

Singapore Management University  
**Institutional Knowledge at Singapore Management University**

---

Research Collection Lee Kong Chian School Of  
Business

Lee Kong Chian School of Business

---

11-2018

# Financial knowledge and portfolio complexity in Singapore

Benedict S. K. KOH

*Singapore Management University, [skkoh@smu.edu.sg](mailto:skkoh@smu.edu.sg)*

Olivia S. MITCHELL

*University of Pennsylvania*

Susann ROHWEDDER

**DOI:** <https://doi.org/10.1016/j.jeoa.2018.11.004>

Follow this and additional works at: [https://ink.library.smu.edu.sg/lkcsb\\_research](https://ink.library.smu.edu.sg/lkcsb_research)

Part of the [Asian Studies Commons](#), [Finance Commons](#), and the [Portfolio and Security Analysis Commons](#)

---

## Citation

KOH, Benedict S. K.; MITCHELL, Olivia S.; and ROHWEDDER, Susann. Financial knowledge and portfolio complexity in Singapore. (2018). *Journal of the Economics of Ageing*. 1-11. Research Collection Lee Kong Chian School Of Business.

**Available at:** [https://ink.library.smu.edu.sg/lkcsb\\_research/6087](https://ink.library.smu.edu.sg/lkcsb_research/6087)

This Journal Article is brought to you for free and open access by the Lee Kong Chian School of Business at Institutional Knowledge at Singapore Management University. It has been accepted for inclusion in Research Collection Lee Kong Chian School Of Business by an authorized administrator of Institutional Knowledge at Singapore Management University. For more information, please email [libIR@smu.edu.sg](mailto:libIR@smu.edu.sg).



ELSEVIER

Contents lists available at ScienceDirect

## The Journal of the Economics of Ageing

journal homepage: [www.elsevier.com/locate/jeoa](http://www.elsevier.com/locate/jeoa)

Full length article

Financial knowledge and portfolio complexity in Singapore<sup>☆</sup>Benedict S.K. Koh<sup>a</sup>, Olivia S. Mitchell<sup>b</sup>, Susann Rohwedder<sup>c,\*</sup><sup>a</sup> Singapore Management University, 50 Stamford Road, #04-01, Singapore 178899, Singapore<sup>b</sup> Wharton School, 3620 Locust Walk, St 3000 SHDH, Philadelphia, PA 19104-6320, USA<sup>c</sup> 1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138, USA

## ARTICLE INFO

## Keywords:

Financial literacy  
Investment  
Portfolio diversification  
Pension  
Central Provident Fund  
Retirement  
Saving

## JEL codes:

D14  
E21  
G11  
J32

## ABSTRACT

Financial literacy in Singapore has not been analyzed in much detail, despite the fact that this is one of the world's most rapidly aging nations. Using the Singapore Life Panel<sup>®</sup>, we explore older Singaporeans' levels of financial knowledge and compare them to those observed in the United States. We assess portfolio complexity for these older households, to examine how financial literacy is related to outcomes of interest. We show that older Singaporeans' levels of financial literacy are comparable overall to those in the United States, even though older Singaporeans score slightly lower on some dimensions (knowledge of interest and inflation), and slightly higher on their knowledge of risk diversification. We document that women are less informed than men about stock diversification, and educated people tend to be more financially knowledgeable than their less educated counterparts. We also find that financial literacy is positively associated with respondents having both more wealth and more diversified and complex portfolios.

## Introduction

Around the world, higher levels of financial literacy have been shown to be associated with more financial planning and saving, better investment behavior, and a better understanding of how to manage retirement drawdowns (Lusardi and Mitchell, 2014). This is particularly important in view of peoples' increased responsibility to effectively plan for and manage their own retirement savings and decumulation in the context of defined contribution plans. Nevertheless, several studies have also found that financial knowledge is low among older adults, even in nations with highly developed financial systems such as the UK and the US, as well as countries with less sophisticated financial markets such as Russia (Lusardi and Mitchell, 2011a,b).

Until recently, Singapore was a country where financial literacy had been little analyzed, notwithstanding the reality that it is one of the world's most rapidly aging nations (Chan, 2001). Moreover, Singaporeans must make a number of key financial decisions in connection with their contributions to, investments in, and decumulation from their nation's mandatory pension scheme known as the Central Provident

Fund (CPF). On the one hand, one might anticipate that older Singaporeans would be quite financially literate, having benefited from the country's globally-renowned educational system, top-ranked since the 1960s (OECD, 2012). On the other hand, the government has, since 1955, required participation in the CPF. Participants who expected that their CPF accounts would provide financial security in retirement may have devoted less effort to self-management and investing in financial knowledge. Moreover, the diversity of backgrounds, languages, and relatively lower levels of education among the older Singaporean population versus today's prime-age population could imply lower levels of financial knowledge for this group (OECD, 2016).

This paper reports the first analysis of older Singaporeans' financial literacy using a unique new dataset, the Singapore Life Panel (SLP<sup>®</sup>). Using this nationally representative survey, we address three important questions. First, we assess older Singaporeans' levels of financial knowledge and compare their results to findings from the US. Second, we examine the empirical linkages between financial literacy and retirement preparedness in Singapore. Third, we evaluate the extent to which financial knowledge in Singapore is associated with financial

<sup>☆</sup> The authors acknowledge excellent programming assistance from Yong Yu and the Singapore Life Panel (SLP<sup>®</sup>) team at Singapore Management University, as well as the RAND SLP<sup>®</sup> team. The research was supported by the Singapore Ministry of Education (MOE) Academic Research Fund Tier 3 grant with the MOE's official grant number MOE2013-T3-1-009, the Singapore Management University, and the Pension Research Council/Boettner Center at The Wharton School of the University of Pennsylvania. All opinions are solely those of the authors. © 2018 Koh, Mitchell, and Rohwedder. All rights reserved.

\* Corresponding author.

E-mail addresses: [skkoh@smu.edu.sg](mailto:skkoh@smu.edu.sg) (B.S.K. Koh), [mitchelo@wharton.upenn.edu](mailto:mitchelo@wharton.upenn.edu) (O.S. Mitchell), [susannr@rand.org](mailto:susannr@rand.org) (S. Rohwedder).

<https://doi.org/10.1016/j.jeoa.2018.11.004>

2212-828X/ © 2018 Published by Elsevier B.V.

portfolio complexity and asset diversification among the older population.

To preview our findings, we show that overall financial literacy among older adults in Singapore is comparable, but nevertheless slightly lower than in the United States. Somewhat unexpectedly, financial literacy in Singapore is higher for the 55–70 age group versus the age 50–54 reference category. Better-educated people are more financially knowledgeable, while women are less financially informed. These results are similar to those from other countries. We also show that close to half of older Singaporeans anticipate that they will struggle in retirement (46%), and fewer than half say they are well prepared financially for retirement (43%). Overall, the most financially literate are least worried about retirement finances. Finally, we evaluate the correlates of complex portfolio holdings and asset diversification among older Singaporeans. We show that financial knowledge is associated with higher household net worth, higher net financial wealth, and more net non-housing wealth, and the financially savvy hold more diversified and riskier portfolios. This is true even after controlling for education, indicating that financial literacy plays a role in peoples' portfolio decisions, independent of schooling. These findings represent empirical associations between financial literacy and peoples' financial decisionmaking since our research design does not support a causal interpretation. As such, this paper is a first step in a larger research plan on retirement saving in Singapore.

In what follows, we first provide a brief background on the Singaporean retirement system. Next we describe the dataset and then outline the empirical methodology we use to answer our three questions. Subsequently we present results, and we conclude with a discussion of issues deserving of further research attention.

