0.108***	-0.017	-0.127**	0.143***
	[0.017]	[0.025]	[0.041]	[0.025]	[0.055]	[0.050]
Male	0.020*	0.024*	-0.044**	0.021	0.024	-0.045*
	[0.010]	[0.012]	[0.022]	[0.016]	[0.030]	[0.027]
Self-employed	-0.039**	-0.037***	0.077**	-0.017	-0.093**	0.110***
	[0.019]	[0.013]	[0.031]	[0.024]	[0.045]	[0.039]
Paid employee	-0.037*	-0.034	0.071*	-0.030	-0.062	0.092*
	[0.022]	[0.021]	[0.042]	[0.029]	[0.058]	[0.052]
Cannot work/student/retired	0.054	0.007	-0.061	0.163***	-0.211***	0.048
	[0.045]	[0.010]	[0.045]	[0.059]	[0.079]	[0.061]
Rural area	-0.013	-0.015	0.028	-0.066***	0.096**	-0.030
	[0.015]	[0.018]	[0.034]	[0.024]	[0.041]	[0.036]
Distance from bank (min.)	-0.000	-0.000	0.000	-0.000	0.001	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Number of observations	989	966

Note: Figures in brackets are standard deviations. ***, ** and * denote statistically significant at the 1%, 5% and 10% levels, respectively. We use provinces dummies in all specifications. Marginal effects are presented. The dependent variables in columns 1-3 are: (i) no savings; (ii) one type of savings (either formal or informal savings); and (iii) two types of savings. Ordered probit is used to estimate (with group of no saving as the reference group). The dependent variables in columns 4-6 are: (i) no savings; and (ii) only informal savings; (iii) both formal and informal savings. We do not use the group of only formal savings because it has only 24 observations (versus 19 covariates in our model). The multinomial probit estimator is used. The weighted sample is used all estimations.
Source: Authors' estimates.

Individuals may adopt different types of savings to mitigate risks or maximize returns. To further examine the role of financial literacy on the saving decision, we estimate how financial literacy affects individuals' choice of saving types (Table 6). Columns 1-3 present the results in which the dependent variable is the number of savings types a respondent holds. A respondent may have no savings, one type of saving (either formal or informal) or two types of savings (i.e., both formal and informal savings). We used the ordered probit estimator due to the nature of the dependent variable. The results show that a higher financial literacy score tends to be associated with having both forms of savings. However, surprisingly, the (absolute) magnitude of the effect of the financial literacy score on having either formal or informal saving is higher than that on having no savings. Our estimation results also indicate that those with higher income tend to save in both forms than those with lower income. Education is also positively correlated with the number of saving forms. People over age 30 are more likely to have both formal and informal savings than those under 30. Male respondents are more likely either not to save or to save in either formal or informal forms than female respondents. We also find that respondents' occupation determines their saving forms. Self-employed and paid employees tend to save more in both formal and informal forms than do those in the reference group.

Columns 4-6 present the estimation results (marginal effects) obtained from the multinomial probit regression. The dependent variables include four mutually exclusive groups of individuals. The first group is those who do not have any savings. We use this group as the reference group in our estimation. The other groups include: those holding only informal savings; and those who hold both informal and formal savings. (We exclude individuals who holds only formal savings because there are only 24 people in this group.) Column (4) reports the marginal effects of financial literacy on having no saving; column (5) presents the marginal effects of financial literacy on using only informal savings, respectively; and column (6) presents the marginal effects on having saved in both formal and informal forms. The results in column (4) show a negative relationship between the financial literacy score and the probability not to save. A one-standard-deviation increase in the financial literacy score reduces the likelihood not saving by 5.8 percentage points. This figure is much lower than those for Cambodia (12.4 percentage points) and Viet Nam (16.8 percentage points). The results also indicate that a higher financial literacy score is negatively correlated with the probability of having only informal savings. However, as expected, the negative effect of the financial literacy score on having only informal savings is lower than that on having no saving. The financial literacy score has a strong positive effect on having both formal and informal savings. If the financial literacy score increases by one standard deviation, the likelihood of having saved in both formal and informal forms increases by 8.4 percentage points, higher than that for Cambodia (7.1 percentage points) but lower than for Viet Nam (10.5 percentage points). However, similar to the results from the OLS and IV estimations presented above, the distance from home to the nearest bank is not statistically correlated with the types and number of savings products that an individual holds.

