ADBI Working Paper Series

**FINTECH AND FINANCIAL LITERACY
IN THE LAO PDR**

Peter J. Morgan and Long Q. Trinh

No. 933
March 2019

Asian Development Bank Institute

Peter J. Morgan is Senior Consulting Economist and Vice Chair, ADBI. Long Q. Trinh is Project Consultant, ADBI.

Abstract

Financial literacy is gaining increasing importance as a policy objective in many countries. A growing literature has examined the role of financial literacy in an individual's income, saving behavior and the use of various financial products. However, so far, no one has examined the relationship between financial literacy and the awareness and adoption of financial technology (fintech) products, i.e., financial products provided via internet-based and mobile-based platforms. This paper examines this relationship in a developing country, the Lao People's Democratic Republic (PDR). We use information collected in the Lao PDR using the standardized questionnaire developed by the Organization for Economic Cooperation and Development International Network on Financial Education (OECD/INFE) to calculate our financial literacy. We find that a higher level of financial literacy has strong and positive effects on an individual's awareness of fintech products. This result still holds when we use a set of instrumental variables for the financial literacy variable. However, there is insufficient data to find a significant relationship between financial literacy and the use of fintech products.

Contents

1. INTRODUCTION

In the literature, there are several widely used definitions of financial literacy. In their review article, Lusardi and Mitchell (2014) define financial literacy as "peoples' ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions." The Organization for Economic Cooperation and Development and the International Network on Financial Education (OECD/INFE) (2016) define financial literacy as "[a] combination of awareness, knowledge, skill, attitude and behavior necessary to make sound financial decisions and ultimately 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). This parallels the stress placed on increasing financial inclusion, i.e., access to financial products and services. If individuals do not well understand financial principles, they will not be able to profit from such increased access. Also, the trend of switching to defined-contribution plans from defined-benefit pension plans implies that individuals will increasingly need to manage their own retirement savings and pensions. At their summit in Los Cabos, Mexico in 2012, Group of Twenty (G20) leaders endorsed the High-Level Principles on National Strategies for Financial Education developed by OECD/INFE, thereby acknowledging the importance of coordinated 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, 2017, 2018a). This indicates that the need for high levels of financial literacy is rising.

Rapid developments in financial technology (fintech) highlight the need to improve financial literacy in order to use innovative financial products and services. With the development of information–communication technology (ICT), there is a growing breed of fintech companies that provides services through internet- and mobile-based platforms, including Uber, Grab, and Airbnb. Recent literature has shown that fintech (especially mobile money) has helped to increase financial inclusion in developing economies where the traditional bank-based financial system is underdeveloped. Other studies have discovered factors that affect the adoption of mobile- and internet-based financial services (Jack, Ray and Suri 2013; Suri 2017). However, we are not aware of any papers that investigate the role of financial literacy in the awareness and/or use of fintech products.

This paper attempts to fill this gap by using newly collected data in a less-developed country with a rather low level of ICT development—the Lao People's Democratic Republic (PDR). More specifically, our question is whether those with a higher level of financial literacy are more likely to be aware of and use fintech products. To answer this question, we construct a financial literacy score based on OECD/INFE (2015a, 2015c) and use both ordinary least squares (OLS) and instrumental variable (IV) estimation methods. We find that higher financial literacy is significantly related to awareness of fintech products. Therefore, improvements in financial literacy could speed the adoption of fintech products and services, and thereby promote financial inclusion.

The paper is organized as follows. Section 2 provides some background on fintech development in general, and in the Lao PDR in particular. Section 3 reviews literature on the effects of financial literacy. Data collection, the definition of the financial literacy score used in this study and some descriptive analyses are presented in Section 4. Econometric approaches and results are reported in Section 5, followed by some concluding remarks in Section 6.

2. FINTECH AND FINTECH DEVELOPMENT IN THE ASSOCIATION OF SOUTHEAST ASIAN NATIONS (TO BE ELABORATED)

2.1 An Overview of Fintech

"Fintech" to refers "any technological innovation in—and automation of—the financial sector, including advances in financial literacy, advice and education, as well as streamlining of wealth management, lending and borrowing, retail banking, fundraising, money transfers/payments, investment management and more" (Investopedia 2018). Earlier generations of finance-related technology typically focused on providing services to already-established financial firms, but today's fintech companies are increasingly providing services directly to consumers. Fintech is changing finance in fundamental ways, from investment management to capital–raising, to the very form of currency itself. In each of these areas, fintech innovation has lowered the barriers to entry, expanded access to financial services and challenged the traditional understanding of how finance works.

Major categories of financial services offered by fintech firms include:

- Payments and transfers (e-commerce payments; mobile banking, mobile wallets; person-to-person (P2P) payments and transfers; digital currency; and cross-border transactions including remittances and business-to business (B2B) payments)

- Personal finance (robo-advisors; mobile trading and personal financial management)

- Alternative financing (crowdfunding, alternative lending and invoice and supply-chain finance)

Table 1 provides an overview of the size, composition and regulatory status of fintech markets in some Association of Southeast Asian Nations (ASEAN) economies.

Table 1: Fintech in ASEAN: A Snapshot

	No. of Fintech Companies	Investment in 2017 (USD million)	Key Sectors	Regulatory Sandbox
Indonesia	262	26 (370% yoy growth)	Mobile payments, alternative lending	Yes
Malaysia	196	75 (1,500% yoy growth)	Payments, consumer finance	Yes
Philippines	115	78 (1,300% yoy growth)	Payments (incl. remittances)	Yes
Singapore	490	141 (68% yoy growth)	Wealth management, alternative lending, payments	Yes
Thailand	128	12 (–40% yoy growth)	Payments	Yes
Viet Nam	77	3	Payments	No

yoy = year-on-year.
Source: EY (2018).

2.2 Fintech Development in the Lao PDR

Digital financial services (e.g., savings, credit, insurance and payment facilities through electronic devices) are at a very nascent stage in the Lao PDR. Mobile "top ups" and utility bill payments through a formal bank account, the internet or cell phones are the only digital financial activities currently prevalent in the Lao PDR.