### A brief background on the Singaporean retirement system

Singapore has a national mandatory defined contribution (DC) pension system administered by the Central Provident Fund (CPF), a government statutory board. All workers must contribute to three accounts (Ordinary, Special, and Medisave). The CPF contribution rates and allocation into the three accounts are not uniform, but instead vary with age. Those age 55 and below must contribute 20% of their monthly wages, and their employers 17%, to the CPF Board. Of the total 37% contribution, 23% is deposited into the Ordinary Account, 6% into the Special Account, and 8% into the Medisave Account for those age 35 and younger. For older age brackets (above 35–45; above 45–50; and above 50–55) the allocation rates into the Special Account and Medisave Account rise gradually, while total contributions remain constant at 37%. The objective is to ensure CPF members save for retirement and medical expenses. Beyond age 55, total contributions decline rapidly. At the other end of the age spectrum, contributions from workers over age 65 and their employers decline to 5% and 7.5% respectively; the allocations into Ordinary, Special, and Medisave accounts are 1%, 1%, and 10.5%, respectively. These contribution rates apply to wages up to an income ceiling of S\$6,000 per month.<sup>1</sup>

The Ordinary Account (OA) savings can be withdrawn to purchase homes, service mortgage payments, finance premiums for insurance protection, pay for children's tertiary education, and to invest in financial products to grow savings. The Special Account (SA) holds savings primarily for retirement and these cannot be withdrawn before the age of 55. Members can deposit them with the CPF Board to earn interest, or they can invest in a smaller set of non-CPF financial products (known as the Investment Saving or IS accounts). The Medisave account holds savings for members to pay inpatient hospital bills, selected outpatient treatments, and premiums for insurance against catastrophic illness and disabilities. All working adults have these three

accounts until age 55 when savings earmarked for retirement are deposited into the Retirement Account (RA). Currently, CPF savings in the Ordinary Account (OA) and Special Account (SA) are paid a government-set annual interest rate of 2.5% and 4%, respectively.

As of age 55, CPF members must set aside a 'basic retirement sum' of \$85,500 in their Retirement Accounts (in 2018) provided they pledge their property to the CPF Board. Those who do not pledge their property have to set aside the full retirement sum equivalent to twice the basic retirement sum. These amounts are deemed by the government sufficient to support a subsistence level of living in old age, and the value rises with inflation. Since 2013, all CPF members must annuitize the basic retirement sum so as to provide an income stream (known as CPF Life) from age 65 to death.

### The Singapore Life Panel

The Singapore Life Panel (SLP®) is an ongoing high-frequency survey fielded by the Centre for Research on the Economics of Ageing (CREA) at the Singapore Management University.<sup>2</sup> Since August 2015, it has been collecting monthly interviews to track longitudinally individual and household circumstances and behavior in a representative cohort of Singaporean citizens and permanent residents age 50–70 when recruited in 2015.<sup>3</sup>

Designed with input from the creators of the US Health and Retirement Study (HRS), several of the international sister studies of the HRS, the American Life Panel (ALP) at RAND, and the Chilean Encuesta de Protección Social (EPS), the survey includes many state-of-the-art and globally harmonized questions on a large range of topics eliciting information on respondents' individual circumstances (e.g., their health and labor force status, their expectations and preferences, government program participation, etc.), as well as information on household-level variables (such as monthly information on household expenditures across 44 categories, or an annual complete inventory of household wealth and household income and their respective detailed components). The frequency at which survey items are elicited is adjusted to the frequency of change in the underlying variable, combined with considerations about the importance of observing the exact timing of a change. For example, labor force, health status, and several items of subjective well-being are asked every month along with several other high-frequency spending variables, to allow the detailed month-by-month tracking of the effect of a change in health or labor force status on earnings or on measures of well-being. In practice, the varying frequency is achieved by fielding some questions every month, others quarterly or annually, and some content at lower frequencies. As a result, shorter monthly surveys (15–20 min) alternate with longer quarterly surveys (20–30 min). Panel members are compensated for each survey they complete in the form of a grocery store voucher (values range between \$10 and \$25 depending on the expected length of the survey).

The SLP® is conducted primarily over the internet. Respondents who need assistance can call the helpdesk and complete the survey over the telephone, or they can ask for personal assistance by arranging an in-person meeting with a student assistant at a local library or at the survey headquarters.<sup>4</sup> The initial recruitment effort resulted in a panel of 15,000 individuals from 11,500 distinct households who completed a baseline survey in May–July 2015. Analysis of the panel along several dimensions has shown that it is closely representative of the population, and attrition rates are low.<sup>5</sup>

<sup>2</sup> For additional information on the SLP®, see [Vaithianathan et al. \(2018\)](#).

<sup>3</sup> All data are anonymized so no personal identification of individuals or households is feasible.

<sup>4</sup> About 3% of interviews are completed over the telephone every month, and about 1% use in-person assistance.

<sup>5</sup> For additional information on the survey, see <https://crea.smu.edu.sg/>

<sup>1</sup> As of this writing (November 2018), the Singaporean dollar is valued at about US\$0.73.

Two SLP survey modules are central to the present study. First, we fielded a module in the December 2015 survey on financial literacy, asking the Big Three questions developed by Lusardi and Mitchell (2014). Second, the SLP elicits a complete inventory of the asset holdings of each respondent's household (asset components are listed in Appendix Table A1). Respondents complete the asset and income module in the January survey.<sup>6</sup> Some assets are individually owned, such as CPF balances. For these, respondents are asked to report on their own CPF accounts first, and then they are asked to report on their spouse's CPF accounts (if any).<sup>7</sup> In some households, the respondent's spouse is also a study participant, so both are asked to provide their financial information. In that case, we use both observations in our analyses, adjusting standard errors to account for clustering at the household level.

Our analytic sample for this study consists of 6686 persons who were age 50–70 in December 2015 when SLP Wave 5 was fielded, who answered the asset and income module in January or February of 2017 (SLP Waves 18 or 19), and who answered the Financial Literacy module, explained in more detail below.<sup>8</sup>

## Methodology

Our empirical analysis of portfolio complexity and financial literacy in the SLP<sup>®</sup> focuses on three key factors. First, we describe our financial knowledge module, which allows us to evaluate older Singaporeans' financial knowledge and compare it to that of similar-aged individuals in the United States. In addition, we relate financial knowledge to respondent attributes, to adduce systematic patterns. Second, we relate respondents' self-assessed financial preparation for retirement to their measured financial literacy. Third, we examine the relationship between financial literacy and respondents' wealth and portfolio complexity.

### Measures of financial knowledge

To create the financial knowledge variables of interest, we posit that three key concepts lie at the root of economic saving and investment decisions: (i) numeracy and capacity to do calculations related to interest rates; (ii) understanding of inflation; and (iii) understanding of risk diversification. These “Big Three” questions have been implemented in numerous surveys in the United States and elsewhere,<sup>9</sup> and the specific wording in the Singapore Life Panel<sup>®</sup> is as follows (correct answers in **bold**):

- Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: [**more than \$102**,

(footnote continued)

singapore-monthly-panel.

<sup>6</sup> Respondents who missed the January survey were asked to complete the asset and income module in February to maximize the number of respondents with non-missing asset and income information.

<sup>7</sup> Because spouses of married study participants are not systematically included as respondents in their own right, it is important to obtain the complete inventory of household assets and income from each respondent.

<sup>8</sup> We use the 2017 asset measure rather than the 2016 measure because the 2017 survey instrument added questions on the detailed allocation of assets within peoples' CPF accounts.

<sup>9</sup> Lusardi and Mitchell (2014) have added the same questions to several other US surveys, including the 2007–2008 National Longitudinal Survey of Youth (NLSY) for young respondents (ages 23–28); the RAND American Life Panel (ALP) covering all ages; and the 2009 and 2012 National Financial Capability Study. The questions are also now included in the international PISA test to assess high school students' financial knowledge in more than a dozen countries to date; see Lusardi and Mitchell (2008, 2011a,b).

