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Taking control: Active investment choice in Singapore's national defined contribution scheme

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ABSTRACT

This paper examines what factors drive non-default investment choice among more than 7000 older plan participants in the Singaporean Central Provident Fund (CPF), and assesses the extent to which financial knowledge, experience, and attitudes help predict such choice. We find that only 16% of plan participants aged 50 and above in our sample in 2016 invest a portion of their pension savings outside of the default government-run CPF fund. Plan participants who are male, younger, not married, currently working for pay, have higher risk tolerance, and higher net worth are more likely to choose to actively manage their pension savings. Education is a strong independent determinant of active investment choice, but its effect diminishes with age. Longer-term financial planning horizon and experience in managing household finances, as well as in stocks investment, are also significantly associated with higher self-invested balances. Financial literacy is, however, not significantly associated with non-default decision-making in our sample. Our findings have important implications for policy makers seeking to encourage greater individual responsibility in pension savings and investments within defined-contribution retirement systems.

Introduction

Pension income for participants in defined contribution (DC) arrangements depend critically on their accumulations over the life course, as well as the investment returns on those assets. The choice of pension provider, what to invest in, and how to allocate and rebalance assets across various funds over time are important considerations in this respect. Since investment choices have implications for individuals' financial well-being in retirement, the amount of freedom that workers have in pension investing is often regulated in DC systems, and especially so in countries with national DC schemes. In the case of Chile, for instance, plan participants can only choose among five funds and restrictions with respect to age and retirement status apply to the risker funds (Antolin et al., 2010; Berstein et al., 2013). Second-pillar schemes in Latvia and Estonia specify only three fund types (namely, conservative, balanced, and aggressive) across providers, on the premise that doing so will help streamline choice for plan participants (IOPS, 2012; Lieksnis, 2013). In contrast, mandatory DC schemes in Australia and Hong Kong PRC offer considerable choice of investment options and strategies (Tapia and Yermo, 2007; Bateman et al., 2014). While the abundance of investment options does not guarantee that more people will make active choices, having a reasonable range of investment possibilities made available to DC participants is arguably a prerequisite for choice.

This paper focuses on one of Asia's foremost retirement programs, the Central Provident Fund (CPF) scheme, which is a mandatory DC scheme in the city-state of Singapore. The national retirement income program has almost four million members as of the end of 2018; total member balances stand at approximately US$270 billion (S$390 billion) (CPFB, 2019a). Since 1986, the CPF has allowed savers to invest a portion of their pension accumulations into various financial instruments such as insurance products, unit trusts, fixed deposits, bonds and shares offered by commercial providers. As of 2018, there were some 400 investment portfolios on offer to CPF members under the CPF Investment Scheme (CPFIS). This diversity of fund choices is noteworthy. The rules governing the CPFIS are also not particularly stringent, which suggests that there exists a fair degree of investment choice for those who opt into the CPFIS. For individuals who do not want to make their own investment decisions, their savings are channelled entirely to a default CPF fund managed by the CPF Board. This default fund provides guaranteed risk-free annual interest returns of 2.5–5%.

Our study contributes to the research on DC retirement schemes by examining the key determinants of active investment choice among more than 7000 older plan participants in the Singaporean retirement income system in 2016. Data is sourced from the Singapore Life Panel (SLP) survey. Partaking in the CPF Investment Scheme requires an

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active election on the part of pension plan members, and for those who chose to opt in, a second decision point arises. That is, enrollees need to choose the amount of monies to invest via the CPFIS. Our empirical strategy thus jointly models the decision to participate in the CPFIS – and conditional on participating – the amount of monies invested, using a two-part regression framework. Explanatory variables of particular interest include aspects of financial knowledge, education, gender, age, willingness to take risks, and income, among others. Given rapid population aging and escalating concerns over retirement adequacy and security, the question of how older savers invest their pension accumulations is of interest to policymakers and pension administrators who oversee such regimes. The results may also be of interest to individuals and retirees who rely on their pension assets to finance their retirement.

