

Financial inclusion for the elderly in Thailand and the role of information communication technology

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Abstract

One of the financially vulnerable groups is older people, who receive little attention in the financial inclusion literature. The elderly is financially excluded in Thailand, an emerging economy with high financial inclusion and rapid aging of the population. Using the Findex survey data 2017, we construct financial inclusion (FI) scores with five measures and explore the influence of aging, mobile phones, and mobile money, controlling for individual characteristics. Among non-account holders, more than half are older than 55 years old. A significantly negative association between FI and age/age group is confirmed. We also prove the positive effect of mobile phones and mobile money on FI scores, by 0.48–0.49 percentage points. This study sheds light on the drivers of mobile banking among the elderly with Thai ICT data, showing that low internet access and mobile phone use are the biggest barriers to financial inclusion. No gender disparity in FI is found.

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1. Introduction

A consensus has been reached in development theory about the important role of financial inclusion in economic development (Aghion & Bolton, 1997; Chen et al., 2022), and it is also recognized as an important vehicle to promote inclusive growth and reduce poverty (Loukoianova et al., 2018). Subsequent research provides useful insights into how financial inclusion can influence economic growth and development. It raises aggregate savings for long-run economic growth (Aghion et al., 2009). It diversifies loan portfolios of financial institutions through increasing investible surplus and improving the penetration of credit (Bayoumi & Melander,

2008). It also facilitates the participation of different segments of the economy in the formal financial system (Cecchetti & Kharroubi, 2012). Importantly, the levels of human development and financial inclusion in a country move closely with one another (Huang et al., 2022; Sarma & Pais, 2011) along with other socioeconomic and infrastructure-related factors, such as literacy, urbanization, and physical infrastructure for connectivity and information.

Recently, many papers have been written about the interactions between the development and diffusion of information and communication technology (ICT) and overall financial development as well as their joint effects on inclusive growth (Ha, 2022; Nguyen et al., 2020; Ofori et al., 2022; Song et al., 2023). Empirical evidence, however, is not unambiguous, depending on the ICT indicators and the country's level of development in the short or long run. For instance, internet use has a significantly negative impact on overall financial development (through its attribution to financial institutions) but

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positive impacts on financial markets. Meanwhile, use of mobile phones has a positive impact on all nine indexes of financial development (Nguyen et al., 2020).

These cross-country studies offer a good view of the effects of ICT diffusion on financial development, however, few investigations have been performed on the effects on financial inclusion, specifically among vulnerable groups such as women, young people, the elderly, and the poor at a micro-level. Financial inclusion is the process of ensuring that individuals have access to basic financial services in the formal financial sector (Allen et al., 2016; Ozili, 2018). Financial inclusion has also been identified as enabling seven of the 17 United Nations sustainable development goals (SDGs), which aim to leave no one behind (Demirguc-Kunt et al., 2018; (Sahay et al., 2015); Sharma and Changkakati (2022) and help to improve social inclusion in many societies (Bold et al., 2012); Warburton et al. (2013). Although much progress has been made in financial inclusion in many parts of the world, gaps remain large in low- and middle-income countries, where nearly half the adult population still does not have a bank account, and less than 10 percent of the population borrowed from formal financial institutions in 2017 (Demirguc-Kunt et al., 2018).

Some particularly disadvantaged groups often face even greater challenges in accessing financial services, such as women and young adults aged 15–24 years (Aslan, 2022; Demirguc-Kunt et al., 2018; Fanta & Mutsonziwa, 2016; Koloma, 2021, 2021z, 2021uca, 2019). In addition, the needs for financial inclusion among the older segment of the population are sometimes ignored or underestimated. Older people may be particularly vulnerable to economic fluctuations such as recessions, and they may be disadvantaged further by poor understanding of the financial impact on their well-being from social care agencies (Fenge, 2012). Although digital financial inclusion has been studied for these particular groups, few papers have been written on digitization for financial inclusion for the elderly. This study is intended to fill this gap in the literature.

For several reasons, the case of Thailand offers an interesting case study on this subject. First, Thailand ranks fifth in the top quartile in financial inclusion among countries in Asia Pacific along with advanced countries such as South Korea and Singapore and is considered in the frontier benchmark of the region (Loukoianova et al., 2018). The Global Findex reports that in 2017 reports that in Thailand the rate of access to formal financial services is 82 percent. Meanwhile the Central Bank of Thailand (BoT) calculates of the rare at 97 percent in 2016 using a household financial access survey (BOT, 2017). Second, Thailand is an emerging economy with widespread financial access (WorldBank, 2019) and has achieved close gender parity in financial access by Thai men (84%) and women (80%) who have an account at a financial institution (Asli et al., 2018). Therefore, given such impressive indicators, the question is who are still excluded financially in Thailand. Third, in parallel with its economic development, Thailand also formally became an aging society in 2005, as 10.3 percent of the population was from 60 years old and older. In 2017, data

from the National Statistical Office (NSO) of Thailand reported that 11, 312, 447 people were over age 60, equivalent to 16.7 percent of the population.

Research on financial inclusion of the elderly is limited overall. For example, the papers on advanced economies include Warburton et al. (2013) writing about the US and Fenge (2012) about the UK. The few papers on developing and emerging economies comprise Holzmam (2014) discussing Malaysia and Song et al. (2023) examining China. We add to this stream of literature with empirical evidence about Thailand. The majority of studies on financial access in Thailand use household-level data, which is impossible to use exclusively for exploring financial inclusion among the elderly. However, we analyze financial inclusion at the individual level with Global Findex data for Thailand in 2017. Therefore, our study contributes to the literature on the financial inclusion and well-being of the elderly in an aging society in several ways. We look specifically at a financially disadvantaged group in an emerging economy that is fairly financially inclusive to explore the extent of exclusivity. By using micro-data, we can control for individual characteristics, such as education, work, and areas of residence to explore how age itself can affect financial access and inclusion. Unlike previous studies on the impact of ICT diffusion on financial development and financial access at the country level, we offer insights into the importance of internet access and mobile phones to financial access in old age.

As financial transactions remain essential in the daily lives of the elderly, who either receive income from different sources or make payments and contribute to savings, a thorough study of this specific group is important for policy makers and financial sectors seeking to design and implement appropriate measures targeted at this group. In Thailand, in particular, the key concern is not how the use is measured but the quality of financial services, which is expected to be increased by financial technology (fintech) innovation to fill any existing gaps (WorldBank, 2019). In the Asia-Pacific region in general, large gaps are found in the use of fintech between the rich and the poor and between rural and urban areas (Park & Mercado, 2015), demonstrating the so-called digital divide.

Our findings demonstrate a negative effect of age on financial inclusion scores, which are constructed using Global Findex data 2017, and the use of mobile banking has a significant effect on those scores. We go a step further and explain what determines the use of mobile banking among elderly Thais by examining another data set, from a Thai ICT survey in 2016. This data enables more insightful interpretations and policy implications that can improve financial inclusion of the elderly in the Thai socioeconomic context. We examine the level of financial inclusion among different age groups in Thailand, identifying the main determinants of financial inclusion in old age and exploring the potential of digital fintech, such as mobile phones and mobile money/banking, to promote financial inclusion among the elderly.

This paper is organized in four main sections. In section 2, we discuss relevant empirical studies on financial inclusion of the elderly and its association with the development of ICT.

Section 3 describes the data and the methodology to construct FI scores and regression models. We present key results in section 4 with some discussions and additional analysis before highlighting some conclusions in section 5.

2. Relevant empirical studies

2.1. On the financial inclusion of the elderly

In 2016, approximately 12.4 percent of the population in the Asia-Pacific region was over 60 years old, and by 2050 this share is projected to increase to more than 25 percent, or 1.3 billion people (UNFPA, 2017). The ratio varies across the region, with significantly aging populations in Japan and South Korea and, increasingly, China, but less so in Central Asia.

Aging is a product of successful development, which involves higher life expectancy and a higher quality of life. A linear relationship (although not causality) is found between the gross domestic product (GDP) per capita and the level of population aging (Park & Mercado, 2015). However, in some Southeast Asian countries in the middle-income range, the population has become old before becoming rich according to the United Nations Fund for Population Fund (UNFPA) and where aging is advancing quickly, even in countries with a large population share of young people. Whereas it took the United Kingdom 80 years for the over-60 population to increase from 7 percent to 20 percent of the total, the same shift will take place in just over 30 years in Thailand, 22 years in Malaysia, and only 19 years in Vietnam. How are those economies prepared for providing financial services to an increasingly large group of the elderly?