V.3 Effect of financial literacy on financial inclusion

Table 7 reports our estimation results on the relation between financial literacy and financial inclusion.[17] The first column reports the result from the OLS estimator while columns 2 and 3 show the results using instrumental variables for the financial literacy variable. The result in column 1 show that financial literacy is positively associated with financial inclusion and this relationship is statistically significant at the 1% level. A one-standard-deviation increase in the financial literacy score is associated with a rise of 0.25 standard deviations of the financial inclusion score. This result is consistent with the results Morgan and Trinh (2017) for Cambodia and Viet Nam, although the magnitude of the association is somewhat larger in Cambodia and in Viet Nam (0.34 and 0.42 standard deviations, respectively). Higher income is also positively associated with financial inclusion and this relationship is statistically significant at the 1% level. Even when financial literacy and income are controlled for, higher education levels are significantly associated with higher financial inclusion. This result is similar to the case of Viet Nam, while in Cambodia, there is no association between education and financial inclusion when income and financial literacy are controlled for. Being over age 30 is significantly related to financial inclusion. The occupation of respondents is not statistically associated with financial inclusion, which is consistent with the case of Viet Nam as reported in Morgan and Trinh (2017). The results also indicate that people living in rural areas have lower financial inclusion scores and those who live closer to commercial banks have higher financial inclusion score. This latter result highlights the importance of supply-side access for financial inclusion.

Table 7. Financial literacy and financial inclusion in the Lao PDR

	(1)	(2)	(3)
	OLS	IV (2nd stage)	IV (1st stage)
Financial literacy	0.245***	0.392***	
	[0.029]	[0.084]	
Income from 2M to 3.5M Kip	0.293***	0.135*	0.308***
	[0.070]	[0.077]	[0.073]
Income more than 3.5M Kip	0.549***	0.360***	0.286***
	[0.095]	[0.100]	[0.098]
Some secondary education	-0.221**	-0.154	-0.174*
	[0.102]	[0.106]	[0.106]
Some primary education	-0.581***	-0.448***	-0.354***
	[0.112]	[0.118]	[0.112]
Age 30-60	0.211***	0.153**	0.196***
	[0.071]	[0.073]	[0.072]
Age over 60	0.307***	0.265**	-0.025
	[0.107]	[0.104]	[0.106]
Male	-0.050	-0.034	-0.032
	[0.059]	[0.059]	[0.060]
Self employed	0.123	0.078	0.215**
	[0.097]	[0.099]	[0.098]
Paid Employees	0.031	0.001	0.089
	[0.117]	[0.123]	[0.124]
Cannot work/Students/Retired	0.105	0.033	0.223
	[0.149]	[0.154]	[0.154]
Rural area	-0.162**	-0.033	0.078
	[0.081]	[0.085]	[0.086]
Distance from banks (mins)	-0.003***	-0.002*	-0.002

[17] See section III.2 for the definition of the financial inclusion score.

	[0.001]	[0.001]	[0.001]
% people with income at least 2M, dist-level		0.540***	-0.504***
		[0.160]	[0.173]
Average literacy at district level			0.816***
			[0.081]
Whether as good at math as friends			0.282***
			[0.067]
Parents/siblings experienced shocks			0.146**
			[0.058]
Intercept	0.138	0.187	-0.438**
	[0.164]	[0.172]	[0.178]
Anderson canon. corr. LM statistic			119.883
Cragg-Donald Wald F statistic			44.461
Sargan statistics (p-value)			0.105
R-squared	0.253	0.2417	0.2422
N	989	989	989

Note: Figures in bracket are standard deviations. ***, ** and * denote coefficient is statistically significant at the 1%, 5% and 10% levels, respectively. The dependent variable is the financial inclusion z-score. The weighted sample is used all estimations.
Source: Authors' estimates.