**Table 1**

Summary statistics on financial literacy in Singapore among older adults.

Variable	Mean	Std.	Min	Max
FinLit interest (= 1 if correct, 0 otherwise)	0.81	0.39	0	1
FinLit inflation (= 1 if correct, 0 otherwise)	0.72	0.45	0	1
FinLit risk (= 1 if correct, 0 otherwise)	0.47	0.50	0	1
FinLit Index (total # correct)	2.01	0.97	0	3

Note: SLP<sup>®</sup> = Singapore Life Panel. Sample includes SLP<sup>®</sup> respondents age 50–70 who answered the Big Three financial literacy questions and the asset questions in waves 18 and 19 (see text). Unweighted full sample N = 6686.

exactly \$102, less than \$102? Don't know.]

- Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy: [more than, exactly the same as, or **less than today** with the money in this account? Don't know.]
- Do you think that the following statement is true or false? “Buying a single company stock usually provides a safer return than a Unit Trust. [True, **False**, Don't know.]

The goal of the first question is to measure respondents' understanding of a simple interest rate calculation. The second assesses peoples' understanding of inflation in the context of a simple financial decision. The third is a joint test of knowledge of risk diversification and unit trusts or mutual funds. Naturally the answer to this question requires knowledge of both what a stock is, and that a unit trust (mutual fund) is comprised of many stocks.

## Results

### Descriptive statistics and correlates of financial literacy

Table 1 provides summary statistics on SLP<sup>®</sup> responses to the Big Three financial literacy questions. In the first three rows, a correct answer takes the value of 1, and any other answer (incorrect or don't know) is assigned a value of zero. Our tabulations indicate that in the full sample, 81% of older Singaporeans answered the interest rate question correctly, 72% answered the inflation question correctly, and 47% responded to the risk diversification question correctly. For the FinLit index, which is the total number of questions each person answered correctly, Singaporeans averaged around two of three correct answers (2.01). It is worth noting that many respondents (46%) answered “Don't know” to the last question on risk diversification.

Table 2 compares SLP<sup>®</sup> responses to the Big Three questions with those of similar aged adults from the American Life Panel (ALP),<sup>10</sup> a sister survey of the SLP<sup>®</sup> in the United States also using internet-based interviews, which fielded the Big Three questions in 2011. This comparison is of interest because in both countries the provision for retirement relies substantially on defined contribution and individual retirement accounts with only modest levels of annuitization. Consequently, older individuals in Singapore and in the US bear considerable responsibility to manage their finances and associated risks all the while the social safety net is less generous than in other developed economies. The SLP<sup>®</sup> respondents scored 6 percentage points lower on the interest rate question than the ALP respondents (81% versus 87%), and 14 percentage points lower on the inflation question (72% vs 86%). Interestingly, on the risk diversification question, both SLP<sup>®</sup> and ALP respondents performed worse on average than on the other two questions (only 47% and 43% scored correctly, respectively) and the Singaporeans did slightly better than their U.S. counterparts. The

<sup>10</sup> The RAND American Life Panel surveys the US population age 18 and older. For comparisons with the SLP<sup>®</sup> we restricted the age range in the ALP to match that of the SLP<sup>®</sup>.



**Table 2**  
Comparing financial literacy in Singapore and the US: persons age 50–70.

Variable	SLP <sup>®</sup> 2016	ALP 2011	Diff(SLP-ALP)	Significance test for difference
FinLit interest (= 1 if correct, 0 otherwise)	0.81	0.87	−0.05	***
FinLit inflation (= 1 if correct, 0 otherwise)	0.72	0.86	−0.14	***
FinLit safer (= 1 if correct, 0 otherwise)	0.47	0.43	0.04	**
FinLit Index (total # correct)	2.01	2.16	−0.15	***

Note: SLP<sup>®</sup> = Singapore Life Panel; ALP = American Life Panel (<https://alpdata.rand.org/>).

The SLP<sup>®</sup> sample answered three Financial Literacy questions in wave 5 (December 2016) and financial questions in waves 18 or 19 in 2017; data are unweighted. The ALP sample answered financial literacy questions in Modules 179–180 in 2011; data are weighted. \* Significant at 0.10 level, \*\* Significant at 0.05 level, \*\*\* Significant at 0.01 level.

**Table 3**  
Probit multivariate analysis of three financial literacy questions on controls (SLP<sup>®</sup>).

	Interest rate	Inflation	Risk
Age 55–59	0.010	0.030 **	0.024
Age 60–64	0.027 **	0.040 **	0.032 *
Age 65–70	0.037 **	0.071 ***	−0.009
Female	0.009	−0.009	−0.051 ***
Married	0.001	−0.020	−0.001
2ndry educ.	0.043 ***	0.092 ***	0.080 ***
Post-2ndry educ.	0.156 ***	0.288 ***	0.259 ***
Fair/poor health	−0.021 **	0.009	−0.023 *
Work for pay	−0.002	−0.025 **	−0.001
Self-employed	0.028 *	0.021	0.018
Own home	0.072 ***	0.137 ***	0.090 ***
N	6686	6686	6686
R-squared	0.047	0.107	0.050
Dep. Var. Mean	0.813	0.723	0.472
Dep. Var. St. Dev.	0.390	0.448	0.499

Note: \* Significant at 0.10 level, \*\* Significant at 0.05 level, \*\*\* Significant at 0.01 level. Dependent variable in columns 1–3 = 1 if answer correct; 0 otherwise. Probit marginal effects reported. Additional controls include indicators for race/ethnicity, who manages household finances, and missing values. Reference group: Age 50–54; Chinese; Primary education; Respondent manages household finances.

Singaporean mean correct score on the overall FinLit index (2.01 correct of 3 questions) was slightly below the average (2.16) for ALP respondents in the US survey. All differences are statistically significant at 5% or higher.

Next we report results of a multivariate analysis of the Big Three questions in Table 3, regressed on control variables that include the respondent's age, sex, education, marital status, health and other factors commonly used in this context.<sup>11</sup> Based on previous studies conducted in non-Singaporean settings, we expect that age will exhibit an ambiguous relationship with financial literacy, in that older people have more financial experience and exposure, but older people are also more likely to suffer from cognitive decline (Lusardi et al., 2017). Women have also been found in numerous studies around the globe to be less financially savvy than men (Lusardi and Mitchell, 2014). Better-educated individuals are more likely to score better on financial literacy questions, though education is by no means a perfect predictor (Behrman et al., 2012). The literature also suggests that nonmarried persons are more financially frail and less financially literate than their married counterparts, in part due to selectivity in marriage markets (Becker, 1973). Respondents in better health tend to be more

<sup>11</sup> Descriptive statistics are provided in Appendix Tables A2 and A3. In addition, we control on but do not report coefficients for whether respondents indicate being employed, if they are homeowners, and whether they manage the finances in their households (e.g., the respondent alone, the respondent along with another, usually the spouse, or the spouse alone), as well as ethnicity. Additional results are available on request.

financially literate. Investing in financial knowledge is also more attractive to those likely to live longer, inasmuch they have a longer remaining lifetime over which to reap the rewards of this investment (Kim et al., 2016; James et al., 2012).

To investigate how financial literacy varies by demographic characteristics in the SLP<sup>®</sup>, we first estimate a separate model for each of the financial knowledge questions. The dependent variable here takes the value 1 if the respondent gave the correct answer, and 0 otherwise (includes wrong answers and “don't know” responses); estimation is by Probit and marginal effects are reported in Table 3.

A first point worth noting in Table 3 is that older (age 60+) Singaporeans are significantly better informed about interest rates than their younger counterparts. Moreover, persons age 55+ are better informed about inflation than the 50–54 reference group, and those age 65–70 even more so. We have no direct explanation for this interesting difference.