In Malaysia, the social security framework is weak, with incomplete benefit coverage, a low mandated savings level, inadequate disbursement options, and the absence of an enabling political environment (Holzmann, 2014). Malaysians are recommended to switch from a mere retirement savings investment fund to a full-fledged pension fund that offers some minimal annuities. In more developed aging economies, the issues have been studied, with some micro-level solutions for providing financial literacy. Explores the importance of financial education for social workers in the UK whose clients are financially vulnerable individuals and families who frequently have little financial knowledge. The elderly need information and advice to enable them to improve their financial literacy. This can be compounded further by increasingly strict eligibility criteria, which restrict access to services and thereby increase the number of older people who need to fund their own care. Similarly, in the US, many older households have done little or no planning for retirement, and a substantial population has accumulated inadequate savings for retirement. Lusardi and Mitchell (2008) examine planning and financial literacy and show that women have much lower levels of financial literacy than the older population as a whole. This creates particular concern about the relative position of older women, who are more vulnerable to poverty in old age because of their longer lifespans but less financial literacy and planning.

2.2. On the development of ICT and financial inclusion

A growing body of research in recent years has revealed the effect of the development and diffusion of ICT on overall financial development (Ha, 2022; Nguyen et al., 2020; Song et al., 2023). Empirical evidence, however, is somewhat mixed, depending on the ICT indicators and the country's level of development in the short or long run. Overall financial development reflected in nine indicators is used similarly by Ha (2022) and Nguyen et al. (2020) with different country samples. Digitalization measured in terms of digital connectivity, use of the internet, e-business, e-commerce, and e-government (Ha, 2022) shows the positive influence on the development of financial markets and institutions across 27 European countries. Using a sample of 62 low- and middle-income economies and 47 high-income economies, Nguyen et al. (2020) find that internet use has a short-run positive effect on financial development. However, in the long run, it has a significantly negative impact on overall financial development (through financial institutions) but a positive impact on financial markets. In contrast, the use of mobile phones has a positive impact according to all nine indexes of financial development.

The first Global Financial Inclusion (Global Findex) Database in 2017 provides a new set of indicators that measure how adults in 148 economies save, borrow, make payments, and manage risk. Demircuc-Kunt and Klapper (2012) show that 50 percent of adults worldwide have an account at a formal financial institution, though account penetration varies widely across regions, income groups, and individual characteristics. In addition, 22 percent of adults report having saved at a formal financial institution in the past 12 months, and 9 percent report having taken out a new loan from a bank, credit union, or microfinance institution in the prior year.

The 2017 Global Findex data reflects the continued evolution of financial inclusion and recent progress driven by digital payment, government policies, and a new generation of financial services accessed through mobile phones and the internet, including mobile money services, payment cards, and other fintech applications, implying many potential development benefits for financial inclusion. The power of fintech to expand access to and use of accounts is demonstrated most persuasively in sub-Saharan Africa, where 21 percent of adults had a mobile money account in 2017—nearly twice the share in 2014 and easily the highest of any region in the world. Although the use of mobile money has centered in East Africa, the 2017 update reveals that it has also spread to West Africa and beyond financial education. Another study (Asli et al., 2018) shows that digital technology is also transforming the payment landscape. Globally, also in 2017, 52 percent of adults have sent or received digital payments in the past year, an increase over 42 percent reported in 2014. Technology giants have moved into the financial sphere, leveraging deep customer knowledge to provide a broad range of financial services. Payments made through their technology platforms are facilitating higher account use in major emerging economies, such as China, where 57 percent of account owners using mobile phones or the internet to make purchases or pay bills in

2017—roughly twice the share in 2014. Song et al. (2023) find that consumers in China who have better access to bank services are more likely to adopt mobile payment and consequently visit banks less because of distance or social constraints and use mobile payment more to complement bank services. Younger, better-educated households with higher income and smart phones are more likely to adopt and use mobile payment and age has the largest marginal effect on this payment method.

Some successful experiences with financial inclusion reported in developing countries are associated with the use of ICT-based branchless banking, mainly benefiting low-income groups. Diniz et al. (2012) discuss the experience in Brazil, where an ICT-based network delivers financial services to tens of millions of impoverished Brazilians in Autazes, a county in the Amazon region not served by banks until 2002. Although access to financial resources is a fundamental way to promote local development, this access should be accompanied by other inclusive mechanisms. Studying 733 households in Ghana, Amoah et al. (2020) find that sociocultural and psychological factors are crucial in determining whether someone will use mobile money. They find that for technology-savvy cohorts (younger age groups), available services such as phone credit recharging, education, and income are among the key determinants of mobile money use in Ghana. All their findings imply that the consistent use of mobile money to access social and economic services can go a long way in promoting financial inclusion and empowerment and general well-being.

2.3. The case of Thailand

The 2014 Global Financial Inclusion Database (Global Findex) by the World Bank to assess the financial access level of 140 countries around the world indicates that 78.1 percent of Thai households have deposit accounts with financial institutions. This is higher than the average level for upper middle-income group in other countries, 70.5 percent. Among Southeast Asian countries (ASEAN) Thailand ranked third after Singapore (96.4%) and Malaysia (80.7%) (Global Findex 2015). In addition, the World Bank survey also shows no gender inequality in accessing financial services in Thailand, where 75.4 percent of females and 78.1 percent of males have deposit accounts at financial institutions.

A study conducted by FinScope in Thailand in 2013 reveals that 74 percent of the adult population has access to a bank account, with 23 percent using other formal financial services and only 1 percent using informal services. Thus, credit access in Thailand is considered fairly inclusive and available. However, some improvements can be made with regard to broadening financial access for the remaining 1 percent. Thus, financial inclusion and widespread accessibility do not necessarily account for the entire adult population at all levels of income (NSO, 2014).

Overall, Thai households have increasing access to financial services (97.3% in 2016 compared with 95.8% in 2013). Among these households, 86.3 percent use financial services whereas 11.0 percent choose not to use financial services

(voluntarily self-excluded). Males (97.0%) and females (97.6%) have comparable access to financial services. Although commercial banks and specialized financial institutions (SFIs) remain the primary providers of financial services, non-banks such as providers of village funds and electronic payments (e-payments) play an increasing role, but the use of informal sector service providers has decreased (BoT, 2017).

The 2018 report on the proportion of ICT use by Thai households shows a substantial difference between urban and rural areas. The proportion of computer users in municipal (urban) areas was 47.8 percent in 2014 and decreased to 35.2 percent in 2018, it was respectively 30.4 percent and 22.7 percent in rural areas. At the same time, the proportion of internet users in urban areas increased from 44.9 percent in 2014 to 66.1 percent in 2018 and in non-urban areas from 26.9 percent to 49.3 percent. Regarding mobile phone use, the gaps is smaller: 91.5 percent in urban areas and 87.9 percent in rural areas in 2018. In 2014–2018, all age groups showed an upward trend in internet use, but the group of those 50 and over had the lowest share of use, 21.2 percent.

The latest survey on internet use among the elderly in Thailand, in 2014, reveals that only 3.3 percent of them older persons have used it although they are located in provinces with a nationally high rate of use, such as Phuket (22.5%), Chonburi (11.4%), and metropolitan Bangkok (10.9%). A study by NSO (2015) examines the factors that affect internet use by the elderly, such as age, gender, marital status, education level, household income, and work status as well as the use of computers, tablets, or smart phones, access to the internet, and cohabitation with others who use the internet.

Population aging has been discussed in Thailand over the decades. Although the material well-being of older Thais has improved, rapid aging of the population poses important challenges for the government and society as a whole Knodel and Chayovan (2008). The recent spread of telephones improves their ability to maintain contact with children and relatives who live elsewhere. One might question the importance of financial inclusion as well as the use of ICT among the elderly in Thailand because mutual support among family and communities is a typical characteristic of Thai society, such that access to those services for the elderly may not seem to be urgently needed. However, the most recent survey of the elderly in Thailand, in 2017, shows that among the more than 11.3 million elderly, 10.8 percent live alone and over 20 percent live only with a spouse. If we assume that these spouses are in a similar age range, it would mean that over 30 percent of the Thai elderly do not live with younger generations who are more likely to use ICT. These conditions should lead us to reconsider the importance of independence in employing financial services and the use of technology in daily life.