Similar to the relationship between financial literacy and the savings decision, the OLS estimates may suffer from endogeneity problems. To address this, we also use the average financial literacy score at the district level, mathematical ability and financial shocks experienced by parents and/or siblings as instrumental variables for financial literacy score. The test statistics indicate that our set of instrumental variables do not suffer from under-identification or weak instrument problems. The Sargan test also suggests that our instrumental variables satisfy the exclusion condition. The estimation results show a positive and significant impact of financial literacy on financial inclusion, actually larger than the OLS estimate. This result is consistent with other studies that use IV's for financial literacy such as Agnew, Bateman, and Thorp (2013), Bucher-Koenen and Lusardi (2011) and Morgan and Trinh (2017). According to Lusardi and Mitchell (2014), the true effect of financial literacy seems to be biased downward although the larger magnitude of the IV coefficient may be attributed to either measurement errors or a larger response of those who are affected by the instruments. The estimation results also show that the correlations between financial inclusion and other covariates are not qualitatively different from the OLS results, except for the variable indicating whether an individual has some secondary education or not. The result also indicates that, when we control for endogeneity of financial literacy, the relationship between distance to the bank and financial inclusion is still statistically significant, although only at the 10% level.

VI. Conclusion

Our study of adult financial literacy in the Lao PDR produced findings that are very consistent with our earlier study of Cambodia and Viet Nam (Morgan and Trinh 2017). It also breaks new ground by introducing new instrumental variables for financial literacy in order to correct for endogeneity, and introducing a supply-side variable, the distance from the nearest bank. This increases our confidence in our findings that financial literacy positively affects both savings and financial inclusion, and thus provides supporting evidence for our earlier findings in this regard on Cambodia and Viet Nam.

Generally, our study corroborates the findings of studies of other countries but uncovers some differences as well. The overall scores of financial literacy in Cambodia (11.5), the Lao PDR (12.5) and Viet Nam (12.7) are at the low end of the range seen in the other 30 countries cited in OECD (2016). However, these results are if anything positive, given the relative low levels of per capita income in those two countries.

One of the most robust finding is that higher levels of education were generally found to be highly significant and positively correlated with financial literacy. This holds for both the overall measure of financial literacy and the sub-scores for financial knowledge, financial behavior and savings. The results for the overall financial literacy score were consistent with the findings for the other 30 countries reported in OECD (2016) and the findings of Morgan and Trinh (2017) for Viet Nam and Cambodia. However, different from Cambodia and Viet Nam, having at least some secondary education was significant for improving all three sub-indices of financial literacy.

Respondents age 30-60 years old had significantly higher overall financial literacy scores, but the effects of age on individual sub-scores were not consistent. In particular, there was no significant effect of age on financial knowledge while the age 30-60 group has higher financial behavior scores and people over age 60 have lower financial attitude scores. Gender seemed to have little effect on financial literacy, financial knowledge or financial attitude scores while males have lower financial behavior scores. These results are consistent with (Morgan and Trinh (2017), who find that the gender coefficient was generally not significant for Cambodia and Viet Nam.

Financial literacy has statistically significant effects on savings and financial inclusion. Individuals with higher financial literacy score tends to save more in both formal and informal ways than those who have lower financial literacy score, even when we control for income and education. People with higher financial literacy also have higher financial inclusion. The results suggest that richer and more educated people tend to hold both formal and informal savings while people with some primary education are more likely to hold only informal savings. Furthermore, younger people (age less than 30) do not hold formal savings but they usually save informally. People in rural areas are more likely to save in the form of informal savings than people in urban areas. This may be because of lower level of financial development and access to financial services in rural areas. Although the results did not suggest a correlation between the time from an individual's house to nearest banks and savings decision, the former have an effect on one's financial inclusion. The results generally showed that self-employed workers had higher levels of financial literacy than did people in other employment categories, but this relationship is relatively weak. This result is somewhat similar to the case of Cambodia and Viet Nam. However, in Cambodia and Viet Nam, paid employees also tend to have higher financial score.