Many past studies have shown that investor inertia is widespread in pension plans (see, e.g., Samuelson and Zeckhauser, 1998; Madrian and Shea, 2001; Agnew et al., 2003; Cronqvist and Thaler, 2004; Mitchell et al., 2006; Dahlquist and Martinez, 2015; Bateman et al., 2014). In the US, for instance, over 65% of 401(k) plans members are enrolled in default funds (Choi et al., 2002). In Australia, levels of non-default decision-making among superannuation members are generally low (Bateman et al., 2014); one study reports that only about 10% of Australians chose non-default funds in their DC investment portfolios (Gallery and Gallery, 2005). Only 8% of new enrollees in Swedish DC plans in 2003 chose their own portfolios (Cronqvist and Thaler, 2004), while in Chile, only 14% made active choices when the investment menu of five funds was first offered in 2002 (Tapia and Yermo, 2007). Plan design, mental accounting, self-perceived low investment skill, and information overload may partly explain why DC plan participants tend to follow the "path of least resistance" (Benartzi and Thaler, 2001; Agnew and Szykman, 2005; Choi et al., 2009; Butt et al., 2018). The lack of active choice, or so-called default option bias, has also been documented in Singapore's context.[1]

Specifically, Koh et al. (2008) find that most CPF members use their money for housing purchase and default the remainder to the CPF fund. As of 2005, more than 70% of the non-housing pension savings sit in the CPF-run default fund. Only a fraction of workers elected to participate in the CPFIS, with high-income earners and males taking on more portfolio risk than low-income earners and females. That study concluded that inertia and the attractive risk-free rates of return from the default fund are potential reasons why few CPF account holders invest outside the default government investment pool.[2] Nonetheless, because Koh et al. (2008)'s analysis had relied on aggregate statistics, it offered little insights into individual investment choice and behavior among CPF members. This present study aims to fill the gap by analyzing the characteristics of DC plan members who choose to actively manage their pension savings in Singapore. In particular, do gender and income levels predict non-default investment choice after controlling for confounding factors such as education and marital status? Is financial literacy associated with the active management of pension monies? And if so, which aspects of financial knowledge, skills, and attitudes are most important?

Related also to our study is a large literature on the role of financial knowledge in investment choices. For example, Calvet et al. (2007) show that Swedish households which were less financial sophisticated held under-diversified portfolios or did not participate in financial markets at all, with non-negligible welfare costs. In that study, however, wealth, education, and the ratio of private pension contributions to income were used as proxies for financial sophistication. Using an instrumental variable approach, Van Rooij et al. (2011) find that Dutch households with low levels of financial literacy were less likely to have invested in the stock market. Bucher-Koenen and Ziegelmeyer (2013) report similar findings using micro data from Germany. Fewer studies have investigated the association between financial literacy and investment choice within the DC pensions context. One experimental study using a small sample finds that individuals with low financial knowledge are more likely to opt for default funds (Agnew and Szykman, 2005). More recent work by Kristjanpoller and Olson (2015) reports that about two-thirds of the participants in Chile's mandatory government-run DC plan choose to actively manage their pension monies. Using a probit model, the study finds that those who are older, female, higher income, and more financially literate are more likely to make an active investment choice.

The remainder of the article is organized as follows. Section 2 provides an overview of the CPF retirement system and the policy background. We outline the set up and institutional features of the CPFIS, which is the focus of our study, and show how aggregate pension wealth invested through the scheme has evolved over the past decade. Section 3 presents the data and methodology. It also outlines various factors, including aspects of financial knowledge, that may prompt active investment choice. Section 4 evaluates the key determinants of total CPFIS investment among plan participants and reports the marginal effects for the combined version of the two-part model. Sensitivity analysis is also presented. A final section concludes with a discussion of policy implications and areas for future research.

Policy and institutional background

Overview of the CPF program

Established in 1955, the CPF in Singapore is a compulsory savings program; half a century later, it has evolved into a wide-ranging social security system covering 3.9 million CPF members, of whom 2.0 million are active (as of June 2018). Since its inception, the CPF has been a defined contribution plan financed by mandatory levies on employees' regular monthly earnings up to a cap. Contribution rates vary with age, as do the breakdown of the allocations across various CPF-designated accounts. Currently, workers age 55 and below contribute 37% of monthly wage to the CPF (17% from employer, 20% from worker). By contrast, older workers' total contribution rates stand at 26% (ages 55–60), 16.5% (ages 60–65) and 12.5% (ages 65+) respectively.

Total contributions are split into three accounts: being the Ordinary Account (OA), Special Account (SA), and MediSave account (MA). OA monies can be withdrawn for financing home purchases, insurance premiums, education expenses and other purposes, whereas SA monies are earmarked for old age. In other words, there is little flexibility in withdrawing SA monies pre-retirement. For illustrative purposes, the stipulated allocation to the three CPF subaccounts are 21% (OA), 7% (SA) and 9% (MA) for a worker aged 35–45. Allocation rates vary by age; for example, the respective allocations for a worker aged 45–50 are slightly different at 19% (OA), 8% (SA), and 10% (MA).[3]

Of most interest for our purposes, the Approved Investment Scheme (AIS) was introduced in 1986 as an alternative avenue for members who wanted to invest on their own with their CPF savings.[4] Members were allowed to invest a portion of their *excess* balances (that is,

[1] Note that we define the terms 'active' and 'passive' in terms of making non-default and default investment choices, respectively, in a pension plan. This is not to be confused with active and passive portfolio management, which describes how a fund manager may utilize and manage the investments held in the portfolio over time.