3. Data and methodology

3.1. Data

To fulfill our research objectives, we employ two sets of data: the Global Financial Index (Global Findex) with a

selection of Thai data for 2017 and Thailand's national survey on the use of ICT by Thai households in 2016 (NSO, 2016).

The Global Findex comprises survey data covering almost 150,000 people in more than 160 countries, carried out by Gallup (part of the Gallup World Poll) in 2005, 2014, 2017, and, most recently, in 2021. It samples approximately 1000 people in each country, using randomly selected, nationally representative samples. The target population is the entire civilian, noninstitutionalized population age 15 and above. In addition to the indicators collected in 2014 (e.g., information on access to and use of accounts, credit, payments, and savings), the 2017 edition includes new information on the use of fintech, including the use of mobile phones and the internet to perform financial transactions. As a result, the 2017 Findex enables the calculation of indicators such as digital payment in the past year; use of an account to pay utility bills, receive private sector wages, or government payments; use of the internet to pay bills or to make purchases online; and use of a mobile phone or the internet to access an account. We apply descriptive analysis and econometric analysis methods with the Findex dataset to construct financial inclusion measures, such as the dependent variable (described in Section 3.2).

To explain the econometric results, we also use Thailand's survey on the use of ICT by Thai households in 2016. This is a nationally representative survey with information at the individual level. We limit the sample to individuals 15 years old and above, which reduces the sample size to 171,763 observations.

3.2. Construction of financial inclusion measures

Financial inclusion goes beyond the simple supply-side perspective of the accessibility of services to encompass engagement by the consumer, following the OECD International Network on Financial Education Toolkit -OECD/INFE 2016 for measuring financial literacy and financial inclusion as shown in Appendix Table A2. According to this broader definition, a financial inclusion index has two components:

holdings of financial products and active consumption of financial products. The measurement of product holdings focuses on four financial products: savings or retirement products; payment products, such as a current account or mobile money (excluding credit cards and other types of accounts that offer payment facilities such as savings accounts); insurance products; and credit products, such as a credit card or a mortgage.

The active consumption component of financial inclusion consists of three indicators: whether consumers are aware of available financial products; whether they are making conscious choices among financial products; and whether they have turned to family or friends to help them save money or make ends meet.

As the Findex dataset does not provide all these indicators, we adapt similar ones in our calculation of financial inclusion. Our FI score is calculated from five questions whose answers take a value of 0 or 1, as shown in Table 1. Therefore, the value of FI ranges from 0 to 5, with indicators of equal weight.

3.3. Empirical model for econometric analysis

We conduct a multivariate analysis with the ordinary least squares (OLS) method applied to different models, both basic and extended. First, following Morgan and Trinh (2019), we normalize/standardize the FI scores with a value from 0 to 5, into a z-score using the following formula:

$$FI\ z\text{-score} = \frac{FI\ score - mean(FI\ score)}{Std.Dv(FI\ score)}$$

We estimate basic models and extended models with FI z-scores as the dependent variable. In the basic models, the control variables include gender, education level, income level, labor force participation, and age with different measurements (level and categorical dummies). In the extended models, we add two variables representing the use of ICT by users, such as owning a mobile phone and having a mobile money account.

Table 1
Definition of Financial Inclusion (FI) indicators.

Indicator	Name of variables used	Definition	Value
Have an account	account	Has an account at a financial institution or nonfinancial institution	Binary variable, takes a value of 1 if any product is held, otherwise 0
Saved in the past 12 months	Saved, fin15, fin16, fin17a, fin17c	Savings in any forms or for any purposes	Binary variable, takes a value of 1 if any product is held, otherwise 0
Borrowed in the past 12 months	Borrowed, fin19, fin20, fin21a, fin21b, fin21c	Any credit products such as credit cards, house/land mortgage, bank loans, etc from any formal or informal institutions	Binary variable, takes a value of 1 if any product is held, otherwise 0
Possible source of emergency fund from family or friends	fin26, fin28	Possible coming up with emergency fund and the main source of such fund comes from family or friends	Binary variable, takes a value of 1 if any product is held, otherwise 0
Sent or received domestic remittances in the past 12 months	fin24, fin25	Either sent or received domestic remittances in the past 12 months	Binary variable, takes a value of 1 if any product is held, otherwise 0

Source: Adapted from (OECD, 2016).

Basic models:

$$FIz - score_i = \beta_1 + \beta_2 Gender_i + \beta_3 Educ_i + \beta_4 Income_i + \beta_5 LaborForce_i + \beta_6 Age_i + \epsilon_i$$

Extended models:

$$FIz - score_i = \beta_1 + \beta_2 Gender_i + \beta_3 Educ_i + \beta_4 Income_i + \beta_5 LaborForce_i + \beta_6 Age_i + \beta_7 Mobilephone_i + \beta_8 MobileMoneyAccount_i + \epsilon_i$$

3.4. Supplementary analysis with household survey data on the use of ICT

Finally, to confirm the role of ICT on financial inclusion, we take a further step by analyzing the survey of ICT use in Thai households at the individual level in 2016 (NSO, 2016) to shed light on the analytical results obtained from the Findex data. In particular, following the selection of the Thai NSO for surveys on a wider range of older persons, we focus on the elderly 55 years old or above and explore their access to internet banking or mobile banking in relation to their use of ICT devices and internet access.

4. Results and discussion

4.1. Descriptive analysis

We find that among the sample of 1000 respondents to the 2017 Findex survey in Thailand, a large proportion of the respondents have accounts (812) and almost the same number have these accounts at financial institutions (809), so we define them as the same. However, among those holders of bank accounts, only 57 people, or 7 percent, have a mobile money

account, and 3 have a mobile money account somewhere other than financial institutions.

Among the 188 respondents who do not have an account, more than half (50.5%) are age 55 or above. The disaggregation by age group also shows that more than a third (36.7%) of those without an account are age 60 or over. Fig. 1 clearly shows that the share of people with mobile money accounts is larger among young people than those who are older. The highest ratio (over 23%) is found for the two youngest groups (age 15–34), compared with the groups of those who are middle-aged (ages 35–44 and 45–54), whose shares are only 7.8 percent and 4.5 percent, respectively. A negligible share of mobile money accounts is held by the elderly (age 55 and over).

Ironically, 88.5 percent of the respondents overall have a mobile phone, and 84 percent of the account holders also have mobile phones. Unfortunately, the Findex survey does not specify whether these mobile phones are smart phones. We assume, for simplicity, that, at the time of the survey in 2017, a majority of mobile phones are smart phones that enable users to conduct financial transactions. In other words, this data implies that the two prerequisites (owning a mobile phone and having a bank account) are not adequate for someone to perform mobile money transactions.

4.1.1. Gender analysis and labor force participation

Among the respondents to the Findex survey 2017 in Thailand 63 percent are female. The proportion of the elderly (age 60 and over) in both the male and female subsamples is around 29 percent.

In the full sample, 73.7 percent of the respondents are in the labor force. The group of those ages 25–34 has the highest share (90.83%), followed by those age 35–44 (86.8%) and 45–54 (81.3%). The retirement age in Thailand is set at age 60 for both men and women, but we found that a large number of

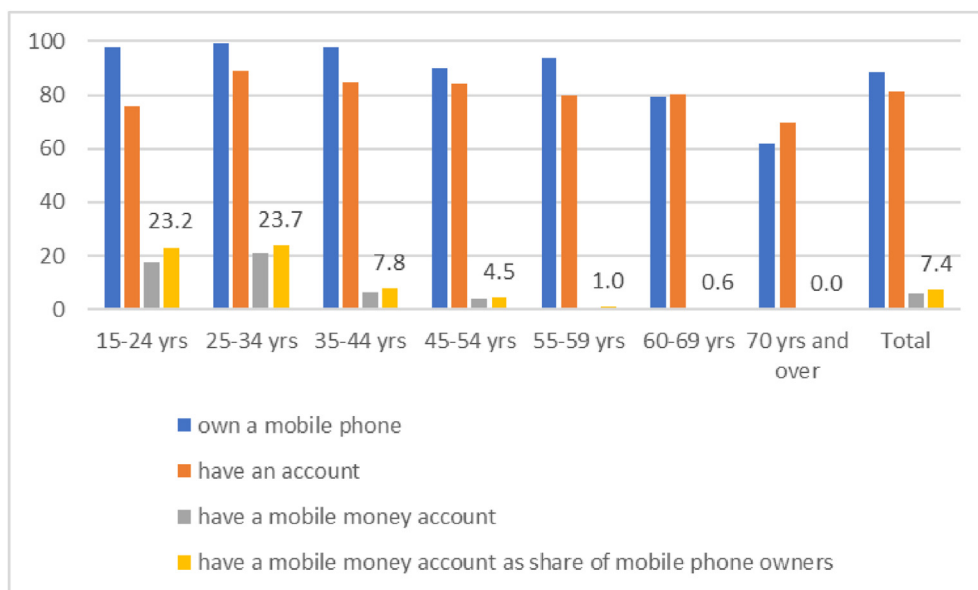


Fig. 1. Respondents having a bank account, a mobile money account, and a mobile phone (%). Source: Authors calculations from Findex 2017 for Thailand.

older people remain in the workforce, 66.8 percent among those age 60–69 and 37.4 percent of those over age 70.