Moreover, in current circumstances, no fintech startup can pose any threat to incumbent formal financial institutions. The Banque Pour Le Commerce Exterieur Lao (BCEL) and other financial institutions are preparing for the adoption of digital financial services.

- BCEL has a mobile application (app) to facilitate cardholders' payments and transactions;

- BCEL and UNITEL plan to launch a mobile app through which people can deposit money that can be used as e-money (i.e., transfer money via the mobile app); and,

- The Central Bank of Lao PDR is preparing to launch branchless banking.

2.2.1 Internet Infrastructure in the Lao PDR

Mobile connectivity has grown rapidly in the Lao PDR, but internet services do not seem to be adequate to facilitate the use of digital finance services. According to the Lao Statistics Bureau (LSB) (2017), in the financial year 2015-16:

- 14% owned a home telephone;

- 85% used cell phones;

- 16% used computers; and,

- 20% had access to the internet.

Internet access in the Lao PDR is still relatively underdeveloped (LSB 2017). The breakdown of access by the level of the network is:

- 1.5% with 4G network;
- 61% with 3G network; and
- 90% with 2G network.

The environment for fintech startups in the Lao PDR is still difficult. Two government departments deal with startups: the Department of Small and Medium Enterprise Promotion (DOSMEP) and the Ministry of Science and Technology (MOST). However, government agencies believe that small-scale industries and startups are similar, so there are no new guidelines under which startups are registered. They are registered under small and medium enterprise (SME) rules.

Tax authorities, too, treat SMEs and startups alike. There is no tax incentive or registration subsidy from the government for any startup firms at present. Even laws on foreign investment make it difficult for foreign investors to collaborate or invest in any startup in the country. Many experts suggest that the government should provide incentives and encourage regulation for startups to boost the startup eco-system in the Lao PDR.

3. LITERATURE SURVEY

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

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 United States in 1997, described in Mandell (2009). Lusardi and 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 models 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 4.1.

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, 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 than men to admit that they do not know an answer. 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).

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 United States, in response to the increasing shift toward defined-contribution pension plans. This area of research received a further boost after the global financial crisis of 2008–2009, which drew attention to numerous scams inflicted on individual borrowers and investors in the United States 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 people who were 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; de Bassa Scheresberg 2013). People who are 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.

But, as far as we are aware, no one has examined whether there is a link between financial literacy and the awareness and adoption of financial technology. We conjecture that there is a positive correlation between financial literacy and the awareness and adoption of financial technology.

4. FINANCIAL LITERACY AND FINTECH IN THE LAO PDR

4.1 Measurement of Financial Literacy

Financial literacy is multi-dimensional, reflecting not only knowledge but also skills, attitudes and actual behavior. Data on financial literacy provides information on the need for financial education or other supportive policies, and indicates which groups have the greatest needs. To this end, the OECD/INFE developed a standard survey instrument for gathering information on financial literacy. The questionnaire includes not only questions about financial literacy but also questions about individual information (such as gender, age, income, occupation and other socio-demographic information). 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 respondents' parents' education, school performance, distance from the nearest bank, household experience of financial shocks, and use of fintech products.[1]

We also follow the methodology in OECD/INFE (2015a) to calculate scores for the various indicators of financial literacy. In the survey, financial literacy is divided into three related aspects: financial knowledge; financial behavior; and attitudes to longer-term financial planning.

---

[1] The questionnaire translated into Lao, and the translation was checked by the Bank of Lao PDR (BoL).

i. Financial knowledge helps individuals 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 implication for their financial well-being. Financial literacy can be measured both objectively (through survey questions) and subjectively, i.e., by asking respondents to rate their own literacy as compared to their peers. The score for financial knowledge is calculated from responses to survey questions reflecting the subject's understanding of basic knowledge (or awareness) as it relates to finance, such as calculating interest rates, compound interest rates, risk and return evaluation, and understanding inflation and financial diversification. This indicator ranges between 0 and 7.

ii. 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. The financial behavior 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.

iii. 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. 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 seven 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.

4.2 Data Collection

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 (see the Appendix for sample distribution).

4.3　Stylized Facts of Financial Literacy in the Lao PDR

Figure 1 compares the average values of the scores of financial literacy and the major subscores for the Lao PDR with a number of major economies. The average financial literacy score for the Lao PDR is 12.5 (out of total possible score of 21). The Lao PDR's financial literacy score is lower than the 30-country average score of 13.3 and those of some other developing Asian economies, including the People's Republic of China (PRC), Indonesia, Thailand and Viet Nam, but higher than those of Malaysia, India and Cambodia. The results may be viewed as neutral to positive, taking into account the relatively low level of per capita income in the Lao PDR. Figure 2 shows that there is a fairly high correlation between the average financial literacy score and per capita GDP (0.64), although there is still wide variation relative to the trend line. The score of the Lao PDR lies above the trend line.

There are some differences according to the subcategories of the financial literacy score. The score for financial knowledge is at the low end of the sample. Of greater concern, perhaps, is the fact that only 30% of the respondents correctly answered 5 out of 7 financial knowledge questions, which is considered to be the minimum target level. Similarly, the financial "savvy" or behavior score (5.5) was slightly lower than those of Viet Nam, Thailand and the PRC, but slightly higher than of India. On the other hand, the financial attitude score of the Lao PDR (3.3) is among the highest among the economies surveyed.