Coefficients on other correlates are also of interest: for instance, women score slightly worse on the risk diversification question, consistent with findings from other countries (Lusardi and Mitchell, 2007). Marital status is never a significant discriminator, while unsurprisingly, the better-educated are more financially literate than the reference group (those with less than a secondary education). These patterns are similar to those discovered in the US and other contexts. Those in fair or poor health are less informed about interest rates, perhaps indicating that less-healthy individuals find the cost of investment needed to learn about financial matters too great, or it may provide a lower return given possibly shorter life expectancy. Results also show that homeowners are better informed about financial matters than are renters.<sup>12</sup>

Table 4 reports estimation results for the FinLit index that counts respondents' total number of correct answers to the financial knowledge questions. The dependent variable, denoted FinLit score, ranges from 0 to 3; accordingly, estimation uses Ordered Probit analysis and the same vector of control variables is used as in Table 3. Echoing the prior results, older respondents, men, the better educated, and homeowners have a higher probability of answering all financial knowledge questions correctly (statistically significant at 5- or 1-percent level). Differences in the FinLitScore by self-rated health status are small and not statistically significant.

<sup>12</sup> In results not reported here in detail, we also analyzed which respondents say “don't know” versus giving a wrong answer. Multivariate analysis of the factors most strongly associated with people responding “don't know” are relative youth (older people are better informed about interest rates and risk diversification); being less educated (better educated respondents are more likely to be correct and less likely not to know correct answers to all three questions); and owning a home (those who own homes are less likely to say “don't know”). Similar to other cross-national comparative studies, women are more likely to say they “don't know” than men, particularly about stock market diversification (Lusardi and Mitchell, 2014). This could imply that women might be more open to financial education efforts, as they are less confident in their knowledge.

**Table 4**  
Ordered probit multivariate analysis of FinLit score on controls (SLP®).

	FinLit score = 0		FinLit score = 1		FinLit score = 2		FinLit score = 3	
Age 55–59	–0.011	**	–0.013	**	–0.005	*	0.029	**
Age 60–64	–0.017	**	–0.020	**	–0.008	**	0.044	**
Age 65–70	–0.015	**	–0.018	**	–0.007	**	0.040	**
Female	0.010	**	0.012	**	0.004	**	–0.026	**
Married	0.003		0.004		0.001		–0.008	
2ndry educ.	–0.036	***	–0.042	***	–0.016	***	0.095	***
Post–2ndry educ.	–0.113	***	–0.137	***	–0.074	***	0.324	***
Fair/poor health	0.007		0.007		0.002		–0.016	
Work for pay	0.005		0.006		0.002		–0.013	
Self-employed	–0.009		–0.011		–0.004		0.025	
Own home	–0.057	***	–0.055	***	–0.006	**	0.117	***
Dep. Var. Mean	2.009							
Dep. Var. St. Dev.	0.974							

Note: \* Significant at 0.10 level, \*\* Significant at 0.05 level, \*\*\* Significant at 0.01 level. Dependent variable: FinLit score which counts the number of correct answers to the three financial knowledge questions. Marginal effects from an Ordered Probit model reported. Additional controls include indicators for race/ethnicity, who manages household finances, and missing values. Reference group: Age 50–54; Chinese; Primary education; Respondent manages household finances.

### Linking financial literacy and key outcome measures

Ideally, one would like to know whether financial knowledge facilitates greater wealth accumulation, possibly through more sophisticated investment strategies, and whether it helps individuals or households achieve greater financial security. We lack the data to establish such causal relationships. We therefore examine a wide variety of descriptive patterns to verify whether those could be consistent with such interpretations. Specifically, we relate the financial literacy index, FinLit score, to several different measures of household wealth, respondents' self-assessed financial preparation for retirement, household investment portfolio complexity and portfolio diversification.

### Household wealth, retirement preparedness, and financial literacy

The SLP® collects the details of the complete inventory of households' assets by asking about ownership and the respective values of many different types of asset. This allows constructing various wealth measures, three of which we link to our financial literacy index. The most comprehensive measure is *total household net wealth*; this includes total household wealth including pension assets, financial wealth, life insurance face values, business, vehicles, primary (and any secondary) residences, net of debt. Inasmuch as housing wealth is a particularly important form of wealth in Singapore, accounting for about 53% of total household net worth among 50–70 year olds, we believe it crucial to include it in the analysis.<sup>13</sup> The second measure we call *total non-*

<sup>13</sup> Singaporeans can purchase two types of public housing units: BTO flats and resale flats. The first category (BTO) refers to new housing units supplied by a government statutory board in the primary market. Buyers of such housing units are restricted from selling in the first five years of ownership. Beyond five years, they are allowed to sell their homes to unlock home equity. The second category refers to resale public housing units which buyers can purchase and sell in the secondary market without restrictions. Public housing apartments have registered five times appreciation since 1990 or an annual 8.2% over the last 23 years. The sharp appreciation in the value of homes allows home-owners the option of cashing out their properties if the remaining period of the leasehold is sufficiently long. Note that public housing units are sold on 99-year leaseholds in Singapore. The value of such housing units may depreciate when the leasehold period approaches its maturity date and the housing unit is returned to the government. This will not affect the cohort of current older households, however, because their remaining leasehold periods are still sufficiently long. There are various tiers of public housing so that owners of a larger home can downgrade to a smaller home with sizeable capital unlocked in the process. For private properties, the price appreciation has been 16 times since 1975 or an annual 7.8% in the past 38 years. Owners of private properties have the option of downgrading to homes in suburban areas or public housing units, if they wish to extract equity to finance retirement.

*housing wealth*, which excludes from the previous measure all housing assets and debt. The third measure, *net financial wealth*, excludes pension assets and the value of transportation, business and "other assets" from the previous measure (see also Appendix Table A1). Descriptive statistics on the three wealth variables in Table 5 show that our older Singaporean households report mean *total net wealth* of S\$1,143,300 (median: S\$652,800); mean *non-housing net wealth* of S\$484,800 (median: S\$238,000); and *mean net financial wealth* of S\$191,300 (median: S\$38,000). It should be noted that each value represents the sum of all assets of the household, that is, for couples, it is the sum of both respondent's and spouse's assets.

The survey also gathers two important measures of self-assessed retirement readiness, based on questions that encourage respondents to take into account their own needs and potential financial risks, as follows:<sup>14</sup>

Most people face uncertainty about financial needs during retirement (such as large home repairs, out-of-pocket medical expenditures or the need to hire help or pay for a nursing home). On a scale from 0 to 100, where 0 means no chance and 100 means absolutely certain: What do you think are the chances you will experience financial distress sometime during your retirement?

\_\_\_% or  Not applicable/I don't think I will ever retire

And

Now thinking of your financial situation in retirement: Considering all your financial and other assets, including your CPF account, how would you rate your financial preparation for retirement?

1 Excellent; 2 Very good; 3 Good; 4 Fair; 5 Poor

Answers to these two and the other measures of retirement preparedness appear in Table 5. As before, control variables include respondents' FinLit score, age, sex, marital status, education, self-reported health, and other factors.<sup>15</sup> Results confirm the economically meaningful and statistically significant relationship between financial

<sup>14</sup> To examine the validity of these self-assessed measures of economic preparation for retirement we regressed them on a set of covariates. We find that the coefficients on wealth and education are strongly significant and show the expected patterns, i.e. wealthier, higher educated, and healthier individuals report better preparation for retirement and lower chances of financial distress during retirement (results available upon request).

<sup>15</sup> In sensitivity analysis not detailed here, we also controlled on respondent self-assessed confidence regarding financial knowledge, an indicator of the respondent's planning horizon, and indicators of the respondent's risk preferences (one regarding general risk and another regarding financial risk). Results are qualitatively similar.

Table 5

Multivariate analysis of retirement preparedness on financial literacy and other controls (SLP<sup>®</sup>; OLS coefficients provided unless noted).