This sample illustrates a substantial gender gap in the labor force participation, and the gap seem to be wider in older age groups. For example, in the age group of those ages 25–54, the prime age for employment, men participate at a higher rate than women, 93 percent versus 89.4 percent. This gap widens to almost 30 percent among those age 70 and over, suggesting that older men are more economically active than older women. Does this also imply a gender difference in financial inclusion between groups of the elderly? This is an interesting question that is worth investigating.

4.1.2. Mobile phones and mobile money accounts

We find that only 16.8 percent of the full sample use mobile phones and the internet to access accounts at a financial institution. This share is higher among those in the labor force (18.4%) than among those who are absent from the workforce (11.6%). A similar pattern is observed in the use of mobile phones or the internet to check account balances: 19.5 percent use internet banking. Workforce participation is also an important factor: 21.7 percent of those who are working versus 12.2 percent among nonparticipants in the workforce. Among people age 60 years and over, the share of those who use mobile phones and access the internet is only 5 percent, and 3.2 percent use them for accessing financial accounts or checking balances. Unsurprisingly, only 2.2 percent of the elderly who are not in the workforce use internet banking to check balances.

4.1.3. Education level and income level

The problem of financial illiteracy suggests that education can play a role in financial access. Our analysis clearly shows that those who are more educated and richer are more likely to have a mobile money account or to use mobile phones/internet to access their account at a financial institution. For example, the two richest quintiles (the top 40% of the sample) comprise

43 percent and 26.7 percent of the mobile money account owners, respectively—together, they make up about 70 percent. The middle-income group holds only 16.7 percent of the mobile money accounts. In addition, more than half (53%) of the respondents who use mobile phones or the internet to access their account completed a secondary-level education, and 30 percent had a tertiary-level education. However, the pattern among the elderly is different. Only 19 of the respondents age 55 or over access their account with mobile phones or the internet, and 15 of them did not complete their primary education. The sample size is small, so it is difficult to form a conclusive assessment. Therefore, we look at the household survey data on Thailand to obtain a more comprehensive determination of financial inclusion, including factors such as the residential location (urban and rural), household socio-economic status, and demographic characteristics of households.

Fig. 2 reflects the level of popularity among the elderly of various types of financial transactions. Certain kinds of financial transactions are considered priorities by older users, such as withdrawals from and deposits into accounts, savings for old age, receiving government transfers, remittances, and self-employment payments or agricultural payments. Other services, such as borrowing or saving for business purposes and using credit cards, seem to be less popular. We next explore how the elderly perform such transactions, using cash, bank accounts, and mobile accounts or online tools.

First, elderly respondents were asked about the channels they use for borrowing money (Table 2). Of the 154 elderly respondents (about 36% of those age 60 and over) who had borrowed funds in the past, 49 percent used financial institutions, and 46 percent had received loans from family members or friends. Only about 9 percent took out loans from informal saving clubs, which indicates that there is still room for the formal financial sector to extend loans to the elderly. This is the opposite of the situation with saving behavior, in

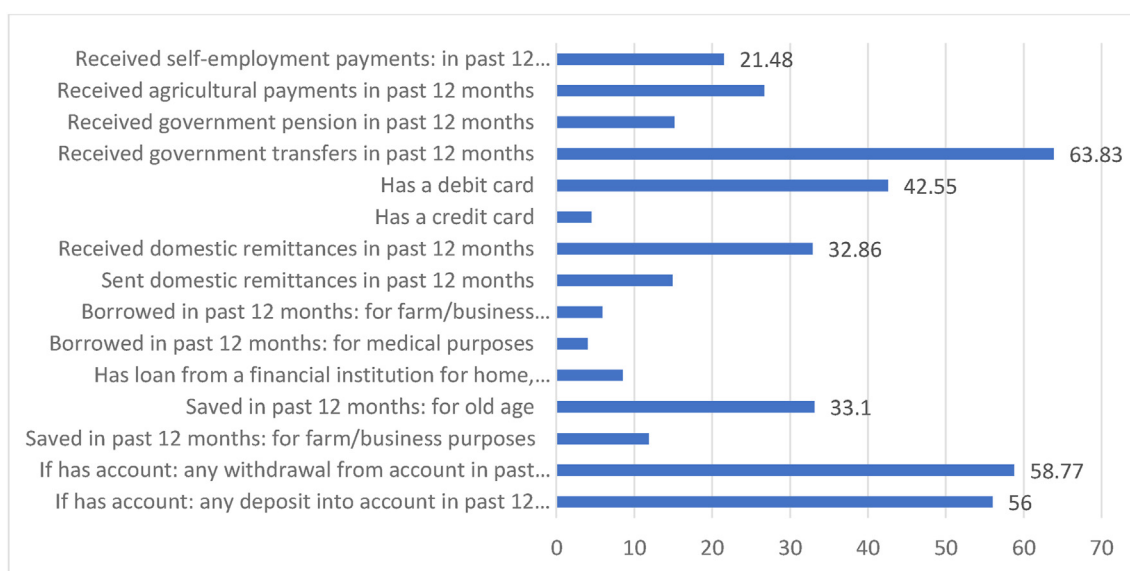


Fig. 2. Use of financial transactions by the elderly in Thailand. Source: Authors calculations from Findex 2017 for Thailand.

Table 2
Various channels used by the elderly for borrowing and saving.

	No. of elderly	Channel used		
		Formal financial institutions (FIs)	Informal Savings Clubs	Family and Friends
Borrowed in the past year	150	76	14	71
	36%	49%	9%	46%
Saved in the past year	192	124	40	
	45%	65%	21%	

Source: Authors calculations from Findex 2017 for Thailand.

which the majority (65%) of older respondents kept their assets at formal financial institutions, rather than savings clubs.

The Findex survey presents several options in terms of instruments used for transactions, such as cash, cards, mobile phones, and internet use with a financial institution. Table 3 shows that almost none of the elderly respondents use a mobile phone to receive payments, but most do so with bank accounts or in cash. A majority of the older respondents use bank accounts rather than cash when receiving government transfers and remittances.

Table 4 shows that the share of the elderly who use mobile phones or internet banking for their utility bill payment or sending domestic remittances is quite low: The dominant method for paying utility bills is in cash. Moreover, 73 percent send remittances through financial institutions, and 25 percent still make their transfers using cash or money transfer organizations such as post office.

A small number of the elderly make online purchases, which are paid in cash (4 of the 423 respondents paid cash on delivery) or online (5). The low numbers show that e-commerce is not in the preferred choice of older people. Overall, our descriptive analysis demonstrates that elderly people need

Table 3
The elderly use different methods for receiving payments.

	No. of elderly	Channel used		
		Formal financial institutions (FIs)	Mobile phones	Cash/MTOs
Government transfers	270	164	1	96
	64%	61%	0%	36%
Agricultural payments	113	28	1	82
	27%	25%	1%	73%
Self-employment payments	55	4	0	48
	13%	7%	0%	87%
Wages	76	25	0	47
	18%	33%	0%	62%
Domestic remittances	139	86	3	50
	33%	62%	2%	36%

Source: Authors' calculations from Findex 2017 for Thailand.

Notes: MTO = money transfer organizations such as the post office.

Table 4
The elderly use different methods for payment.

	No. of elderly	Sent/paid through		
		Formal FIs	Mobile phones	Cash/MTOs
Paid utility bills	369	22	0	344
	87%	6%	0%	93%
Sent domestic remittances	63	46	1	16
	15%	73%	2%	25%

Source: Authors' calculations from Findex 2017 for Thailand.

and have demand for various types of financial services, but they chiefly perform them through the banking system and rarely use online methods with mobile phones and the internet. Hence, they form a ripe target for financial literacy efforts focused on e-banking and e-commerce.