[2] Koh and colleagues also observed that the lack of interest in CPFIS instruments may also be attributed to high fees and charges, and that most fund managers of the professionally managed CPFIS unit trusts/ mutual funds found it difficult to turn in consistent performance over time (Koh et al., 2008, 2010).

[3] Allocation rates are expressed as a percentage of monthly wage. Different allocation rates are defined for seven age bands; for details, see https://www.cpf.gov.sg/Employers/EmployerGuides/employer-guides/paying-cpf-contributions/cpf-contribution-and-allocation-rates/otherstab#Others.

[4] The AIS was launched in the same year that members were first allowed to invest in commercial properties in Singapore using pension monies.

balances above a minimum threshold set by the CPF Board) in stocks traded on the Singapore stock exchange, unit trust/mutual funds and other instruments approved by the CPF Board. In 1993, the government converted the AIS into the Basic Investment Scheme and the Enhanced Investment Scheme. The difference between the two schemes was that the former allowed a narrower selection of financial products and instruments that was considered less risky. In around 2001, the two schemes were consolidated into what is currently known as the 'CPF Investment Scheme, or CPFIS'. The CPFIS comprises the CPFIS-OA and CPFIS-SA schemes, demarcated primarily by the source account from which the funds are drawn.

Early on, members were permitted to invest only a portion of their *excess* CPF savings outside of the default CPF fund. However, from 2001, this proportion was raised to 100% providing CPFIS participants (or active members) with much latitude and discretion in terms of creating and determining their own retirement asset portfolio. The CPF-stipulated savings thresholds are currently set at S$20,000 for the OA and S$40,000 for the SA, and these monies are automatically channelled to the default CPF fund (CPFB, 2019*b*).[5] For passive members who do not participate in the CPFIS, their excess savings are also channelled to the default fund. Monies in the default fund are aggregated and then invested by the CPF Board – on behalf of the members – to earn risk-free interest returns of 2.5–5%.[6] All in all, the design of the CPFIS framework reflects in part paternalistic policy intents which emphasize capital preservation for a savings base (via mandatory participation in the default fund), while serving to encourage active investment choice for those individuals with extra pension savings to deploy.[7]

Investment choice, investment menu and participation in CPFIS

Active investment choice has come into sharper focus as the amount of accumulations in the CPF system increased over time. Over the last 10 years, average balances of CPF members grew at about 8.0% annually (CPFB, 2017). As of 2016, CPF balances (net of withdrawals) averaged about S$80,000 for females and S$90,000 for males.[8] These statistics suggest that the majority of members have balances in excess of the stipulated savings thresholds, and are eligible to participate in the CPFIS. The administrative process to join the CPFIS is fairly straightforward and inexpensive. Members who invest using their OA funds can open a CPF Investment Account for free at any of the three local banks (agent banks), and then approach the CPFIS-approved product providers directly. These include fund management companies like Allianz Global, Blackrock, or JP Morgan Asset Management, as well as investment brokerage firms such as Phillip Securities Pte Ltd. All information about the product providers, and the complete list of CPFIS-approved investments by asset type, are listed on a publicly accessible webpage that is updated regularly.[9] Members who invest using their SA funds do not need a CPF Investment Account and can approach the product providers directly. Active members must also have a Central Depository (or CDP) account to trade in the Singapore securities market, and where applicable, a trading account with a brokerage firm.[10]

Over the years, the CPF Board has progressively expanded the menu of CPFIS instruments, giving those members who wish to invest on their own more choice. Initially, members can only invest in stocks listed locally. Since 1995, members have been allowed to buy foreign stocks and bonds through collective investment schemes offered under the CPFIS. Investments in foreign assets, initially set at 20% of the market value of a mutual fund, was raised to 40% in 1997 and then 50% in 1999. Currently, the range of investment products available to CPFIS enrollees is diverse (see Table 1). For instance, OA funds could be invested in fixed deposits, Treasury bills, corporate bonds, property funds, equities traded on the Singapore stock exchange, government bonds, annuities and endowments, investment-linked insurance products, unit trusts, exchange-traded funds, fund management accounts, and gold. As SA balances are earmarked for retirement purposes, a narrower set of investment products that excludes shares, property funds and corporate bonds has been curated for CPFIS-SA. It must be noted that the CPF Board does not endorse any product included in the CPFIS menu, though all instruments need to satisfy certain criteria stipulated by the Board before they can be included under the program.[11]