	HH total net wealth (\$100 k)		HH non-housing wealth (\$100 k)		HH net financial wealth (\$100 k)		Chances (%) of struggling financially in retirement		Good financial prep. for retirement (Probit)	
FinLit score	1.668	***	0.977	***	0.526	***	−1.383	***	0.034	***
Age 55–59	1.048		0.602	**	0.466	***	−1.211		0.030	*
Age 60–64	2.370	***	0.657	**	0.482	***	−4.249	***	0.074	***
Age 65–70	1.843	**	0.133		0.606	***	−6.514	***	0.089	***
Female	1.301	***	0.598	***	0.336	***	−2.043	***	0.022	*
Married	4.217	***	1.565	***	0.479	***	−0.494		0.025	
2ndry educ.	2.078	***	1.359	***	0.433	***	−2.095	**	0.054	***
Post-2ndry educ.	10.235	***	4.936	***	2.370	***	−7.571	***	0.157	***
Fair/poor health	−1.661	***	−0.656	***	−0.300	***	7.762	***	−0.255	***
Work for pay	−0.506		0.793	***	−0.018		0.120		0.021	
Own home	2.920	***	0.535	**	0.136		−2.235	*	0.025	
N	6686		6686		6686		5391		6670	
R-squared	0.107		0.181		0.138		0.065		0.101	
Dep. Var. Mean	11.433		4.848		1.913		45.594		0.430	
Dep. Var. St. Dev.	20.493		7.830		4.523		26.163		0.495	
Dep. Var. Median	6.528		2.380		0.380		50.000		0.000	

Notes: \* Significant at 0.10 level, \*\* Significant at 0.05 level, \*\*\* Significant at 0.01 level. Column 1 dependent variable is total household net wealth (including pension assets, financial wealth, life insurance face values, business, vehicles, residences, minus debt). Column 2 uses total non-housing wealth which excludes from the previous measure housing assets. Column 3, net financial wealth, excludes pension assets and the value of transportation, business and “other assets” from the previous measure. If wealth < \$1000, we dropped the observation; thus 287 observations were omitted for total wealth, 1672 for financial wealth, and 421 for nonhousing wealth. All amounts are expressed in January/February-2017 Singapore Dollars. Column 4 reports self-reported chances of struggling financially in retirement, and the dependent variable in Column 5 = 1 if preparation for retirement excellent/very good/good and = 0 otherwise. Specifically, the “Chance of struggling financially in retirement” variable is based on the following SLP question, asked in the baseline survey:

Most people face uncertainty about financial needs during retirement (such as large home repairs, out-of-pocket medical expenditures or the need to hire help or pay for a nursing home). On a scale from 0 to 100, where 0 means no chance and 100 means absolutely certain: What do you think are the chances you will experience financial distress sometime during your retirement?

\_\_\_% or  Not applicable/I don't think I will ever retire

And “Self-assessed financial preparation for retirement” draws on the following SLP question, asked in the baseline survey:

Now, thinking of your financial situation in retirement: Considering all your financial and other assets, including your CPF account, how would you rate your financial preparation for retirement?

1 Excellent, 2 Very good, 3 Good, 4 Fair, 5 Poor

Probit marginal effects reported. Additional controls: indicators for missing values, race/ethnicity, who manages household finances. Reference group: Age 50–54; Chinese; Primary education; Respondent manages household finances.

knowledge and household wealth (expressed in S\$100,000). For instance, holding all else constant, one additional correct answer to the FinLit questions is associated with S\$166,800 additional total net wealth; S\$97,700 more nonhousing net wealth; and S\$52,600 higher net financial wealth. Versus the mean, this would be worth about 15% more total net wealth, 20% more nonhousing wealth, and 27% more net financial wealth. Overall, we confirm that, in the SLP<sup>®</sup>, greater financial knowledge is associated with substantially higher household wealth, regardless of whether we focus on the broadest measure available or look instead at narrower measures such as non-housing and financial wealth.

The last two columns of Table 5 report the results from multivariate analyses of the self-assessed retirement preparedness questions, relating them to the same covariates as the household wealth measures. The average reported chance of struggling financially in retirement is 46%, while 43% of respondents rate their own financial preparedness for retirement as good or better on a five-point scale. We used OLS estimation when the dependent variable is the percentage chance of struggling financially in retirement and Probit when the dependent variable is “good or better” financial preparation for retirement (= 1, 0 otherwise).

Not surprisingly, respondents who are more financially informed deem themselves less likely to experience financial distress in retirement, and they are more likely to indicate they are financially well prepared for retirement. It is also interesting to note that respondents age 60–70 are more financially confident than their younger counterparts, perhaps due to the recently-introduced Silver Support program

targeted at the elderly poor in Singapore.<sup>16</sup> Better-educated respondents are substantially more optimistic about their retirement prospects, and women are also relatively less concerned about financial distress in retirement. Those expressing most concern are those in fair/poor health, who are much less optimistic on both metrics.

Besides the FinLit coefficients, other controls behave as expected. For instance, older people, better-educated, and married persons are better off than their counterparts. Those reporting themselves in fair or poor health have significantly less wealth, according to all three measures. Homeowners also report more wealth than renters, though they do not differ in terms of net financial wealth. We also find the expected systematic variation by wealth, education, and health, controlling for other demographic characteristics as well (see Appendix Table A3 for list of control variables).

#### Portfolio complexity

Next we examine two broad categories of portfolio holdings: assets held *outside* respondents' CPF (retirement) accounts, and assets held *inside* their CPF accounts.<sup>17</sup> Most Singaporean households indicate they

<sup>16</sup> See for instance Chen and Tan (2017). Nevertheless, it is worth noting that this supplement targets only the bottom 20% of the older population and therefore may only lead to marginal improvements of financial security in old age among those eligible.

<sup>17</sup> For non-CPF assets, we sum each age-eligible respondent's holdings plus those of the spouse, if any, to obtain household non-CPF assets; for some assets we cannot disentangle ownership, notably those that tend to be jointly held by spouses of a couple, like homes. For CPF assets, the respondent reports own CPF balances and—in separate survey questions—the CPF balances of the spouse (if

own a primary residence (83%) and checking/saving accounts (80%); only 8% hold a secondary property. Fewer than a quarter (24%) hold whole life insurance and fixed term deposits (23%), and only 26% reported holding shares outside their CPF accounts. Very few have gold/gold funds (2%), mutual funds or managed accounts (5%), bonds or bond funds (4%), or own businesses (5%). Within their CPF accounts, only a small minority of respondents indicate they have investments through their CPF Investment Scheme (IS) accounts: 9% hold shares, 6% have investment-linked insurance products, and each of the products we asked about amount to 4% or less (endowment insurance, government or corporate bonds, collective investments, or gold).

To evaluate these patterns more succinctly, we tally the *total number of complex asset holdings*, defined as the sum of the total number of complex assets held outside and inside respondents' CPF accounts. We also distinguish people's allocations to what we term to be *noncomplex* versus *complex* holdings in each of the two asset locations. For nonpension wealth, we define *noncomplex investments* as including an owner-occupied home, a checking/saving bank account, a vehicle, any fixed-term deposits, bonds, and whole life insurance. *Complex nonpension assets* include own businesses, investment property, shares/stock funds, gold/gold funds, managed accounts, and mutual funds/unit trusts. We categorize pension holdings according to whether people left their CPF retirement funds in their default accounts to be invested by the government, or whether they moved their money to "permitted" assets managed by non-government entities via the CPF Investment Scheme (CPFIS). Koh et al. (2008a,b) and Koh and Mitchell (2010) previously reported that many CPF participants left their retirement assets to be managed by the CPF since their net-of-expense returns were perceived to be safer than and often exceeded returns from investing in relatively expensive and riskier non-CPF products.<sup>18</sup> Nevertheless, several options available under the CPF IS may be attractive to savers willing to take additional risk including gold ETFs and gold certificates, investment-linked insurance products, annuities, government-guaranteed and statutory board bonds, unit trusts, and property funds.<sup>19</sup> For this analysis, we classify as *noncomplex CPF assets* money managed by the CPF, and as *complex CPF assets* those held in CPF-Investment Scheme (IS) accounts.