4.2. Calculation of financial inclusion scores

In this section, we calculate FI scores and examine the determinants of financial inclusion of the elderly; then, we examine the role of ICT, such as internet access, mobile phones, and internet banking, in promoting financial inclusion.

Overall, the full sample has an average FI score of 2.5 and a standard deviation of 1.322. Table 5 disaggregates the FI scores by gender, education level, income quintile, and labor force participation. It is very clear that women, on average, have lower scores than men by almost 1 point, with a wider dispersion. Respondents with higher education seem to have better FI scores on average. People who have completed a tertiary education have an average score of 3.45 and a median of 4, and with less variation than groups with less education. Similarly, people in higher income groups tend to achieve higher scores. The mean difference between the poorest and the richest groups is exactly 1 point, and the richest quintile group has both a mean and median score of 3. The gaps between the other three groups in the middle are not very large. Workforce participation seems to be correlated with FI scores as well. People in the workforce, on average, have a higher score (2.7) than their nonparticipating peers (1.94).

4.3. Econometric analysis of FI determinants

We use multivariate regression models (base and extended), with the FI scores converted into z-scores. As shown in Appendix Figure A1, the distribution appears to be normal.

Age is the only continuous variable, as the other variables are either dummies or categorical. We also use age groups as alternative to the Age variable, leading to the creation of three more models in Table 6. Using the retirement age in Thailand (age 60), we define a dummy variable, *Aging60*, with takes a value of 1 if the respondent is age 60 and over, and 0 otherwise. To test the robustness of our results, we also use a different cut-off, age 55.

The results in all four models suggest that no significant difference exists between men and women in terms of financial inclusion. As expected, education and income levels have significantly positive effects on FI, and the magnitude

Table 5
Financial inclusion scores in different categories.

Category	Obs.	Mean	Std.Dev.	Min.	25th per	Quantiles		Max.
						Median	75th per	
Gender								
Male	368	2.56	1.29	0	2	3	4	5
Female	632	2.47	1.34	0	2	3	3	5
Education level								
primary or less	594	2.21	1.28	0	1	2	3	5
secondary	328	2.82	1.29	0	2	3	4	5
tertiary or more	76	3.45	0.97	0	3	4	4	5
Income quintile								
poorest 20 percent	199	1.99	1.27	0	1	2	3	5
second 20 percent	202	2.39	1.24	0	2	2	3	5
middle 20 percent	186	2.47	1.38	0	1	3	4	5
fourth 20 percent	191	2.63	1.36	0	2	3	4	5
richest 20 percent	222	2.99	1.17	0	2	3	4	5
Labor force participation								
out of the workforce	263	1.94	1.24	0	1	2	3	5
in the workforce	737	2.7	1.29	0	2	3	4	5
Age group								
15–24 yrs.	91	2.64	1.4	0	2	3	4	5
25–34 yrs.	109	3.15	1.22	0	2	3	4	5
35–44 yrs.	167	2.8	1.25	0	2	3	4	5
45–54 yrs.	210	2.68	1.26	0	2	3	4	5
55–59 yrs.	128	2.38	1.38	0	1	2	3	5
60–69 yrs.	196	2.11	1.24	0	1	2	3	5
70 yrs and over	99	1.74	1.12	0	1	2	3	4
Overall	1000	2.5	1.32	0	2	3	3	5

Source: Authors' calculations from Findex 2017 for Thailand.

increases with their level. People in the workforce apparently experience more financial inclusion than their nonparticipating counterparts.

Age has a statistically negative association with the FI z-scores (Fig. 3). On average, FI declines by 0.006 percentage points for every one-year increase in age. In other words, after a decade, financial inclusivity is reduced by 0.06 percentage points, holding other factors constant. After the respondents are divided into age groups, we find no statistically significant differences in financial inclusion between people age 70 and the reference group of those between ages 15 and 24. However, the coefficients for the groups of those ages 55–59 and 60–69 are both negative, implying that the influence of older age on FI scores is insignificantly negative. The difference in scores between the oldest group (70 and over) and the youngest (15–24) is strong and significant, at 0.287 percentage points. In Models 3 and 4, only a dummy variable for age is used, and the results are statistically very significant. The FI score of those who are 60 or over is 0.25 percentage points lower than those of the reference group. Similarly, using the cut-off of age 55, the relationship between aging and financial inclusion scores is negative, with an effect of 0.24 percentage points.

Table 7 lists the results of our extended models that include some ICT variables. First, we consider having a mobile phone as an essential condition for access to electronic banking and financial services. Its effect on the FI z-scores is highly significant, as shown in Model 5. FI z-scores are 0.47 percentage points higher for owners of a mobile phones than for those

without them. Second, we look at the role of a mobile money account in determining the financial inclusivity of respondents and again find a strong positive effect: having a mobile money account can add as much as 0.49 percentage points to their FI z-scores. Surprisingly, the correlation between these two variables is very weak (correlation coefficient = 0.07), as one would expect that having a mobile phone is a prerequisite to having a mobile money account. That explains why when both mobile phone and mobile money account variables are incorporated into the model, they can maintain their own significance with similar magnitudes of the effects. There is no apparent risk of multi-colineary. As a result, the interaction term between these two variables, though positive, has no significant additional effects on FI scores.

4.4. Discussion

Given the gender gaps in financial inclusion in many other parts of the world, even in countries with the highest financial inclusion, our findings on gender disparity in Thailand are encouraging. In 2017, 65 percent of women around the world have an account compared with 72 percent of men, and this seven-percentage-point gap remained steady since 2011 (Demirguc-Kunt et al., 2018). Even after individual characteristics are controlled for, gender affects financial inclusion, which implies that financial services are biased against females (Fanta & Mutsonziwa, 2016). Otherwise, our results in Thailand are very consistent with the general pattern in many countries in some respects, including the results for education,

Table 6
Determinants of financial inclusion.

	Model 1	Model 2	Model 3	Model 4
<i>Gender (Female as reference group)</i>				
Male	0.0262 (0.0617)	0.0165 (0.0616)	0.0258 (0.0615)	0.0244 (0.0615)
<i>Education level (primary or less as reference group)</i>				
Secondary	0.216*** (0.0790)	0.223*** (0.0818)	0.248*** (0.0710)	0.226*** (0.0733)
Tertiary or higher	0.593*** (0.127)	0.622*** (0.129)	0.635*** (0.122)	0.615*** (0.123)
<i>Income quintile (poorest group as reference group)</i>				
second quintile	0.175* (0.0933)	0.150 (0.0937)	0.149 (0.0937)	0.168* (0.0931)
Middle	0.178* (0.0961)	0.137 (0.0974)	0.136 (0.0970)	0.164* (0.0960)
Fourth quintile	0.249*** (0.0966)	0.213** (0.0979)	0.210** (0.0977)	0.233** (0.0967)
Richest	0.393*** (0.0982)	0.351*** (0.0990)	0.362*** (0.0987)	0.371*** (0.0984)
<i>Labor force participation (non-participant as reference group)</i>				
In the workforce	0.434*** (0.0688)	0.383*** (0.0713)	0.415*** (0.0692)	0.424*** (0.0687)
Age	-0.00613*** (0.00224)			
<i>Age group (15–24 old as reference group)</i>				
agegroup2 (25–34)		0.218 (0.133)		
agegroup3 (35–44)		0.0414 (0.122)		
agegroup4 (45–54)		0.134 (0.124)		
agegroup5 (55–59)		-0.0430 (0.135)		
agegroup6 (60–69)		-0.152 (0.129)		
agegroup7 (70 and over)		-0.287** (0.146)		
aging60			-0.254*** (0.0729)	
aging55				-0.240*** (0.0684)
_cons	-0.352** (0.169)	-0.582*** (0.141)	-0.551*** (0.105)	-0.537*** (0.107)
R-squared	0.155	0.165	0.159	0.159
No. of observations	998	998	998	998

Notes: standard errors in parentheses * p < 0.1, **p < 0.05, ***p < 0.01.

income, and labor force participation. For example, mobile money ownership is low among women, the retired, low-income groups, and rural people in developing countries in southern Africa (Fanta et al., 2016). Aslan (2022) finds that the education level, formal employment, and having a national ID are also important drivers of financial inclusion in South Asia. Özşuca (2019) indicates that a significant portion of the disparity in financial inclusion in the Middle East and North Africa (MENA) region is attributable to employment, and age and tertiary education are contributing factors to the financial inclusion gap.