While administrative and compliance costs for CPFIS investors are relatively low, active members are exposed to a wide range of transactional fees and charges levied by the private fund management companies and other product providers. For example, purchase of stocks using CPFIS-OA will attract a broker commission of 0.275–0.28% of trade contract value (minimum of S$10–25), CDP fees of 0.04% of trade contract value, and agent bank's fees.[12] Active members who purchase mutual funds (or unit trusts) may pay front-end sales commissions (up to 1.5%), transaction fees, wrap fees (up to 0.7%), service charges, annual fund operations fees, performance fees, and sometimes redemption charges.[13] To help lower the costs of investment for CPFIS participants, however, the government has recently announced that front-load charges will be removed entirely and wrap fees will be capped at 0.4% from October 2019.[14]

[5] The conversion rate is approximately S$1 = USD0.70.

[6] The Special Singapore Government Securities are issued and guaranteed by the Singapore Government, and the coupon rates on these securities are pegged to the CPF interest rates that members receive. Returns from investing in the default fund are considered "risk-free" since the Singapore Government is triple-A credit-rated. The interest rate for OA is 2.5–3.5% per annum, while the interest rate for SA and MA is slightly higher at 4–5% per annum.

[7] Thus by design, active members in the CPF are also required to invest (a portion of their savings) in the default fund whereby the plan provider/CPF Board makes investment decisions on their behalf. In other words, the dichotomy between active and passive members is less clear in the CPF context as compared to say, other DC pension systems since active CPF members do not have full discretion over how their pension savings are invested.

[8] This includes balances in the OA, SA, MA and Retirement Accounts (CPFB, 2017).

[9] See https://www.cpf.gov.sg/Assets/members/Documents/CPFISInvestmentProducts.pdf.

[10] The CDP account is operated by the Singapore Exchange and provides integrated clearing, settlement and depository facilities for trading (both stocks and bonds) in the Singapore securities market. Application can be made online and is free (no administrative fees; transaction fees for trades). CPFIS participants who wish to buy and sell stocks, as well as other listed securities, will also need a brokerage/ trading account. There are currently more than 10 investment brokerage firms in Singapore, including CIMB Securities, Citibank, and DBS Vickers. These brokerages charge administrative fees and/or trading fees.

[11] For instance, the admission criteria for corporate bonds under CPFIS requires that the bonds are issued by a company incorporated in Singapore; rated at least A2 by Moody's, A by Standard and Poor's or A by Fitch; listed on the Singapore Exchange main board; and so on.

[12] Broker commission and CDP fees are identical to those levied on retail investors. In addition, CPFIS investors must pay agent bank fees, which typically includes a transaction fee of $2 per lot of shares (maximum of $20 per transaction) and a quarterly service charge of $2 per holding for the maintenance of the CPF Investment Account.

[13] Koh et al. (2008) provides a detailed summary of the charges incurred for various investment products under the CPFIS scheme. The authors also noted wide diversity and complexity in terms of the fees charged for different investments, which may appear perplexing to many CPFIS participants. CPFIS investors are allowed to move freely between investments without any penalty fees imposed by CPFIS. However, like normal retail investors, they will need to bear the switching costs and surrender charges (if any) imposed by the private fund management companies and other product providers.

[14] See https://www.straitstimes.com/singapore/govt-moves-to-lower-costs-of-cpfis-investments.

Table 1
Financial instruments available for investment through the CPF Investment Scheme.

CPFIS-OA	CPFIS-SA
Fixed deposits	Fixed deposits
Treasury bills	Treasury bills
Singapore government bonds	Singapore government bonds
Statutory board bonds	Statutory board bonds
Annuities	Annuities
Endowment policies	Endowment policies
Unit trusts	Selected unit trusts*
Investment-linked insurance products	Selected investment-linked insurance products*
Exchange traded funds (ETFs)	Selected exchange traded funds*
Fund management accounts	
Up to 35% of investible savings#:	
Shares	
Property funds	
Corporate bonds	
Up to 10% of investible savings#:	
Gold ETFs	
Other gold products (e.g. gold certificates, gold savings accounts)	

Notes: #Investible savings refer to the net Ordinary Account balance after withdrawals for education and investment.
*Higher risk funds are excluded.
1. Annuities, endowment insurance policies, and investment-linked insurance products must be offered by insurance companies included under CPFIS.
2. Unit trusts and investment-linked insurance products must be offered by Fund Management Companies or service/product providers included under CPFIS. Fund Management Companies must comply with the CPF Investment Guidelines issued by the CPF Board.
3. ETFs included under CPFIS are evaluated by the CPF Board's investment consultant.
4. Collective investment schemes (unit trusts and investment-linked insurance products) included under CPFIS are required to meet certain admission criteria, including being in the top 25 percentile of funds in the global peer group; sales charge not exceeding 1.5%; track record of good performance for at least 3 years; total expense ratios not exceed stipulated caps in the various risk categories. Details on the admission criteria for funds are found at: https://www.cpf.gov.sg/Assets/members/Documents/APPLICATIONANDADMISSIONCRITERIAFORFUNDSMANAGEDBYFMC.pdf.
5. Shares, property funds and corporate bonds must be offered by companies incorporated in Singapore.
Source: https://www.cpf.gov.sg/Assets/members/Documents/CPFISInvestmentProducts.pdf.