The first three columns of Table 6 report coefficient estimates from multiple regression analyses of the number of complex assets held inside/outside respondent CPF accounts as well as overall. The next three columns report results for the share of complex assets in peoples' portfolios, again inside versus outside the CPF holdings, and overall. It should be noted that the portfolio holdings are drawn from survey responses, so they represent what people report and presumably believe they own.

From the base of the table, we see that older Singaporeans hold relatively few complex assets overall, namely an average of 0.7 complex assets per respondent. Nevertheless, there is important variation inside and outside the CPF accounts, since respondents average 0.5 complex

(footnote continued)

any). The respondent was also asked to provide the details of his or her own CPF investment allocations. However, with respect to the spouse's CPF investment allocations the respondent was only asked to provide the fraction of the CPF balance held in shares. Accordingly, our variable measuring household CPF total complex holdings sums the respondent's complex investments and the spouse's share CPF investments.

<sup>18</sup> This was confirmed in a recent CPF Advisory Panel report showing that the funds permitted under the investment scheme remain expensive by international standards; see [https://services.mom.gov.sg/cpfpanel/media/recommendations/part2/Chapter%205\\_Simpler%20Investment%20Choices%20for%20CPF%20Savings.pdf](https://services.mom.gov.sg/cpfpanel/media/recommendations/part2/Chapter%205_Simpler%20Investment%20Choices%20for%20CPF%20Savings.pdf).

<sup>19</sup> These are available only to persons having at least \$20,000 in their Old-Age account, or at least \$40,000 in their Special Account. For additional detail see <https://www.cpf.gov.sg/Assets/members/Documents/CPFISInvestmentProducts.pdf>.

nonpension assets but only 0.2 inside their pension accounts. These results confirm prior suggestions that older respondents tend to keep their pension money in what they consider to be a safe government-invested account. Consistent with expectations, estimated coefficients on the FinLit index in Table 6 show that the more financially knowledgeable have a statistically significantly higher number of complex assets.<sup>20</sup> Being able to answer one additional financial question correctly is associated with 0.17 more complex assets overall (a difference of almost 25%). We also see that older Singaporeans (age 60–70) hold fewer complex assets in their pension accounts than do the younger reference group, while in their non-CPF accounts they hold slightly more complex assets than their younger counterparts (though these estimates are not statistically different at the 5-percent level). Across the board, better-educated individuals have more complex assets, and the association is quantitatively large and statistically significant. Persons in poor health hold fewer complex assets, while married persons are less diversified in their CPF accounts.

A similar result obtains in the next three columns of Table 6, where the dependent variables focus on the share of each wealth type held in complex assets. Here again, the FinLit score is consistently statistically significant and positive, confirming that those with more financial knowledge hold larger shares of their net wealth in complex assets. Overall, answering one more FinLit question correctly is associated with a 1.5 percent higher share held in complex assets, a quantitatively large (25%) result compared to the mean (6.1). As above, the older age groups (60–70) has a smaller share of complex assets in their pension accounts but not outside their pensions, and better-educated respondents have much higher complex wealth shares.

#### Portfolio diversification

The dataset also allows us to create three variables providing insights into how older Singaporeans diversify their pension and nonpension investments. The first variable indicates whether a respondent is *diversified*, which we take to mean that his overall portfolio includes at least some equity/stocks, fixed-income/bonds, and cash. The second variable is an indicator of whether the respondent's equity share of financial assets falls within  $\pm 10\%$  of the fraction conventionally recommended by financial advisors, namely 100 minus his age. This variable, which we call *EquityAsPerAge*, is a rule of thumb widely used by financial practitioners to proxy for rising risk aversion with age (e.g. Arshanapalli and Nelson, 2012; Bodie and Crane, 1997; Mayer et al., 2011; Lankford, 2005). It is also consistent with theoretical work by Bodie et al. (1992) showing that, due to declining labor flexibility as one ages, it is sensible to reduce the financial risk of one's portfolio to maintain a constant overall risk exposure. Accordingly, we use this as one way to evaluate respondents' risky share by age. A third measure of diversification compares the respondent's risky share to that commonly used in Target Date Funds (TDFs) which recommend that young people invest more in equity and older people follow a glide path to less risky holdings. For instance, the Vanguard family of TDFs has an equity fraction of 90% as of age 20, declining by 1.5% per year to age 40; the fraction then declines by 2% per year to 60% at age 60; then it declines by 2.9% per year of age to 50% at age 65; to 40% at age 72; and to 30% after age 72.<sup>21</sup> Again, we measure whether each respondent's equity share of financial assets falls within  $\pm 10\%$  of the TDF glide path. Results are provided in Table 7.

At the base of Column 1 in Table 7, we see that around one-third (33.3%) of SLP® respondents hold cash, stocks, and bonds; hence this group is diversified in this very basic way. Only around 8% of the full sample holds a risky share of financial assets that approximately meets the 100-Age rule of thumb (column 2), and only 5% of the portfolio is

<sup>20</sup> This accords with US data from Clark et al. (2015).

<sup>21</sup> Of course, different firms' TDF glidepaths differ somewhat, though the glidepath is always less risky at older ages (Antonelli, 2018).



**Table 6**  
Multivariate analysis (OLS) of portfolio complexity measures on financial literacy and other controls (SLP®).

	#Complex NonCPF	#Complex CPF	Total # Complex	% Complex of non-CPF net wealth	% Complex of CPF Wealth	% Complex of Total Net Wealth
FinLit score	0.093 ***	0.074 ***	0.166 ***	1.393 ***	0.115 ***	1.504 ***
Age 55–59	0.006	–0.064 ***	–0.058 *	–0.140	0.036	0.123
Age 60–64	0.035	–0.142 ***	–0.107 ***	0.173	–0.572 ***	–0.237
Age 65–70	0.046 *	–0.211 ***	–0.162 ***	2.501 ***	–0.699 ***	2.029 **
Female	0.048 ***	–0.017	0.032	1.587 **	0.062	1.693 **
Married	–0.059 ***	–0.046 **	–0.105 ***	–2.574 *	–0.481 *	–2.864 *
2ndry educ.	0.152 ***	0.065 ***	0.216 ***	1.242 ***	0.164 ***	1.449 ***
Post-2ndry educ.	0.405 ***	0.203 ***	0.604 ***	5.327 ***	0.803 ***	6.053 ***
Fair/poor health	–0.022	–0.027 *	–0.050 **	0.422	–0.181	0.236
Work for pay	–0.050 ***	0.061 ***	0.010	–0.754	–0.029	–0.895
Own home	–0.020	–0.031	–0.051	–5.468 ***	–0.787	–6.250 ***
N	6589	6570	6613	6569	6196	6156
R-squared	0.284	0.122	0.287	0.065	0.012	0.063
Dep. Variable Mean	0.467	0.215	0.679	5.886	0.500	6.137
Dep. Variable St. Dev.	0.747	0.567	1.048	24.828	6.047	25.882

Notes: \* Significant at 0.10 level, \*\* Significant at 0.05 level, \*\*\* Significant at 0.01 level. The first three columns refer to the number of complex assets inside and outside respondents' CPF accounts; complex nonpension assets are own businesses, investment property, shares/stock funds, gold/gold funds, managed accounts, and mutual funds/unit trusts, while complex pension assets include those held in CPF-Investment Scheme (IS) accounts. The last three columns indicate the complex share of non-CPF net wealth, the complex share of CPF wealth, and the overall share complex of total net wealth. Additional controls include indicators for race/ethnicity, who manages household finances, and missing values. Reference group: Age 50–54; Chinese; Primary education; Respondent manages household finances.