**Figure 1: Financial Literacy Scores in Selected Economies**
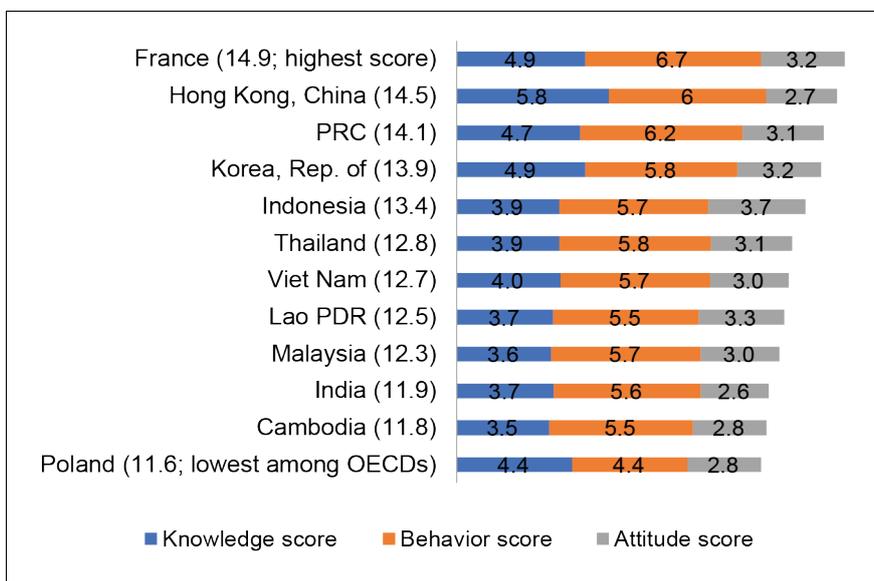
Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China.

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.

Figure 2: Financial Literacy Score vs GDP per Capita
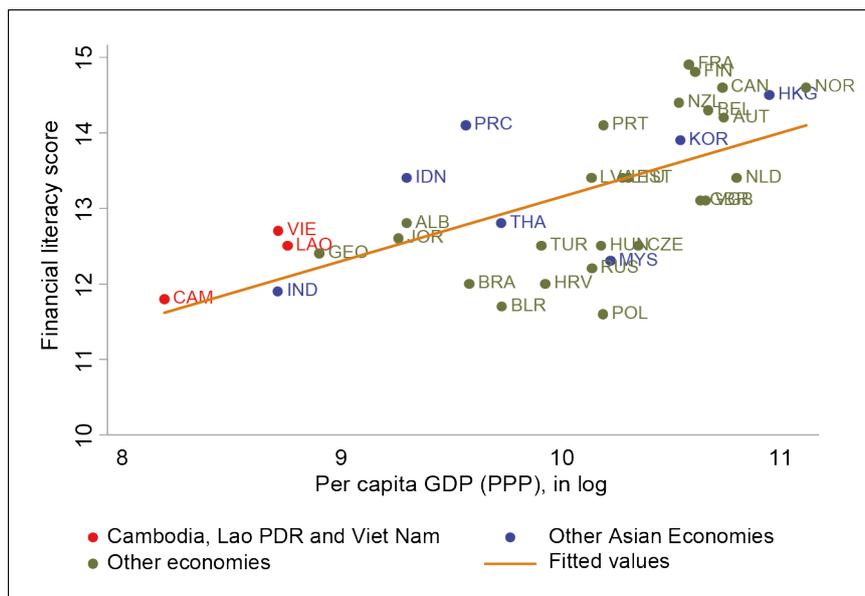
Source: OECD/INFE (2016), World Bank World Development Indicator database, (http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD), authors' calculation.

Table 2: Financial Literacy and Financial Inclusion Scores in the Lao PDR

	All	Urban Residents	Rural Residents	Women	Men	Aged Under 30	Aged from 30–60
Lao PDR							
Financial knowledge	3.68	3.82	3.63	3.58	3.79	3.67	3.70
Knowledgeable people (%)	29.8%	34.2%	28.2%	27.9%	32.1%	29.2%	30.3%
Financially "savvy" behavior	5.55	5.67	5.51	5.58	5.50	5.33	5.75
Financial attitude	3.26	3.34	3.24	3.25	3.28	3.38	3.26
Financial literacy	12.49	12.83	12.37	12.42	12.57	12.38	12.71
Financial inclusion	2.59	2.97	2.46	2.56	2.63	2.48	2.66
Formal savings (last 2 years)	24.0%	33.1%	20.8%	24.1%	23.9%	24.7%	22.0%

|	Aged Over 60	People with Some Education	People with Some Secondary Education	People with Some Primary Education and Lower	Below Median	Above Median
Lao PDR						
Financial knowledge	3.58	4.20	3.90	3.45	3.46	3.96
Knowledgeable people (%)	28.9%	43.6%	33.6%	25.0%	25.0%	35.9%
Financially "savvy" behavior	5.07	5.94	5.69	5.41	5.32	5.84
Financial attitude	3.04	3.53	3.31	3.18	3.17	3.39
Financial literacy	11.69	13.67	12.90	12.04	11.94	13.19
Financial inclusion	2.52	3.35	2.89	2.28	2.25	3.04
Formal savings (last 2 years)	32.0%	41.8%	31.5%	16.2%	15.5%	35.0%

Source: Authors' calculation.

Table 2 shows financial literacy and financial inclusion scores for various subgroups of the sample. Urban residents have higher financial literacy scores than do their rural counterparts, and the gap is rather high at 0.46. Moreover, 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, especially for financial knowledge. 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.

4.4 ICT Adoption and Financial Literacy

Although more than 80% of Lao respondents in our survey report using a telephone, only 30% of them have a smartphone (Figure 3). The penetration of smartphones in urban areas is much higher than in the rural areas (47.3% vs 23.9%). Moreover, one fifth of rural respondents did not use a telephone, which is twice as high as for urban residents. Women are more likely to use smartphones than men, but the share of male and female respondents that do not use telephones is about the same. Nearly three-fifths of younger people (aged under 30) use smartphones; a much higher percentage than for the middle-age group (23.5%) and the elderly group (0.8%). The share of elderly that do not use telephones (31.3%) is much higher than that of the young- and middle-aged groups. The effects of education and income levels on smartphone penetration are also large. Most individuals with some tertiary education (72.7%) own a smartphone, while the figure is only 12.1% for those with only some primary education. The smartphone penetration rate among high-income people (i.e., those with incomes higher than 3.5 million Lao kip) is much higher than for those with low incomes.