The diversity of CPFIS instruments available and the different fees associated with various products makes it challenging to compare the potential returns of an active member against those of a passive member. Whether active members make a beneficial choice depends critically on which CPFIS instruments they select, investment holding horizons, as well as investment timing. Past studies by Koh and colleagues have documented that endowment policies and stocks are popular options among CPFIS-OA investors. Endowment plans in Singapore generate long-term net returns of about 3.6% per annum over a 10-year holding period, while stocks have historically provided investors with more attractive returns. Active members who invested in the Straits Times Index from 2009 to end 2018, for instance, would have earned annualized total returns of about 9.2% (The Straits Times, 2019).[15] In comparison, passive members who left their OA savings in the default CPF fund would earn risk-free returns of 2.5–3.5% per annum.

Any returns that active members earn on their CPFIS investments are automatically channelled back into their CPFIS accounts and cannot be withdrawn until age 55. From age 55 onwards, active members are allowed to withdraw their CPFIS investments and investment account cash balances, conditional on them being able to set aside a CPF-stipulated retirement sum (CPFB, 2019b). This stipulated retirement sum is S$161,000 in 2016 and has increased over time.[16] It can be set aside using the pension accumulations in CPF-OA and SA, as well as through a property pledge.[17] If active members are unable to set aside this stipulated retirement sum, their CPFIS investments will simply not be transferred back to them and continue to be held in the pension system. For active members who satisfy the retirement sum criterion, CPF Board will proceed to close the CPFIS account(s) and transfer the CPFIS investments to the members' own names. Individuals can then choose to continue to hold the investments, or liquidate them as they wish and have the sale proceeds paid to them directly.

Government statistics show that approximately one in four CPF members leverage on the CPFIS-OA to grow their retirement wealth. In 2018, there are about 937,000 CPFIS-OA participants, constituting about 24% of the total membership base nation-wide.[18] Although the absolute number of CPFIS-OA investors has been increasing, the share proportion has remained relatively stable over time. In contrast, there are only about 316,000 CPFIS-SA participants (or 8% of total membership base). Less than one in ten members invest using the CPFIS-SA. This is possibly due to the higher stipulated minimum savings threshold for SA; in fact, the minimum threshold was raised twice between 2009 and 2010 making it more challenging for members to meet the savings cut-off over the years.[19] As shown in Table 1, CPFIS-SA also has a more limited menu of permissible instruments than CPFIS-OA.

Fig. 1 shows the aggregate wealth invested in CPFIS over time. The primary vertical axis depicts the total dollar amounts in S$ millions, while the secondary axis depicts the amounts as a percentage of total CPF balances.[20] The flow of funds into this alternative investment scheme was substantial in the early 2000s. At its peak in 2008, the scheme attracted almost S$35B (US$25B) in pension monies representing 23% of total members' balances. The bulk (S$27B) was sourced from the OA, with the remaining S$8B from SA. The amounts dedicated to the scheme has declined somewhat post-2008 global financial crisis. As at 2013, aggregate wealth balances in CPFIS stand at about S$27B and 11% of total members' balances. By 2018, the total balances pooled in the CPFIS program has dropped to S$23B. While still substantial in absolute dollar terms, this amount represents only 6% of total CPF balances (net of withdrawals) as at June 2018.

Methods

Data

Individual-level data is sourced from the 2015/2016 Singapore Life Panel survey. The SLP is a high-frequency internet-based survey conducted by the Centre for Research on the Economics of Ageing at the Singapore Management University.[21] It is a longitudinal survey of about

[15] The FTSE Straits Times Index is a capitalisation-weighted stock market index that is regarded as the benchmark index for the Singapore stock market.

[16] The CPF-stipulated retirement sum refers to CPF savings earmarked for retirement purposes. It was S$80,000 in 2003 and S$117,000 in 2009, and has increased over time due to inflation.