**Table 7**  
Probit multivariate analysis of portfolio diversification on financial literacy and other controls (SLP®).

	Diversified asset allocation (1/0)	EquityAsPerAge (1/0)	EquityAsPerTDF (1/0)
FinLit score	0.082 ***	0.018 ***	0.007 *
Age 55–59	–0.047 ***	0.001	0.026 **
Age 60–64	–0.092 ***	0.022 *	0.051 ***
Age 65–70	–0.127 ***	0.040 ***	0.074 ***
Female	0.022 *	0.010	0.005
Married	–0.024	–0.009	–0.009
Secondary education	0.092 ***	0.040 ***	0.034 ***
Post-secondary education	0.263 ***	0.096 ***	0.054 ***
Fair/poor health	–0.038 ***	0.001	–0.007
Work for pay	0.066 ***	–0.002	–0.004
Own home	0.156 ***	–0.011	–0.003
N	6606	5014	5022
Pseudo R-squared	0.147	0.074	0.063
Mean of dep. Variable	0.333	0.078	0.052
Std. dev. of dep. Variable	0.471	0.268	0.223

Notes: \* Significant at 0.10 level, \*\* Significant at 0.05 level, \*\*\* Significant at 0.01 level. Dependent variable in first column = 1 if respondent held cash, stocks, and bond; = 0 otherwise. Second column dependent variable = 1 if respondent's equity share of financial wealth conforms within 10% of the (100-age) glide path; = 0 otherwise. Third column dependent variable respondent's share of equity in financial wealth. Probit marginal effects reported. Additional controls: indicators for missing values, race/ethnicity, who manages household finances. Reference group: Age 50–54; Chinese; Primary education; Respondent manages household finances.

consistent with a conventional TDF glidepath (column 3). In general, then, we conclude that older Singaporeans are less financially diversified than might have been anticipated, lending support to the government's stated intention to include Target Date-style funds in its CPF investment portfolio in the near future.<sup>22</sup>

Nevertheless, under all three diversification definitions, more financially literate individuals are better diversified. For instance, the coefficient in the first row and column of Table 7 indicates that people who answered one additional FinLit question correctly were 8 percentage points more likely to be diversified, or 25% above the mean; they were also 2 percentage points more likely to have an equity share consistent with the 100-age rule (column 2). The effect is also positive though marginally significant for the final column. It is also worth

noting that these effects remain strong and statistically significant even when controlling for education (which is also positive and statistically significant). While few financially savvy Singaporeans appear to follow a Target Date profile when allocating their asset portfolios, older and better-educated respondents' investments are better diversified.

In sum, our analysis underscores the result that financial literacy tends to be related to higher levels of net wealth, better self-assessed financial preparation for retirement, and more diversified and more complex asset holdings at older ages. We have no direct evidence in this dataset as to how these patterns translate into net investment returns, as this would require links to administrative records (which at present we lack). We do know from our previous work that many people who purchased CPF IS investments earn less after fees than they would if they had left their money under CPF administration (Koh et al., 2008a,b). While that research did not discuss any links between financial literacy and investment earnings, in the US context, Clark et al. (2015) found a strong positive relationship between higher financial literacy scores and investment returns.

<sup>22</sup> See CPF Advisory Board (2016). Hong Kong has already adopted TDFs in its Mandatory Provident Fund default portfolio from 2017 (Willis Towers Watson, 2017).

## Implications and conclusions

This paper reports the first results from an analysis of older Singaporeans' financial literacy using a unique new dataset, the Singapore Life Panel®. With this new and nationally representative survey of the population age 50–70, we addressed three important questions. First, we explored how financially knowledgeable Singaporeans are, and how their results compared to a similar internet-based US study, the American Life Panel. Second, we examined the relationship of financial literacy and wealth and self-assessed financial security, issues of key interest in a wide range of policy circles. Third, we examined whether greater financial knowledge in Singapore is associated with more complex portfolios.

We showed that older adults' level of financial literacy in Singapore is comparable to, albeit a bit lower than, that for similar-aged respondents in the US American Life Panel. Older women in Singapore tend to be less informed about stock diversification, while educated and wealthier people are more financially knowledgeable. Moreover, financial literacy is positively associated with having more wealth, greater financial security, and better-diversified portfolios both inside and outside CPF pensions. We also showed that financial literacy was positively and significantly associated with most of our portfolio complexity measures, holding other factors constant. Additionally, better-educated and healthier respondents exhibited more portfolio diversification.

## Appendix A

**Table A1**

List of assets queried in the SLP®.

Variable name	Asset	H = HH level, I = Indiv. level	Total HH Net Wealth	Non-housing wealth	Net financial wealth
hachckw	Checking and Savings	H	X	X	X
habondw	Investment Bonds	H	X	X	X
hastckw	Investment Shares	H	X	X	X
hadcw	Fixed Deposit Account CD	H	X	X	X
hawliw	HH Whole Life Ins	I	X	X	X
hagoldw	Investment Gold	H	X	X	X
hainvothrw	Investment Other	H	X	X	X
habsnsw	Business Val	H	X	X	
haccdebtw	Credit Card debt	H	X	X	X
hacpfisw	HH CPF IS	I	X	X	
hacpfnonisw	HH CPF NON-IS	I	X	X	
harpenw	HH Retirement and Pension	I	X	X	
hahousw	Home Value Amt	H	X		
hamortw	Primary mortgage owed	H	X		
hahoubw	Other Real Estate/sec. resid Amt	H	X		
hamrtbw	Secondary mortgage owed	H	X		
haothrdebtw	Other Debt amt	H	X	X	X
haothrw	Other Assets Val	H	X	X	
hatranw	Transportation	H	X	X	

Notes: "HH = household level" means that the survey asked about the sum of the respondent's and the spouse's asset holdings in the listed category. "I = individual level" means that the survey asked separately about the respondent's asset holdings in the listed category and then separately about the spouse's asset holdings in the listed category.

<sup>23</sup> A meta-analysis of 168 papers by [Fernandes et al. \(2014\)](#) suggested that many financial literacy interventions have had relatively weak impacts. Nevertheless, numerous other studies including [Skimmyhorn \(2016\)](#) and a wide range of research overviewed by [Lusardi and Mitchell \(2014\)](#) reported more powerful effects in proper experimental settings.

**Table A2**  
Descriptive statistics on financial knowledge and other financial variables.

Variable	Mean	Standard Deviation
FinLit interest (= 1 if correct, 0 otherwise)	0.81	0.39
FinLit inflation (= 1 if correct, 0 otherwise)	0.72	0.45
FinLit safer (= 1 if correct, 0 otherwise)	0.47	0.50
FinLit Index (total right)	2.01	0.97
HH total wealth (S\$100k) (incl. 2nd residence)	11.43	20.49
HH non-housing wealth (S\$100k)	4.85	7.83
HH financial wealth (S\$100k)	1.91	4.52
Chance of struggling financially in retirement	45.59	26.16
Good financial preparedness for retirement (= 1 if yes, 0 otherwise)	0.43	0.50
NumComplexNonCPF	0.47	0.75
NumComplexCPF	0.22	0.57
TotNumComplex	0.68	1.05
% complex investment in non-CPF	5.89	24.83
% of complex investment in CPF	0.50	6.05
% of complex investment in total wealth	6.14	25.88
Diversified asset allocation	0.33	0.47
EquityAsPerAge: Equity/Financial wealth	0.08	0.27
EquityAsPerTDF: Equity/Financial wealth	0.05	0.22
Self-assessed financial preparation for retirement	2.42	0.93
N = 6686		

Note: SLP<sup>®</sup> unweighted data. Sample includes respondents age 50–70 who answered the Big Three financial literacy questions in December 2015 and financial questions in January or February 2017. Amounts are expressed in January/February-2017 Singapore Dollars.