**Figure 3: Telephone Penetration in the Lao PDR**
(%)
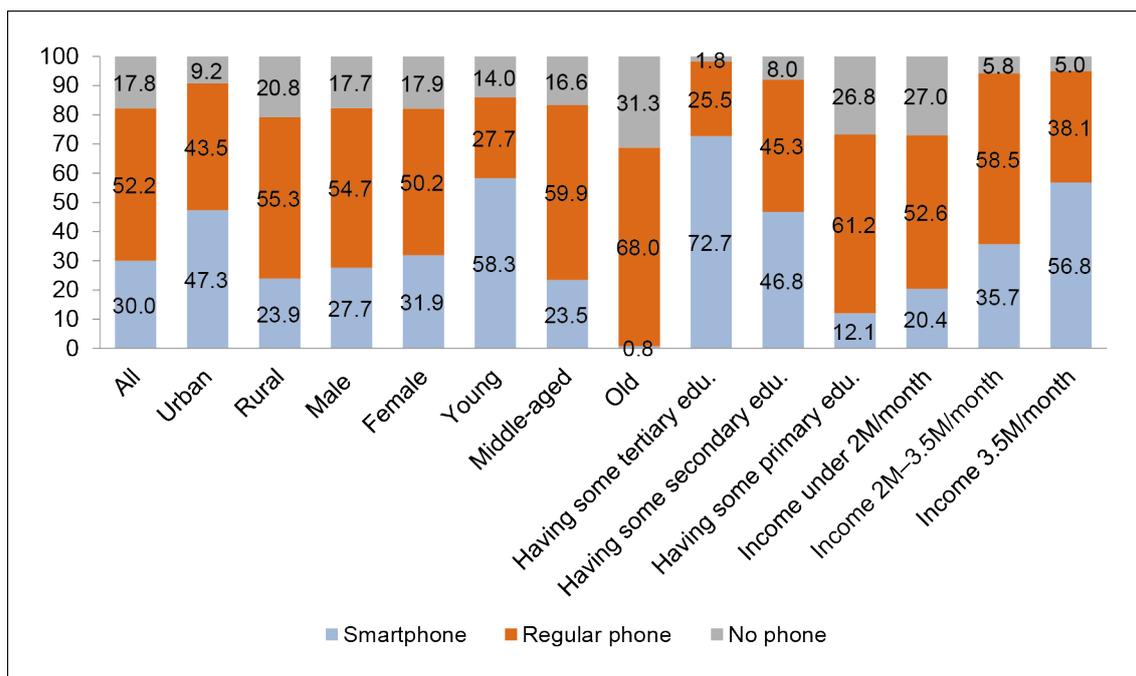
Source: Authors' calculation.

Figure 4 shows how smartphones are used among those who have smartphones (aside from phone calls). Unsurprisingly, most smartphone users (about 70%), regardless of their location, gender, age, education level and income level, use their smartphones for browsing social media apps. Around 30% uses smartphones

for accessing the internet (other than social media apps). The proportion using smartphones for online shopping is very small, only about 1%. Those with incomes of more than 3.5 million kips tend to use smartphones more for online shopping than do other income groups (3%).
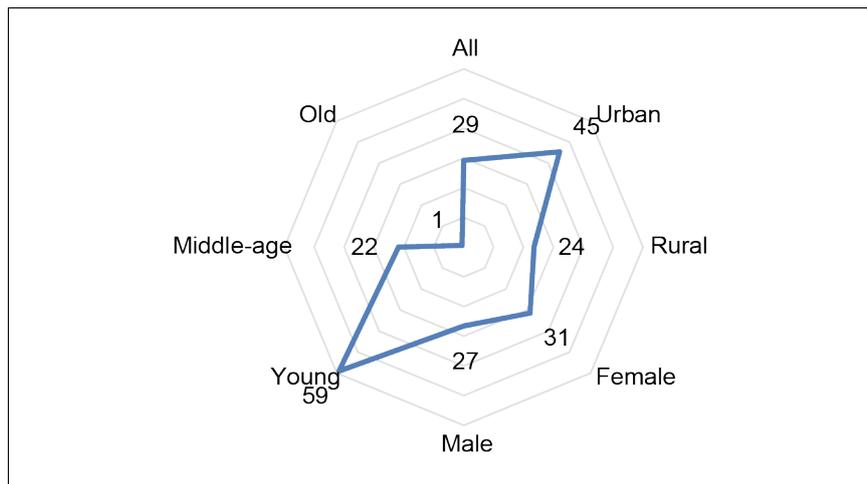
Figure 4: Smartphone Usage
(%)
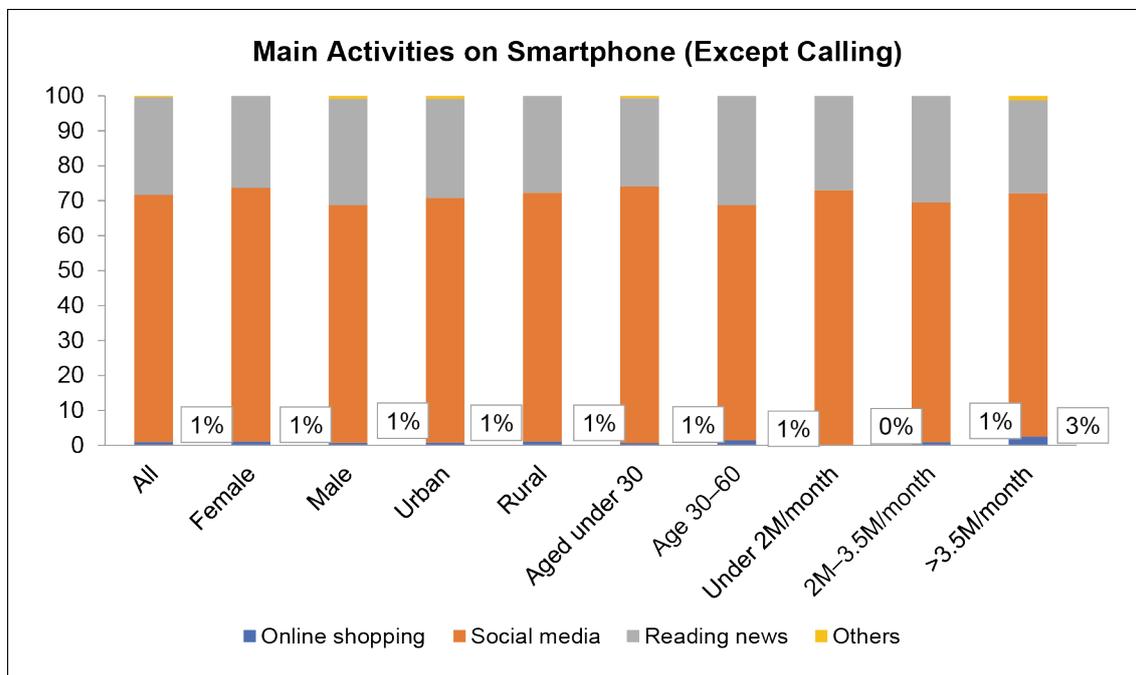
Source: Authors' calculation.