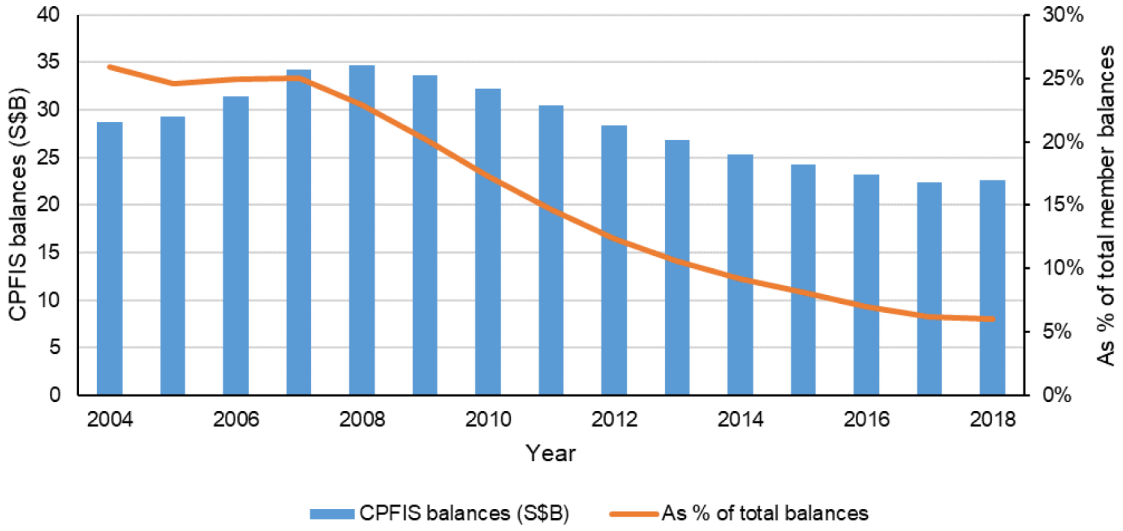
[17] The property pledge is to help Singaporeans who have previously withdrawn CPF monies for property purchase during their working years to meet the CPF-stipulated retirement sum in their retirement years. There are also various criteria imposed on the type of eligible property, e.g. needs to have more than 30 years of lease remaining and others.

[18] Total number of CPF members is about 3.87 million.

[19] The initial CPFIS-SA savings threshold was set at $20,000, then raised to $30,000 from 1 May 2009 and further raised to $40,000 from 1 July 2010. A key reason is to encourage members to be more conservative with regards to SA monies that are earmarked for retirement.

[20] One S$ approximately equals 0.7 US$.

[21] For more information see https://crea.smu.edu.sg/singapore-monthly-panel, and Vaithianathan et al. (2017) for a detailed description of this survey and a discussion of the data quality.



Source: Author's own, constructed from CPF data.

Fig. 1. Aggregate wealth invested in CPFIS over time. Source: Author's own, constructed from CPF data.

15,000 Singaporean citizens and permanent residents initially aged 50–70 as well as their spouses. Participants have been surveyed every month since August 2015, and thus far, over 50 waves have been completed. The survey is conducted over the internet, and respondents unable to understand the survey questions or lacking internet access can answer the survey over the phone or at centres located conveniently around Singapore. Consequently, attrition rate is low.

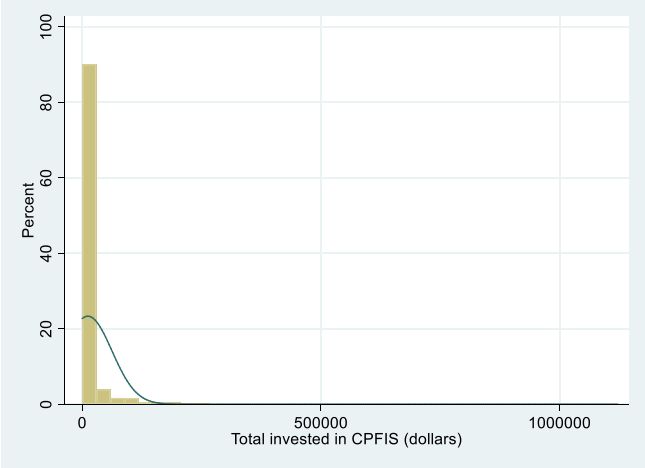
Our analytical sample in this study comprises respondents age 50–70 in the SLP Dec 2015 wave who responded to questions on financial literacy, as well as key financial and investment questions subsequently fielded in Jan/Feb 2016 (N = 7076). The SLP panel is representative of the Singapore resident population, and it provides extensive information on respondent socio-demographic characteristics, health, wealth and income, investments, retirement expectations, family support, and spending which allows us to explore the determinants of CPFIS participation and investment.