Perhaps most importantly from a macroeconomic perspective, both financial literacy and general education levels are positively and significantly related to formal and informal savings activity, and financial literacy has an independent effect even when the general education level is corrected for. This result holds even when the possible endogeneity of financial literacy is corrected for by using three instrumental variables. Thus, improving general education levels is important, but additional gains can be obtained by developing policies such as financial education programs that directly affect financial literacy. These could have important potential impacts in terms of increasing savings in those countries. This result also supports similar findings for Cambodia and Viet Nam, where only one instrumental variable was used.

Also importantly, both financial literacy and general education levels are positively and significantly related to the measure of financial inclusion. This result also holds even when the possible endogeneity of financial literacy is corrected for by using three instrumental variables. These results are also consistent with those for Cambodia and Viet Nam. Therefore, increased financial inclusion holds the prospect of making increased savings more readily available for investment activity in those countries. Again, this suggests the importance of developing policies to raise both general education and financial literacy. Access to finance, i.e., distance from the bank, is also shown to be important.

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Appendix 1: Sample distribution

Province	Population	Sample	% male	% female	% age under 30	% age 30-60	% age over 60
Vientiane Capital	55,018	60	31.7%	68.3%	25.0%	70.0%	5.0%
Oudomxay	146,250	180	50.0%	50.0%	29.4%	56.7%	13.9%
Laungpabang	220,665	120	40.8%	59.2%	39.2%	52.5%	8.3%
Bolikhamxai	154,770	110	49.1%	50.9%	19.1%	69.1%	11.8%
Khammuan	219,264	130	33.1%	66.9%	29.2%	55.4%	15.4%
Savanaket	566,675	200	50.5%	49.5%	24.0%	56.5%	19.5%
Sekong	45,095	60	40.0%	60.0%	36.7%	61.7%	1.7%
Champasak	384,295	140	45.7%	54.3%	19.3%	68.6%	12.1%
Total	2,287,194	1,000	44.4%	55.6%	27.1%	60.1%	12.8%

Appendix 2. Financial knowledge, financial behavior, financial attitude literacy and saving behavior in the Lao PDR

	(1)	(2)	(3)
	Save (both formal and informal)	Formal save in previous year	Formal save in previous two years
Financial knowledge	-0.004	0.008	0.007
	[0.007]	[0.014]	[0.014]
Financial behavior	0.068***	0.079***	0.059***
	[0.007]	[0.014]	[0.014]
Financial attitude	-0.013*	0.049***	0.019
	[0.007]	[0.013]	[0.013]
From 2M to 3.5M Kip	0.024	0.103***	0.117***
	[0.017]	[0.032]	[0.032]
More than 3.5M Kip	0.015	0.151***	0.202***
	[0.021]	[0.043]	[0.045]
Some secondary education	-0.007	-0.053	-0.036
	[0.022]	[0.053]	[0.052]
Some primary education	-0.025	-0.170***	-0.154***
	[0.024]	[0.055]	[0.054]
Age 30-60	-0.013	0.085***	-0.009
	[0.016]	[0.030]	[0.030]
Age over 60	-0.001	0.159***	0.187***
	[0.021]	[0.050]	[0.051]
Male	-0.005	-0.035	-0.025
	[0.015]	[0.027]	[0.026]
Self employed	0.012	0.108***	0.010
	[0.020]	[0.040]	[0.043]
Paid Employees	0.017	0.111**	0.048
	[0.026]	[0.052]	[0.055]
Cannot work/Students/Retired	-0.148**	0.050	0.007
	[0.058]	[0.065]	[0.066]
Rural area	0.057***	-0.041	-0.024
	[0.019]	[0.035]	[0.035]
R-squared	0.2319	0.1734	0.1428
N	989	989	989