As shown in Figure 5, less than one-third of respondents in our survey have accessed the internet (either by personal computer or mobile phone). This figure is similar to the smartphone penetration rate presented in Figure 3. This is mainly due to the fact that nearly all internet users access the internet by smartphone. Younger individuals access the internet at much higher rates than middle-aged and elderly people, and urban dwellers have much higher access rates than rural dwellers. Most internet users (72%) started to access the internet only in the last three years, and most of them access it by smartphone.

Only 30.7% of respondents in our survey have heard about fintech products (Figure 6). Men, urban residents and younger persons were more likely to be aware of fintech products than women, rural residents and older persons. Around 40% of urban residents and young people have heard about fintech products, while the figure is only 26.6% for rural residents and 18.8% for elderly people. Among those who have heard of fintech products, only 9.1% (or about 3.7% of the whole sample) have used one or more of these products. Even some of fintech users did not recognize the product they used as a fintech product. We also found a low level of awareness of fintech products among the self-employed (27%) and retired/unemployed (13%), while the figures for paid employees and students are about 50–52%. Only 2.4% of respondents use online banking, while virtually all respondents (more than 99%) still use cash for payment (including offline and online shopping) and for money transfers.

Figure 5: Internet Users

Source: Authors' calculation.

Figure 6: Awareness of Fintech Products
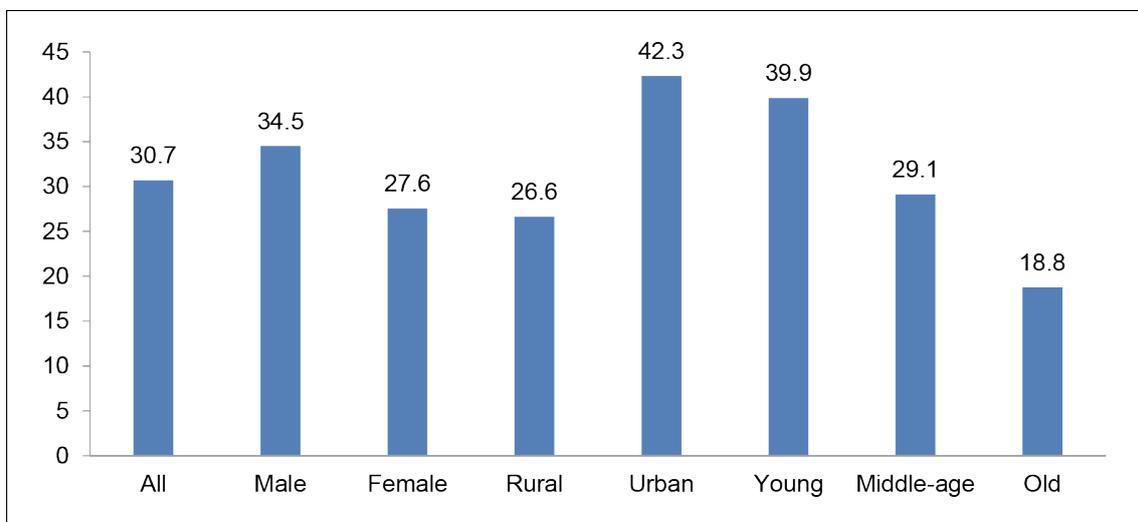
Source: Authors' calculation.

Figure 7 shows the relationship between the financial literacy score and internet access, smartphone usage and awareness of fintech products. Those who access the internet and use smartphones have higher financial literacy scores than those who do not access the internet and did not use smartphones. The average financial score of those who access the internet is 13.1, higher than those who do not access the internet by 0.9 point. The difference in score between those who use smartphones and those who use normal phones is 0.5 point, while the score of those who did not use a phone is much lower (11.0). Also, the financial literacy of those who have heard about fintech products is 1.4 points higher than that of those who have not heard about fintech products. This indicates a positive correlation between financial literacy and awareness of fintech products.