Although several studies consider age as a contributing factor to ownership of a bank account or mobile money, with opposite effects, our study looks at the influence of age on overall financial inclusion. Song et al. (2023) find that, in

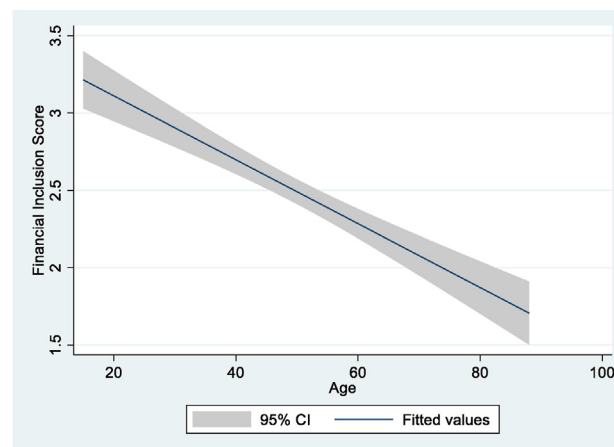


Fig. 3. Correlation between Financial Inclusion Score and Age. Source: Authors' calculations from Findex 2017 for Thailand.

China, age has the largest marginal effect on the likelihood of using mobile payment whereas income has the least. Meanwhile, Fanta and Mutsonziwa (2016) show that, in Africa, access to a bank account is positively affected by age beside other factors, such as income, marital status, employment status, place of residence, and level of education. Our findings

Table 7
Effects of mobile phones and mobile money accounts on financial inclusion.

	Model 5	Model 6	Model 7	Model 8
<i>Gender (Female as reference)</i>				
Male	0.0292 (0.0605)	0.0328 (0.0611)	0.0356 (0.0601)	0.0362 (0.0602)
<i>Education level (reference group is primary or less)</i>				
Secondary	0.219*** (0.0703)	0.199*** (0.0717)	0.171** (0.0709)	0.171** (0.0709)
Tertiary or higher	0.639*** (0.121)	0.554*** (0.123)	0.558*** (0.122)	0.562*** (0.123)
<i>Income quintile (the poorest group as reference)</i>				
second quintile	0.142 (0.0923)	0.160* (0.0931)	0.154* (0.0917)	0.155* (0.0919)
Middle	0.115 (0.0961)	0.138 (0.0963)	0.117 (0.0954)	0.117 (0.0954)
fourth quintile	0.200** (0.0964)	0.202** (0.0970)	0.193** (0.0957)	0.193** (0.0958)
Richest	0.339*** (0.0978)	0.353*** (0.0981)	0.331*** (0.0972)	0.330*** (0.0973)
<i>Labor force participation (non-participant as reference group)</i>				
in the workforce	0.394*** (0.0683)	0.407*** (0.0687)	0.386*** (0.0679)	0.387*** (0.0679)
aging60	-0.169** (0.0741)	-0.241*** (0.0725)	-0.156** (0.0737)	-0.157** (0.0738)
mobile phone	0.469*** (0.0992)		0.470*** (0.0985)	0.466*** (0.0991)
mobile money A/C		0.489*** (0.127)	0.482*** (0.125)	0.198 (0.914)
mobile*A/C interaction				0.288 (0.920)
_cons	-0.956*** (0.136)	-0.560*** (0.105)	-0.965*** (0.135)	-0.963*** (0.135)
R-square	0.180	0.171	0.192	0.192
No. of observations	991	998	991	991

Notes: standard errors in parentheses * p < 0.1, **p < 0.05, ***p < 0.01.

lead to the strong conclusion that age has a significantly negative effect on overall financial inclusion, in particular, the elderly are very disadvantaged.

The extensive literature on the effects of ICT development and financial inclusion provides a strong background for our findings. With micro-level empirical evidence from individual data, we show that ownership of a mobile phone and a mobile money account strongly and positively improves a person's financial inclusion score. As a result, promoting digital banking and mobile money, though challenging, could be a very effective solution to expand financial including among older citizens. Because our analysis uses data for 2017, it cannot reflect the long-term effect of ICT on financial inclusion or broader financial development. Over the long term, the development of ICT can have a negative effect on financial development through the channel of financial institutions, as shown in (Nguyen et al., 2020). This can be explained by the fact that mobile money has been a success because of ability to enable people to use financial services that are not provided by financial institutions, as shown in (Fanta et al., 2016). In the short term, the role of mobile money is important not only for countries with low financial inclusion but also those, such as Thailand, with overall high financial inclusion.

4.5. Supplementary analysis on the internet use, mobile phones, and digital banking among Thai elderly

In this section, we take a further look at the relationship between internet use, ICT devices, and mobile or internet banking to confirm our prior findings and to explore areas for targeting policy. We deploy a household survey on the use of ICT by Thai households in 2016 with information at the individual level and the same age groups. The sample across age groups and

residential areas is described in Appendix Table A1, showing a fair distribution across age groups and residential areas.

Fig. 4 indicates the proportion of internet users in the full sample and the share of mobile banking/internet banking users among internet users. As expected, the proportion of internet users declines by age: highest among the youngest (15–24 years), 87 percent, and the prime working age (25–34 years), 70.7 percent. However, for the three oldest ages groups, ages 55–60, 60–70, and over 70, the share is much smaller: 19.3 percent, 8.6 percent, and 1.7 percent respectively. In particular, a considerable decline in the share is found between the age group 45–54 years old, considered middle age (27.09%), to the age group 55–60, the oldest group still in the workforce (19.34%)—a drop of nearly eight percentage points, as well as a further decline among those of retirement age This implies that, on average, those in retirement face barriers to internet use.

However, among those who already use the internet, these three oldest groups (age 55 and over) continue to use digital banking services (7–10%), a share that is higher than among the population on average (6.9%) and even more than among some younger groups. More impressively, in fact, the group with the highest share (more than 10%) comprises those age 55–60, the old group in the workforce. This finding is critical as it implies that the elderly who use (or access) the internet are more likely to use it for digital banking services.

Fig. 4 leads us to explore the reasons that relatively few Thais use (or have access) to the internet. Overall, the full sample shows that only 39 percent of Thais age 15 and over have ever used the internet. As shown in Appendix Table A4, there are two key reasons for this majority of non-users: they do not know how to use the internet and do not see a need to use it (not interested/not necessary/wastes time), and a smaller number express concern about the high cost of services,

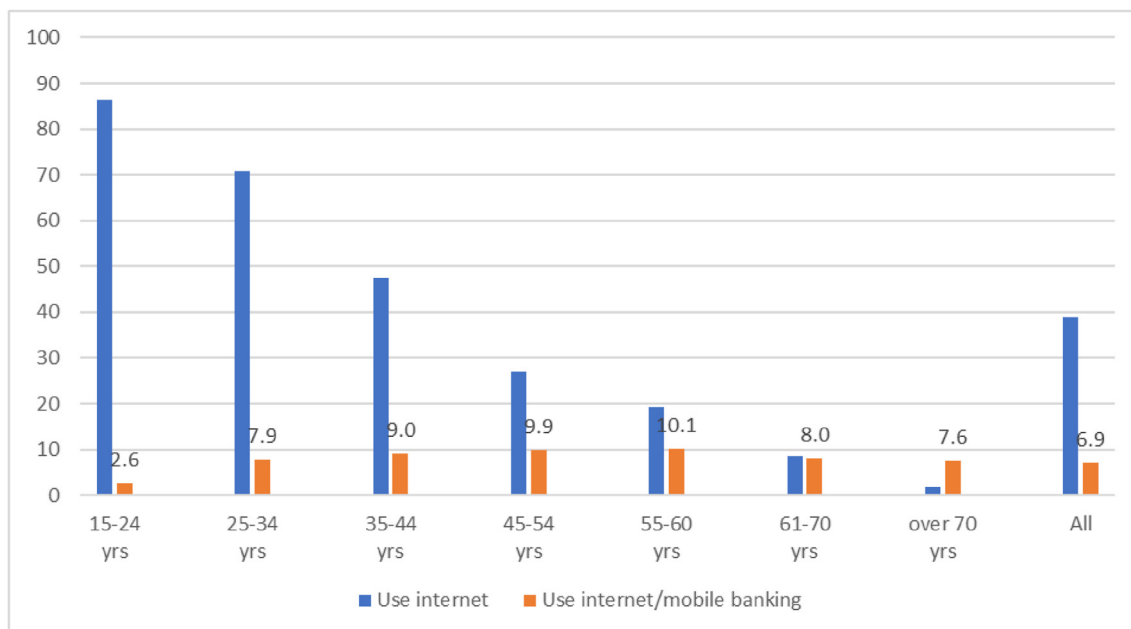


Fig. 4. Share of internet users and digital banking users by age group. Source: Author's calculations from the Thai household survey on ICT use (NSO, 2016).

devices, and networks. Among the elderly in particular, the reasons for not using the internet are more related to their lack of skills and less about their interest in obtaining access. Only 10–17 percent of the elderly who find the internet unnecessary or lack interest in the internet, whereas 62–87 percent simply do not know how to use it. This presents an avenue for more education and training opportunities among the elderly in the interest of increasing their financial inclusion, based on the belief that internet use can facilitate the use of digital banking, a key aspect of inclusion.