Note: Figures in brackets are standard deviations. ***, ** and * denote coefficients significant at the 1%, 5% and 10% statistical levels, respectively. The dependent variables in column 1 is whether the respondent has any types of savings, that in column 2 is whether the respondent has saved formally in the previous year or not and in column 3 is whether he/she had savings in the previous two years or not. Province dummies are included in all estimates.
Source: Authors' estimates

Appendix 3. Effect of each component of financial literacy on types of savings in the Lao PDR (Marginal effects)

	Ordered probit	Multiple nominal probit

	No saving	Either formal or informal	Both formal and informal	No saving	Informal saving	Both formal and informal saving
Financial knowledge	-0.001	-0.002	0.003	0.002	-0.014	0.012
	[0.005]	[0.007]	[0.011]	[0.008]	[0.015]	[0.013]
Financial behavior	-0.055***	-0.075***	0.131***	-0.069***	-0.011	0.081***
	[0.006]	[0.008]	[0.012]	[0.007]	[0.016]	[0.014]
Financial attitude	-0.006	-0.009	0.015	0.013*	-0.060***	0.047***
	[0.004]	[0.006]	[0.010]	[0.007]	[0.014]	[0.013]
From 2M to 3.5M Kip	-0.038***	-0.057***	0.095***	-0.023	-0.082**	0.104***
	[0.010]	[0.018]	[0.028]	[0.017]	[0.035]	[0.032]
More than 3.5M Kip	-0.043***	-0.070***	0.113***	-0.013	-0.141***	0.155***
	[0.012]	[0.027]	[0.038]	[0.022]	[0.047]	[0.043]
Some secondary education	0.011	0.028	-0.039	-0.004	0.035	-0.031
	[0.012]	[0.035]	[0.047]	[0.025]	[0.057]	[0.052]
Some primary education	0.046***	0.077**	-0.122***	0.014	0.125**	-0.139***
	[0.014]	[0.034]	[0.047]	[0.027]	[0.059]	[0.053]
Age 30-60	-0.025**	-0.027**	0.053**	0.010	-0.104***	0.095***
	[0.012]	[0.012]	[0.024]	[0.016]	[0.033]	[0.030]
Age over 60	-0.045***	-0.066**	0.112***	0.001	-0.152***	0.151***
	[0.015]	[0.026]	[0.040]	[0.021]	[0.053]	[0.049]
Male	0.015	0.020	-0.035	0.007	0.032	-0.039
	[0.010]	[0.013]	[0.023]	[0.015]	[0.029]	[0.027]
Self employed	-0.038**	-0.041***	0.079***	-0.013	-0.101**	0.114***
	[0.017]	[0.013]	[0.030]	[0.020]	[0.043]	[0.038]
Paid Employees	-0.036*	-0.037*	0.073*	-0.016	-0.089	0.105**
	[0.021]	[0.022]	[0.041]	[0.027]	[0.057]	[0.051]
Cannot work/Students/Retired	0.046	0.011	-0.056	0.137**	-0.200**	0.063
	[0.041]	[0.010]	[0.044]	[0.057]	[0.078]	[0.063]
Rural area	-0.011	-0.015	0.027	-0.056***	0.095**	-0.039
	[0.014]	[0.018]	[0.032]	[0.019]	[0.038]	[0.034]
N		989			966	

Note: Figures in brackets are standard deviations. ***, ** and * denote statistically significant at the 1%, 5% and 10% levels, respectively. We use provinces dummies in all specifications. Marginal effects are presented. The dependent variables in columns 1-3 are: (i) no savings; (ii) one type of savings (either formal or informal savings); and (iii) two types of savings. Ordered probit is used to estimate (with group of no saving as the reference group). The dependent variables in columns 4-6 are: (i) no savings; and (ii) only informal savings; (iii) both formal and informal savings. We do not use the group of only formal savings because it has only 24 observations (versus 19 covariates in our model). The multinomial probit estimator is used. The weighted sample is used all estimations.
Source: Authors' estimates.