CPFIS investments

Our outcome variable draws on individual plan participants' responses to: (a) whether participate in the CPFIS, and (b) if participate, how much monies is invested. Specifically, we use responses to the following questions: (a) "Do you currently have any investments made through the CPFIS-OA or the CPFIS-SA scheme?" and (b) "If you added up all the investments you have through your CPFIS-OA [or CPFIS-SA] scheme, about how much would they amount to in total?". We verify that sampled respondents who reported positive balances in their CPFIS-OA and/or CPFIS-SA accounts in response to part (b) had answered affirmatively to the yes/no question given in part (a). We sum the self-reported CPFIS-OA and CPFIS-SA amounts to obtain the total dollar CPFIS investment by individual as at Jan/Feb 2016.

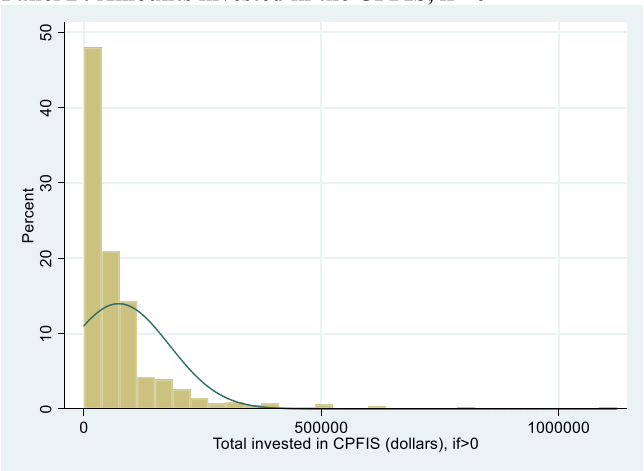
Based on the aggregate statistics presented earlier, we expect that a fair proportion of our survey respondents will have zero CPFIS balances. Nationally, the proportion of pension fund members who utilize the CPFIS program stands at just 24% for CPFIS-OA and 9% for CPFIS-SA in 2016. In other words, the majority of CPF members do not invest using CPFIS. Fig. 2 confirms that the distribution of total CPFIS investment balances in our analytical sample of older Singaporeans is skewed with a mass point at zero. In particular, we observe that the distribution of total dollar CPFIS investment is skewed rightwards with relatively few respondents having very large investment balances. This is plausible since any funds above the stipulated CPFIS-OA and CPFIS-

Panel A: Amounts invested in the CPFIS



Source: Author's own.

Panel B: Amounts invested in the CPFIS, if >0



Source: Author's own.

Fig. 2. Distribution of CPFIS monies invested among households. Panel A: Amounts invested in the CPFIS. Panel B: Amounts invested in the CPFIS, if > 0. Source: Author's own. Notes: Dollar values are expressed in Singapore dollars (S$). One S$ approximately equals 0.7 US$.

SA thresholds can be deployed under the self-investment program. Of the 7076 sampled respondents, 5943 persons (84%) have zero CPFIS balances and 1133 persons have positive balances. This yields a CPFIS participation rate of about 16% in our sample, broadly consistent with the national averages observed.

Explanatory variables related to financial decision-making

We identify six variables in the dataset which encapsulate different dimensions of knowledge, skills, and attitudes that are pertinent to financial decision-making. These are our main explanatory variables of interest. To measure financial knowledge, we use the "Big Three" financial literacy questions of Lusardi and Mitchell (2008, 2011, 2014).[22] Responses to three questions on compound interest, inflation and risk diversification are used to construct a score (range 0–3) for each respondent. The body of knowledge that an individual may draw on for financial decision-making may also depend on his or her education level.[23] In our analysis, education is defined as a categorical variable based on number of years of schooling: less than secondary, secondary (equivalent to at least 10 years of schooling), and post-secondary (more than 10 years of schooling).[24] The CPFIS is essentially a do-it-yourself investment scheme. Accordingly, it is important to include measures of individuals' skills and experience in managing personal finance matters. To this end, we use indicator variables on whether invest in stocks outside of the pension system and whether manage household finances (coded one if the answer to the question was affirmative, zero otherwise). Finally, to capture attitudes that may influence financial decision-making, we include self-reported knowledge regarding household finances and financial planning horizon. SLP respondents who plan for their family's saving and spending for at least the next five years and beyond are classified as having a longer-term financial planning horizon (comparison group are those who state they have similar plans only for the next few months or years).