We are particularly interested in determining whether differences arise among those without internet access, particularly among the three oldest groups, across residential areas or gender. We find that a gender difference does exist, with a higher proportion of women (by three to four percentage points) who have never used the internet because they simply do not know how to use it. Similarly, when we compare rural to urban areas, rural elderly are at a greater disadvantage (by two to seven percentage points) in terms of lack of knowledge about the internet. The results of the proportion tests in Table 8 confirm the high statistical significance of the share of male non-users who respond that they “don’t know” about the internet compared with their female peers and the share of urban versus rural elderly residents. Those designing training programs to educate the elderly about how to use the internet and its relevant benefits should try to bridge these gaps.

We also need to understand where the elderly feel comfortable using the internet. Appendix Table A5 describes experience in using the internet in various places. Among the oldest internet users, the most popular way to use mobile devices and access the internet is at home: 80–90 percent and 70–76 percent, respectively. Among those of working age (55–60), using it in the workplace is also popular (37%); however, the rate drops substantially to 11–18 percent after they retire. This suggests that retirement leads to disruption in their internet access, and they have to use alternative channels to access it. One place that makes internet access available to older people is ICT community centers, but they are more popular among the older groups than the younger groups (5% versus 2.7–2.8%).

Having a mobile phone is very popular among most people, regardless of age in both cities and rural areas. However, for the oldest Thais, possessing one does not seem to be as popular. The survey data show that in 2016 over 60 percent of those age 70

Table 8
Experience using the internet by age group.

Age group	Diff (men vs. women)	SE	z	p-value	N
55–59	–0.042	0.007	–5.69	0.000	12,939
60–69	–0.042	0.005	–7.97	0.000	21,583
70 & over	–0.029	0.005	–5.97	0.000	17,856
all 3 groups	–0.041	0.003	–12.40	0.000	52,378
	Diff (urban vs. rural)				
55–59	–0.066	0.007	–8.99	0.000	12,939
60–69	–0.067	0.005	–12.87	0.000	21,583
70 & over	–0.024	0.005	–5.00	0.000	17,856
all 3 groups	–0.041	0.003	–12.40	0.000	52,378

Source: Author’s calculations from the Thai household survey on ICT use (NSO, 2016).

Table 9
Types of mobile phones owned by elderly Thais.

Type of mobile phone	55–59	60–69	70+	All 55+	All
Feature phone	11,857 18.4%	20,102 31.3%	17,205 26.8%	49,164 76.5%	64,301
Smart phone	6,914 9.1%	10,104 13.3%	11,962 15.7%	28,980 38.1%	76,152
Both	226 10.4%	136 6.3%	39 1.8%	401 18.5%	2166

Source: Authors’ calculation from the Thai household survey on ICT use (NSO, 2016).

and over do not have mobile phones, and among those age 60–69 and 55–59, the share is much lower, only 27 percent and 15 percent, respectively.

The Thai ICT survey also details which types of phones people use, and Table 9 shows that a large proportion of the elderly in Thailand use feature phones, which cannot be used with applications and have only basic functions such as making and receiving calls, SMS, and basic/low-speed web browsing. In the full sample, 64,301 people still use only feature phones (in contrast to 76,152 smart phone users), and 75 percent of them are elderly users.

The survey respondents were also asked whether they use their mobile phones for mobile banking. Among the total population, a small share gave a positive response (4701 out of 142,619 mobile phone users), only 3.3 percent. Among those of prime working age (25–54). However, this survey was conducted in 2016, long before the first national digital payment system was officially used in 2019, called the PromptPay QR code system¹. An estimated 49 million accounts were registered with PromptPay in Thailand as of 2021 (Omise, 2021). More important, over 95 percent of mobile banking users also own at least one smart phone, and 5.5 percent of them even have more than one. Having a smart phone is a critical precondition for using mobile banking services.

5. Conclusion

Thailand formally became an aging society in 2005 and will turn into a super-aged society in the near future with more than 20 percent of the population age 65. Although the country has achieved considerable progress in financial inclusion compared to other Asian countries, it still has some gaps to fill and some vulnerable groups that might be excluded from financial transactions, particularly in the era of digitalization. This study examines the group of elderly Thais who have limited access to financial services and a very low level of financial inclusivity. Among non-bank-account holders in Thailand, about half are elderly (age 55 and over), and more than a third (36.7%) of non-account holders are age 60 and over.

The level of digital financial inclusion for this age group is still low, and only 7 percent have a mobile money account. Even among owners of mobile phones, only 16.8 percent of the

¹ The Policy Guideline: Standardized Thai QR Code for Payment Transactions dated 17 April 2019 issued by the Bank of Thailand

sample uses mobile money. This share is higher among those who are still in the workforce. Among age 60 and over, the share of mobile phone use and internet access for access bank accounts or checking balances is only 5 percent and 3.2 percent, respectively. Unsurprisingly, only 2.2 percent of the elderly who are not in the workforce actually use internet banking for checking bank balances.

We constructed a measurement of financial inclusion, with a score consisting of five different measures or aspects of financial transactions, on a scale of 0–5. The FI scores clearly are positively related to workforce participation, income level, and education level but negatively related to age or age group. Older people have lower FI scores. Our econometric analysis confirms these negative effects and finds a strong correlation between mobile phones and mobile money accounts and FI scores.

In addition, our findings confirm the results of previous studies on financial inclusion in Thailand, showing that overall, the country has no significant gender gap in terms of access to finance or financial inclusion scores, whereas financial inclusion studies in the global literature generally identify prevalent gender disparity (Demirgüç-Kunt et al., 2018; Ghosh & Vinod, 2017). However, when we examine a particular group of the elderly, we find inequality across gender and residential area.

Our additional analysis on ICT use among elderly Thais provides useful interpretations of the disadvantages faced by the elderly with respect to financial inclusion. The overall high financial inclusion in the Thai economy and the low scores among the elderly shed light on some market failures and challenges in achieving a financially inclusive economy, as indicated by Demirgüç-Kunt and Klapper (2012). Common barriers to financial inclusion such as high costs, physical distance, and lack of documentation apply to the elderly in general.

In Thailand, we found that one the biggest challenges for the elderly who wish to use digital financial services is their limited use of the internet and mobile phones. Elderly Thais have a low internet use because of their lack of skills, rather than a lack of interest or belief in the necessity of using such services. Their preference for feature phones shows their low awareness of the benefits of smart phones in their daily life and financial well-being. It is evident that mobile devices, such as smart phones are the key channels for encouraging older people to use the internet. As a result, we recommend the promotion of mobile internet access among the elderly, emphasizing the role of ICT and digital technology to promote financial inclusion. This offers some guidance to policy makers in targeting financial inclusion policies for this group. Certainly, greater internet access and smart phone use to increase mobile money and banking must be accompanied by the promotion of financial literacy and digital financial literacy, in particular among the elderly. As noted in Kumar et al. (2022), the dominance of financial capability and financial autonomy as mediators in financial decision making and financial well-being becomes more evident. Elder-friendly training and teaching about financial transactions can be even more convenient with digital devices.

In recent years, Thailand has increased its adoption of ICT and the introduction of various fintech products, helping to

improve overall financial inclusion. The standardized Thai QR Code for Payment Transactions officially introduced in early 2019 and extensively used during the pandemic is a big step toward financial inclusion. Our study using 2017 data, therefore, can serve as a baseline to track whether such economy-wide innovations can improve financial inclusion among the elderly or more custom-made products and services for this particular group are still needed. Our findings on ICT infrastructure, devices, and financial services suggest the necessity of forming public-private partnerships to enhance the future financial environment in old age.