Figure 7: Fintech Use and Financial Literacy Scores
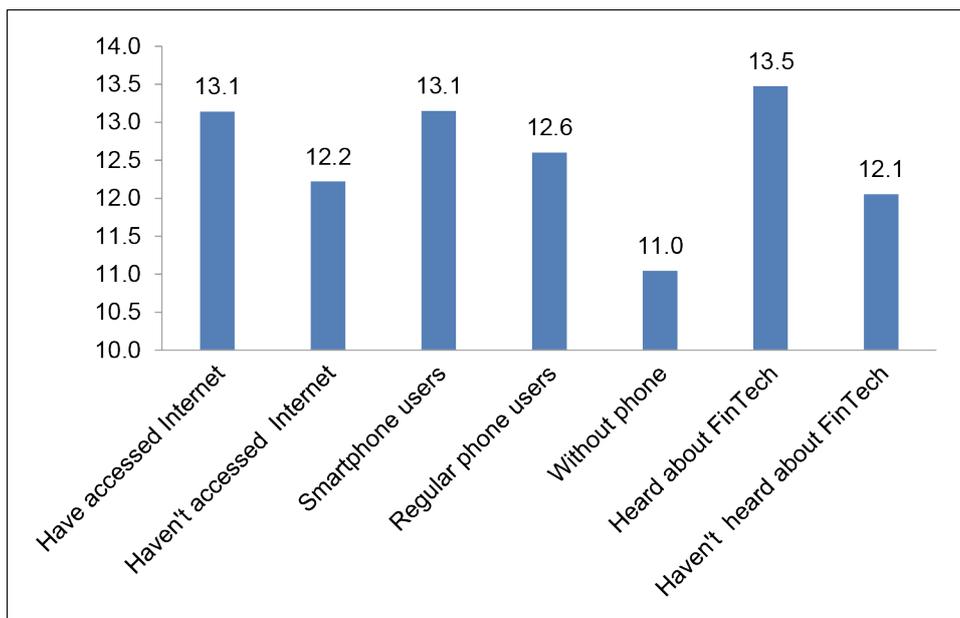
Source: Authors' calculation.

We further examined the differences in each of three sub-components of financial literacy among different groups (Figure 8). In general, more financially aware groups (i.e., those who have internet access, use smartphones and/or are aware of fintech products) have higher financial knowledge, financial behavior and financial attitude scores than those in the less knowledgeable groups. The differences in each sub-component score are largest between groups of individuals who are aware of fintech products and those who are not.

Figure 8: FinTech Use and Three Sub-components of Financial Literacy Score
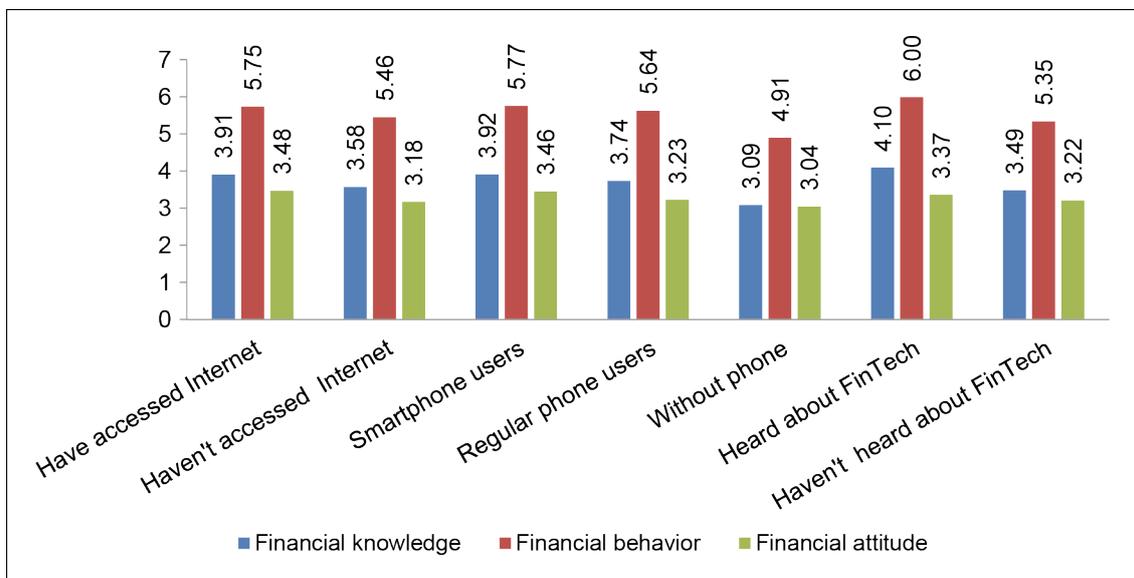
Source: Authors' calculation.

5. EFFECTS OF FINANCIAL LITERACY ON FINTECH AWARENESS

5.1 Empirical Approach

In this paper, we only estimate the effect of financial literacy on the awareness of financial products. There was not sufficient data to estimate the impact of financial literacy on fintech use. To quantify the effect of financial literacy on the awareness of fintech products, the following equation is estimated:

$$Fintech_i = \beta_0 + \beta_1 FL_i + X_i \beta_2 + \eta_i$$

of which

- $Fintech_i$ is a dummy variable, taking the value of one if the individual has heard of any types of fintech products, and zero otherwise.

- FL_i is the financial literacy score, and β_1 measures the effects of financial literacy on fintech awareness.

- The control variables (X_i) include income level, individual's age, education level, gender, occupation, rural versus urban residence, and province. With regard to age, we divided the sample into three age groups: those under 30-years old, those over 30-years old but under 60-years old and those over 60-years old. We used the group of over-60-years-old individuals as the base group. For educational level, we combined the categories into three groups: (i) those with some, or completed, primary education (called the "some primary education" group) ; (ii) those with some, or completed, secondary education (called the "some secondary education" group); and (iii) those with at least some technical education beyond secondary education or university-level education (called the "tertiary education" group). The last group is used as the base group. With regard to occupations, we combined homemakers, retired and disabled people and voluntarily unemployed persons into one group and used this as the base group in this study. The remaining groups were self-employed people, salaried employees and apprentices/students.

- To account for the possible endogeneity of FL_i, we use three instrumental variables: (i) mean financial literacy score at the district level; (ii) respondent's numerical skills; and (iii) financial shocks experienced by parents or siblings. We further explain our instrumental variables in the empirical results section.