**Table A3**  
Descriptive statistics on other control variables.

Variable	Mean	Standard Deviation
Age 50–54	0.27	0.45
Age 55–59	0.30	0.46
Age 60–64	0.23	0.42
Age 65–70	0.20	0.40
Female	0.52	0.50
Married	0.81	0.39
Education, primary	0.21	0.41
Education, secondary	0.41	0.49
Education, post-secondary	0.37	0.48
Fair/poor health	0.34	0.48
Work for pay	0.52	0.50
Self-employed	0.10	0.30
Home owner	0.84	0.36
Respondent manages finances	0.38	0.49
Respondent + other manage finances	0.46	0.50
Other manages finances	0.16	0.36
Household total wealth (S\$100k)	11.43	20.49
Confident about knowledge of HH finances	0.78	0.41
Financial planning long horizon ( $\geq 5$ years)	0.42	0.49
General risk preference	0.15	0.36
Financial risk preference	0.15	0.36
N = 6686		

Note: SLP<sup>®</sup> unweighted data. Sample includes respondents age 50–70 who answered the Big Three financial literacy questions in December 2015 and financial questions in January or February 2017. Amounts are expressed in January/February-2017 Singapore Dollars.

## References

- Antonelli, Angela M., 2018. The Evolution of Target Date Funds. Georgetown University Center for Retirement Initiatives Policy Report. Washington, D.C.
- Arshanapalli, Bala, Nelson, W., 2012. Asset allocation options for wealth accumulation. *J. Wealth Manage.* 14 (4), 22–27.
- Becker, Gary S., 1973. A theory of marriage: Part I. *J. Political Econ.* 81 (4), 813–846.
- Behrman, Jere, Mitchell, Olivia S., Soo, Cindy, Bravo, David, 2012. Financial literacy, schooling, and wealth accumulation. *Am. Econ. Rev. P&P* 102 (3), 300–304.
- Bodie, Zvi, Crane, Dwight B., 1997. Personal investing: advice, theory, and evidence. *Financial Analysts J.* 53 (6), 13–23.
- Bodie, Zvi, Merton, Robert C., Samuelson, William, 1992. Labor supply flexibility and portfolio choice in a life-cycle model. *J. Econ. Dyn. Control* 16 (3–4), 427–449.
- Chan, Angelique, 2001. Singapore's Changing Structure and the Policy Implications for Financial Security, Employment, Living Arrangements and Health Care. Working Paper, Asian Metacentre for Population and Sustainable Development Analysis. National University of Singapore.
- Chen, Yanying, Yi Jin Tan, 2017. Income and Subjective Well-Being: Evidence from Singapore's First National Non-Contributory Pension. CREA Working Paper, Singapore Management University.
- Clark, Robert L., Lusardi, Annamaria, Mitchell, Olivia S., 2015. Financial knowledge and 401(k) investment performance. *J. Pension Econ. Finance.*
- CPF Advisory Board, 2016. Executive Summary of Part II of CPF Advisory Panel's Recommendations. Central Provident Fund, Singapore. <https://www.cpf.gov.sg/Members/News/news-categories-info/cpf-changes/2322>.
- Delavande, Adeline, Susann Rohwedder, Robert Willis, 2008. Preparation for Retirement, Financial Literacy and Cognitive Resources. Michigan Retirement Research Center Working Paper 2008-190, [www.mrrc.isr.umich.edu/publications/papers/pdf/wp190.pdf](http://www.mrrc.isr.umich.edu/publications/papers/pdf/wp190.pdf).

- Fernandes, Daniel, Lynch Jr., John G., Netemeyer, Richard G., 2014. Financial literacy, financial education, and downstream financial behaviors. *Manage. Sci.* 60 (8), 1861–1883.
- James, Bryan D., Boyle, Patricia A., Bennett, Jarred S., Bennett, David A., 2012. The impact of health and financial literacy on decision making in community-based older adults. *Gerontology* 58 (6), 531–539.
- Kim, Hugh Hoikwang, Maurer, Raimond, Mitchell, Olivia S., 2016. Time is money: rational life cycle inertia and the delegation of investment management. *J. Financ. Econ.* 121 (2), 231–448.
- Koh, Benedict, Mitchell, Olivia S., 2010. What's on the menu? Included versus excluded investment funds for Singapore's Central Provident Fund Investors. *Pensions Int. J.* 13 (1-2), 7–14.
- Koh, Benedict S.K., Mitchell, Olivia S., Fong, Joelle H.Y., 2008a. Cost structures in defined contribution systems: the case of Singapore's Central Provident Fund. *Pensions: Int. J.* 13 (1-2), 7–14.
- Koh, Benedict, Mitchell, Olivia S., Tanuwidjaja, Toto, Fong, Joelle, 2008. Investment patterns in Singapore's CPF Central Provident Fund. *J. Pension Econ. Finance* 7 (1), 1–29.
- Lankford, K., 2005. Rating the rules of thumb. *Kiplinger's Personal Finance* 59, 81–84.
- Lusardi, Annamaria, Michaud, Pierre-Carl, Mitchell, Olivia S., 2017a. Optimal financial literacy and wealth inequality. *J. Political Econ.* 125 (2), 431–477.
- Lusardi, Annamaria, Mitchell, Olivia S., 2014. The economic importance of financial literacy: theory and evidence. *J. Econ. Literat.* 52 (1), 5–44.
- Lusardi, Annamaria, Mitchell, Olivia S., 2011a. Financial literacy and retirement planning in the United States. *J. Pension Econ. Finance* 509–525.
- Lusardi, Annamaria, Mitchell, Olivia S., 2011b. Financial literacy around the world: an overview. *J. Pension Econ. Finance* 497–508.
- Lusardi, Annamaria, Mitchell, Olivia S., 2008. Planning and financial literacy: how do women fare? *Am. Econ. Rev.* 98 (2), 413–417.
- Lusardi, Annamaria, Mitchell, Olivia S., 2007. Baby Boomer retirement security: the roles of planning, financial literacy, and housing wealth. *J. Monetary Econ.* 54 (1), 205–224.
- Lusardi, Annamaria, Olivia S. Mitchell, Noemi Oggero, 2017. Debt and Financial Vulnerability on the Verge of Retirement. NBER Working Paper 23664.
- Mayer, R.N., Zick, C.D., Glaittli, M., 2011. Public awareness of retirement planning rules of thumb. *J. Personal Finance* 10 (1), 12–35.
- OECD, 2012. PISA 2012 Results: Creative Problem Solving. [www.oecd.org/countries/singapore/Skills-Matter-Singapore.pdf](http://www.oecd.org/countries/singapore/Skills-Matter-Singapore.pdf).
- OECD, 2016. Singapore: Skills Matter. <http://www.oecd.org/countries/singapore/Skills-Matter.pdf>.
- Skimmyhorn, William L., 2016. Assessing financial education: evidence from boot camp. *Am. Econ. J.: Econ. Policy* 8 (2), 322–343.
- Vaithianathan, Rhema, Bryce Hool, Michael D. Hurd, Susann Rohwedder, 2018. High-Frequency Internet Survey of a Probability Sample of Older Singaporeans: The Singapore Life Panel®. The Singapore Economic Review, Special Edition on Economic Issues of Population Aging in Asia. doi: 10.1142/S0217590818420043.
- Willis Towers Watson, 2017. Hong Kong: Employers/Employees Face New Risks, Costs with MPF Default Investment Strategy Launch. March 29 <https://www.towerswatson.com/en/Insights/Newsletters/Global/global-news-briefs/2017/03/hong-kong-employers-employees-face-new-risks-costs-with-mpf-default-investment-strategy-launch>.