At a broader level, a national strategy that takes into account marginalized and financially vulnerable groups can help policy makers identify gaps in financial inclusion, improve monitoring, strengthen the national focus, and facilitate interagency coordination. Fintech innovations can certainly enhance the quality and utilization of financial services (WorldBank, 2019), but it is also necessary to ensure that the benefits of financial inclusion brought about by such innovations do not exclude sectors of society, particularly in aging societies, such as the elderly rural population, low-income households, elderly women, and remote communities. According to the IMF (2018), having a national financial inclusion strategy can also help to prioritize reforms and resource allocation and exploit policy synergies, including interactions between macro and financial inclusion policies.

Acknowledgments

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Appendix.

Table A1. Sample by age group and area of residence

Age group	Urban/Metropolitan	Rural	All
15–24	13,208	9851	23,059
	13.7	13.1	13.4
25–34	14,029	9883	23,912
	14.5	13.1	13.9
35–44	17,343	13,463	30,806
	18.0	17.9	17.9
45–54	19,800	16,333	36,133
	20.5	21.7	21.0
55–59	9013	7028	16,041
	9.3	9.3	9.3
60–69	13,140	10,475	23,615
	13.6	13.9	13.8
70 & over	9934	8263	18,197
	10.3	11.0	10.6
Total	96,467	75,296	171,763
	100	100	100

Source: Author's calculations from the Thai household survey on ICT use (NSO, 2016).

Table A.2. Computing financial inclusion indicators

Indicator	Question number	Discussion	Method used
Holds payment product	Qprod1_b	Identifies payment products across country level data, such as prepaid cards, current accounts etc.	Binary variable: takes value of 1 if any product is held, otherwise 0
Holds savings, investment or retirement product	Qprod1_b	Identifies savings, investment and retirement products across country level data, such as pensions, investment accounts, savings accounts, savings clubs, bonds, crypto-assets etc.	Binary variable: takes value of 1 if any product is held, otherwise 0
Holds insurance	Qprod1_b	Identifies insurance products across country level data, such as car insurance, home insurance, etc.	Binary variable: takes value of 1 if any product is held, otherwise 0
Holds credit product	Qprod1_b	Identifies credit products across country level data, such as mortgages, credit cards, microloans etc.	Binary variable: takes value of 1 if any product is held, otherwise 0
Aware of at least 5 products	Qprod1_a	Counts all positive responses across Qprod1_a	Binary variable: takes value of 1 if at least five positive responses, otherwise 0
Recent financial product choice	Qprod1_c	Identifies individuals that have made at least one product choice	Binary variable: takes value of 1 for any recent choice, otherwise 0
Relying on family and friends	QF3 and QF12	Identifies people who turn to family or friends to save money for them, or to help them to make ends meet	Binary variable: takes value of 1 if saving through family and friends or turning to family and friends to make ends meet, otherwise 0

Source: OECD (2016).

Appendix Table A3. Correlation matrix for explanatory variables

Variable No.	Variable	Var(1)	Var(2)	Var(3)	Var(4)	Var(5)	Var(6)	Var(7)	Var(8)	Var(9)	Var(10)	Var(11)	Var(12)	Var(13)
(1)	male	1												
(2)	edulevel1 (primary or less)	-0.1186*	1											
(3)	edulevel2 (secondary)	0.1196*	-0.8484*	1										
(4)	edulevel3 (tertiary or higher)	0.0076	-0.3481*	-0.2009*	1									
(5)	income quintile1 (poorest 20%)	-0.0324	0.2481*	-0.1837*	-0.1338*	1								
(6)	income quintile2 (second 20%)	-0.0121	0.1273*	-0.0838*	-0.0871*	-0.2508*	1							
(7)	income quintile3 (middle 20%)	-0.0344	-0.0089	0.0541	-0.0792*	-0.2383*	-0.2405*	1						
(8)	income quintile4 (fourth 20%)	0.0354	-0.0658*	0.0880*	-0.034	-0.2422*	-0.2445*	-0.2323*	1					
(9)	income quintile5 (richest 20%)	0.0414	-0.2902*	0.1233*	0.3188*	-0.2663*	-0.2688*	-0.2553*	-0.2596*	1				
(10)	participate in labor force	0.1214*	-0.1487*	0.1217*	0.0597	-0.1574*	-0.0049	0.0229	0.0649*	0.0732*	1			
(11)	Age	-0.0036	0.5777*	-0.4952*	-0.1921*	0.2180*	0.0538	-0.0045	-0.0915*	-0.1707*	-0.2036*	1		
(12)	own a mobile phone	0.0024	-0.2182*	0.1861*	0.0743*	-0.1303*	-0.0538	0.0637*	0.0193	0.0991*	0.1202*	-0.3252*	1	
(13)	have a mobile money account	0.0604	-0.2723*	0.1910*	0.1658*	-0.0837*	-0.0852*	-0.0126	0.0486	0.1285*	0.0840*	-0.2709*	0.0742*	1

Source: Authors' calculation from the Findex data 2017 for Thailand (World Bank, 2017).

*Significant at the 5 percent level.

Appendix Table A4. Experience in internet use by age group

Age group	Yes	Never, because	
		don't know how	not interested/not necessary/waste time
15–24	19,934	990	1776
	86.45	4.29	7.7
25–34	16,912	2720	3869
	70.73	11.38	16.18
35–44	14,628	8811	6974
	47.48	28.6	22.64
45–54	9789	18,474	7599
	27.09	51.13	21.03
55–59	3102	10,064	2810
	19.34	62.74	17.52
60–69	2032	17,791	3721
	8.6	75.34	15.76
70 & over	341	15,859	1977
	1.87	87.15	10.86
Total	66,738	74,709	28,726
	38.85	43.5	16.72

Source: Author's calculations from the Thai household survey on ICT use (NSO, 2016).

Appendix Table A5. Internet use in different places

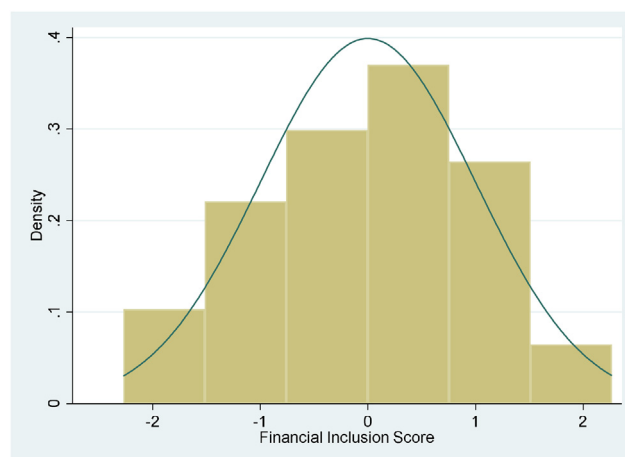
Place	All	55–60 years	61–70 years	over 70 years
1. Home	68.9%	73.7%	75.8%	71.3%
2. Work	37.3%	57.0%	17.8%	11.7%
3. School	17.8%	4.2%	0.9%	1.5%
4. Internet shop	7.8%	1.0%	1.0%	3.5%
5. ICT community centre	3.7%	2.7%	2.8%	5.0%
6. other's house	20.7%	14.5%	13.1%	12.9%
7. Public place	3.9%	3.3%	2.6%	2.3%
8. any place (mobile device)	89.2%	87.8%	84.4%	78.9%
9. other	0.2%	0.3%	0.4%	2.3%
Min	1	1	1	1
Max	9	9	9	6
Average	2.53	2.48	2.01	1.92
No. of obs.	66,738	3102	2032	341

Source: Authors' calculations from the Thai household survey on ICT use (NSO, 2016).

Appendix Table A6. Reasons for not using the internet

Reason	55–59	60–69	70+	All 50+
2. Not necessary	75.0	70.8	60.3	65.6
3. Expensive device	3.3	2.5	0.9	1.7
4. Expensive service	0.8	0.6	0.2	0.4
5. Don't know how to use	11.7	19.1	35.7	27.3
6. No network	0.4	0.4	0.1	0.2
7. Poor signal	0.1	0.1	0.0	0.1
8. other	8.6	6.5	2.8	4.8
	100	100	100	100
No. of elderly with no mobile phone	2,504	6455	10,931	19,890
No. of elderly	16,041	23,615	18,197	57,853
Share	15.6%	27.3%	60.1%	34.4%

Source: Thai household survey on ICT use (NSO, 2016).



Appendix Figure A1. Distribution of the Financial Inclusion Z-Score. Source: Authors' calculations from Findex 2017 for Thailand.

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