5.2 Empirical Results

Table 2 reports our estimation results on the relationship between financial literacy and the awareness of fintech products. The first column reports the result from the OLS estimator, while columns 2 and 3 show the results using two-stage least squares with instrumental variables for the financial literacy variable. The result in column 1 shows that financial literacy is positively associated with the likelihood of awareness of fintech products and this relationship is statistically significant at the 1% level. A one-standard deviation increase in the financial literacy score is associated with an increase in the probability of knowing fintech product by 8.3%. The result also suggests that those with incomes higher than 3.5 million kips (per month) have a higher likelihood of being aware of fintech product than those with income lower than 2 million kips (the reference group),

while there is no statistically significant difference in awareness of fintech product between the reference group and those with incomes from 2 million to 3.5 million kips. This result suggests that only a small proportion of high-income people are more likely to know about fintech products. Even when financial literacy and income are controlled for, individuals with higher education levels have a significantly higher likelihood of awareness of fintech products. For example, an individual with tertiary education tends to have a higher probability of awareness of fintech products than those with some secondary and some primary education, by 34.6% and 20.7%, respectively. Interestingly, if we control for income and education levels, the likelihood of knowing about fintech products is not statistically significantly related to age groups, gender or rural versus urban location. However, paid employees have a higher likelihood of knowing about fintech products than do unemployed people (the reference group).

However, the above estimates may be biased due to endogeneity problems (including reverse causality or the existence of unobservable factors that affect both the awareness of fintech products and financial literacy). In order to address these potential endogeneity problems, we used an instrumental variable (IV) approach. Following Fernandes et al. (2014) and Murendo and Mutsonziwa (2017), we used 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 controlled for the development of the district by the share of people who have income higher than country's median income. We also followed Grohmann (2018) and Grohmann et al. (2016) to use respondents' numerical skills when they were in school as an additional instrumental variable. This variable is a binary variable which 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 or not their parents and siblings experienced any financial shocks in the last year. This type of instrumental variable is used in Van Rooji et al. (2011). We expected that these instrumental variables did not directly affect the respondents' knowledge of fintech, but did only indirectly through their financial literacy level.

The test statistics indicate that our set of instrumental variables does 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 (2006), 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 from those who are affected by the instruments. We also find when we use the IV approach that the effect of income on awareness of financial products loses its significance. People with incomes higher than 3.5 million kips still have a higher likelihood of knowing about fintech products than those with incomes less than 2 million kips, but this difference is no longer statistically significant. Meanwhile, the results for other variables such as education and occupation are not qualitatively different from the OLS estimation, although the magnitude of the estimate coefficient is reduced slightly. Those in the age 30–60 group have significantly less knowledge than those under age 30.

Table 2: Effect of Financial Literacy on Awareness of Fintech Products

	OLS	IV 2nd Stage	IV 1st Stage
Financial literacy	0.083***	0.153***	
	[0.013]	[0.039]	
From 2M to 3.5M Kip	0.008	−0.045	0.308***
	[0.032]	[0.036]	[0.073]
More than 3.5M Kip	0.104**	0.042	0.286***
	[0.047]	[0.046]	[0.098]
Some secondary education	−0.207***	−0.183***	−0.174*
	[0.053]	[0.049]	[0.106]
Some primary education	−0.346***	−0.298***	−0.354***
	[0.055]	[0.055]	[0.112]
Age 30–60	−0.054	−0.077**	0.196***
	[0.034]	[0.034]	[0.072]
Age over 60	−0.051	−0.058	−0.025
	[0.044]	[0.048]	[0.106]
Male	0.026	0.033	−0.032
	[0.027]	[0.027]	[0.060]
Self–employed	0.049	0.026	0.215**
	[0.037]	[0.046]	[0.098]
Paid employees	0.135**	0.121**	0.089
	[0.054]	[0.057]	[0.124]
Cannot work/students/retired	0.112	0.083	0.223
	[0.071]	[0.071]	[0.154]
Rural area	0.004	0.024	0.078
	[0.040]	[0.039]	[0.086]
Average literacy at district level			0.898***
			[0.086]
Whether as good at math as friends			0.287***
			[0.067]
Parents/siblings experienced shocks			0.131**
			[0.058]
Intercept	0.704***	0.649***	−0.242
	[0.075]	[0.082]	[0.189]
Anderson canon. corr. LM statistic			119.883
Cragg–Donald Wald F statistic			44.461
Sargan statistics (p-value)			0.205
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 fintech knowledge dummy variable. The weighted sample is used for all estimations.

Source: Authors' estimates.

6. CONCLUSIONS AND RECOMMENDATIONS

This study is one of the first to examine the relationship between financial literacy and awareness of fintech development. It focuses on a developing country with a low level of ICT development—the Lao PDR. We used the OECD/INFE standardized survey instruments to collect data on financial literacy. Moreover, we also included some extra questions to assess fintech awareness and fintech usage. Following Morgan and Trinh (2017), we also attempted to use several instrumental variables to mitigate the possible endogeneity bias of awareness of fintech products on financial literacy.

Our data and empirical analysis show that:

- 30% of the respondents have access to smartphones, especially young people (under age 30) and urban residents.

- The level of financial literacy is relatively high when compared with per capita income, comparable to Viet Nam.

- 31% of respondents were aware of fintech products, but only 4% have used them.

- Financial literacy is positively associated with higher fintech awareness, along with educational attainment, job status and age (negative relationship).

- Fintech use is negatively correlated with age, and positively correlated with urban residence, education level and income. However, we do not yet have sufficient data to estimate the determinants of fintech use econometrically—more data and analysis are needed.

- General and financial education programs could raise the demand for fintech services.

Not only does the low level of financial literacy explain the low level of awareness and adoption of fintech products; it is also related to the underdeveloped state of ICT infrastructure in the country. Therefore, in addition to general and financial education programs, the country needs to put more effort into the development of the ICT infrastructure as a necessary condition for fintech development.

REFERENCES

Agnew, J.R., Bateman, H. and Thorp, S. 2013. "Financial Literacy and Retirement Planning in Australia." *Numeracy* 6 (2): 7.

Bernheim, B. 1995. "Do Households Appreciate Their Financial Vulnerabilities? An Analysis of Actions, Perceptions, and Public Policy." In *Tax Policy and Economic Growth*, 1–30. Washington, D.C.: American Council for Capital Formation.

Bernheim, B. 1998. "Financial Literacy, Education, and Retirement Saving." In *Living with Defined Contribution Pensions: Remaking Responsibility for Retirement*, edited by Olivia S. Mitchell and Sylvester J. Schieber, 38–68. Philadelphia: University of Pennsylvania Press.

Bucher-Koenen, T.A.B.E.A and and Lusardi, A. 2011. "Financial literacy and retirement planning in Germany." *Journal of Pension Economics & Finance* 10 (4): 565.

Campbell, J. 2006. "Household Finance." *Journal of Finance* 61 (4): 1553–604.

Christelis, D., T. Jappelli, and M. Padula. 2010. "Cognitive Abilities and Portfolio Choice." *European Economic Review* 54 (1): 18–38.

de Bassa Scheresberg, C. 2013. "Financial Literacy and Financial Behavior among Young Adults: Evidence and Implications." *Numeracy* 6 (2).

EY. 2018. *ASEAN FinTech Census 2018*. Available at https://www.ey.com/Publication/vwLUAssets/EY-asean-fintech-census-2018/$FILE/EY-asean-fintech-census-2018.pdf.

Fernandes, D., J. Lynch and R. Netemeyer. 2014. The Effect of Financial Literacy and Financial Education on Downstream Financial Behaviors. Management Science 60 (8): 1861–1883.

Grohmann, A. 2018. "Financial Literacy and Financial Behavior: Evidence from the Emerging Asian Middle Class." *Pacific-Basin Finance Journal* 48: 129–43.

Grohmann, A., Klühs, T. and Menkhoff, L. 2016. "Does Financial Literacy Improve Financial Inclusion? Cross Country Evidence." DEW Berlin Discussion Paper No. 1682.

Group of Twenty (G20). 2012. G20 Leaders Declaration. Los Cabos, Mexico, June 19. Available at: http://www.g20.utoronto.ca/2012/2012-0619-loscabos.html.

Hilgert, M., J. Hogarth and S. Beverly, 2003. Household Financial Management: The Connection between Knowledge and Behavior. *Federal Reserve Bulletin* 89 (7): 309–22.

Investopedia. 2018. "Fintech." Available at: https://www.investopedia.com/terms/f/fintech.asp.

Jack, W., Ray, A. and Suri, T. 2013. "Transaction Networks: Evidence from Mobile Money in Kenya." *American Economic Review* 103 (3): 356–61.

Lao Statistics Bureau (LSB). 2017. *Statistical Yearbook 2017*. Available at https://www.lsb.gov.la/wp-content/uploads/2018/10/Yearbook-2017.pdf.

Lusardi, A. and O. Mitchell. 2006. "Financial Literacy and Planning: Implications for Retirement Wellbeing." Working Paper, Pension Research Council. Philadelphia, PA: University of Pennsylvania.

_____. 2011. "Financial Literacy and Planning: Implications for Retirement Well-Being." In *Financial Literacy: Implications for Retirement Security and the Financial Marketplace*, edited by Olivia S. Mitchell and Annamaria Lusardi, 17–39. Oxford and New York: Oxford University Press.

_____. 2014. "The Economic Importance of Financial Literacy: Theory and Evidence." *Journal of Economic Literature* 52 (1): 5–44. Available at: http://dx.doi.org/ 10.1257/jel.52.1.5.

Mahdzan, N.S. and S. Tabiani. 2013. "The Impact of Financial Literacy on Individual Saving, An Exploratory Study in the Malaysian Context." *Transformations in Business and Economics* Vol 12 (1 (28): 41–55.

Mandell L. 2009. "The Financial Literacy of Young American Adults: Results of the 2008 National Jump$tart Coalition Survey of High School Seniors and College Students." Washington, DC: Jump$tart Coalition.

Moore, D. 2003. "Survey of Financial Literacy in Washington State: Knowledge, Behavior, Attitudes, and Experiences." Washington State University Social and Economic Sciences Research Center Technical Report 03-39.

Morgan, P.J. and Trinh, L.Q. 2017. "Determinants and impacts of financial literacy in Cambodia and Viet Nam." ADBI Working Paper Series No. 754. Tokyo: ADBI.

Murendo, C. and Mutsonziwa, K. 2017. "Financial Literacy and Savings Decisions by Adult Financial Consumers in Zimbabwe." *International Journal of Consumer Studies* 41 (1): 95–103.

OECD/INFE. 2015a. Guide to Creating Financial Literacy Scores and Financial Inclusion Indicators Using Data from the OECD/INFE 2015 Financial Literacy Survey. Paris: OECD.

_____. 2015b. Policy Handbook on National Strategies for Financial Education. Paris: OECD. Available at: http://www.oecd.org/g20/topics/employment-and-social-policy/National-Strategies-Financial-Education-Policy-Handbook.pdf.

_____. 2015c. 2015 OECD/INFE Toolkit for Measuring Financial Literacy and Financial Inclusion. Paris: OECD.

_____. 2016. OECD/INFE International Survey of Adult Financial Literacy Competencies. Paris: OECD.

_____. 2017. G20/OECD INFE Report on Adult Financial Literacy in G20 Countries. Paris: OECD. Available at: http://www.oecd.org/daf/fin/financial-education/ G20-OECD-INFE-report-adult-financial-literacy-in-G20-countries.pdf.

_____. 2018a. Financial Inclusion and Consumer Empowerment in Southeast Asia. Paris: OECD. Available at: http://www.oecd.org/finance/Financial-inclusion-and-consumer-empowerment-in-Southeast-Asia.pdf.

Stango, V., and J. Zinman. 2009. "Exponential Growth Bias and Household Finance." *Journal of Finance* 64 (6): 2807–49.

Suri, T. 2017. "Mobile money." *Annual Review of Economics* 9: 497–520.

van Rooij, M., A. Lusardi, and R. Alessie. 2011. "Financial Literacy and Stock Market Participation." *Journal of Financial Economics* 101 (2): 449–72.

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%