Statistical analysis

Since the distribution of total CPFIS investment balances is skewed with a mass point at zero (that is, a substantial proportion of respondents had no CPFIS investments), a two-part multivariable regression model is used (Duan et al., 1983; Manning and Mullahy, 2001; Mihaylova et al., 2011). A probit model is first estimated for the probability of observing a zero versus positive total investment balances, and then a generalized linear model with log link and gamma distribution is estimated in the second part. This approach is used to evaluate the factors that prompt the decision to participate in and invest using the CPFIS. We also derive the predicted CPFIS investment balances from the fitted model. Note that the marginal effect estimates and predicted dollar values reported subsequently are for the entire sample, and not just for the conditional subsample of those with positive CPFIS investments.

We employ a set of covariates that may independently affect the likelihood and level of total CPFIS investment balances among respondents. These include the six variables related to financial knowledge: namely, education level (less than secondary, secondary, and post-secondary); financial literacy (a score of 0–3); whether invest in stocks using private monies (yes/no); whether manage household finances (yes/no); longer-term financial planning horizon (yes/no); and whether knowledgeable about household finances (yes/no). Specifically, individuals who have existing experience in financial management and investments may be more likely to take control of how their pension monies are invested and thus more likely to leverage on the CPFIS. We also control for age, sex, marital status, and baseline age in four age bands (50–54, 55–59, 60–64, and 65–70). In addition, we include home ownership and whether currently working to account for older adults exposed to real estate and labour market risk, who may therefore be less likely to make active investment choices with their pension monies.[25] A binary variable for whether fully retired is also included since retirees are more likely to subscribe to the default fund that provides risk-free returns. A risk tolerance variable (scale 0–1), which assesses a respondent's willingness to take risks concerning financial decisions, is also included.[26] Finally, we include household annual income in quartiles (bottom, second, third, and top) and net wealth in terciles (low, middle, and high).[27] Statistical analyses are performed using STATA version 14.0 (STATA Corp., TX, USA).

Results

Descriptive statistics

Table 2 describes the sample characteristics. The mean age of respondents is 58.8; over half (52%) are female; and over one-third (38%) has a post-secondary education (more than 10 years of schooling). The mean financial literacy score is 2.03 with a standard deviation of 0.96, implying that older Singaporeans average two of three correct answers to the "Big Three" questions fielded. Most respondents are married (81%) and own a home (87%). Respondents exhibit general low risk tolerance: the average risk level stands at 0.14 on a 0–1 scale. Some two-thirds of the sample report that they are currently employed and working for pay, while 15% are fully retired.[28] While most respondents (84%) report experience in managing household finances, a smaller proportion (34%) has experience in stocks/ funds investment. 73% are confident about their knowledge on household finances and 39% state they have a longer-term financial planning horizon. Average annual household income is S$63,150 (US$45,000) and median income is S $30,000 (US$21,000). Mean and median total net worth are S$1.2 million (US$0.84 million) and S$0.67 million (US$0.47 million) respectively. Most of the elderly respondents are in good health with

[22] The "Big Three" financial literacy questions test key concepts underlying economic saving and investment decisions and have fielded in surveys in a large number of countries and perform well in the population at large (Lusardi and Mitchell, 2014). The first question measures whether people understand the basic principle of a compound interest rate, the second is about inflation, and the third is about the principle of risk diversification, requiring some knowledge of financial market products.

[23] Earlier studies have shown that literacy is not necessarily a good proxy for schooling and it is important to separate the independent effect of financial knowledge from the impact of education level.

[24] Prior to higher education, Singaporean students attend primary and secondary school for a combined total of 10 years: six years in primary and four years in secondary. Some students then proceed to junior colleges for another two years of education (junior college graduates would have attained the equivalent of a U.S. high school education) before entering university.

[25] SLP respondents are asked about their current employment situation and the response categories (e.g. working for pay, self-employed, disabled, homemaker, retired, and so on) are not mutually exclusive. Our definition of 'currently working' includes those who said they were working for pay or self-employed. Our definition of 'fully retired' include those who said they were retired and not working for pay or self-employed.

[26] The SLP question is phrased as follows: "Some people have a different willingness to take risks, depending on the context and situation. On the same scale from 0 to 10, how willing are you to take risks when it comes to financial decisions, like saving and investments? (0 is not at all willing to take risk and 10 is very willing to take risks)."

[27] The wealth measure we use is total net worth *excluding* CPFIS balances. Total net worth is the sum of financial wealth, bank accounts, insurance, pensions, vehicles, as well as primary and secondary residences, net of all debt. The models also include dummies for missing values of controls.

[28] Many respondents were still participating in the labour force since the statutory retirement age in Singapore is 62, with re-employment encouraged up to age 67.

Table 2
Sample descriptive statistics.

Variable	Mean	SD
Female	52%	
Married	81%	
Num. living children	1.8	1.0
Baseline age	58.8	5.5
Age bands		
50–54	27%	
55–59	31%	
60–64	22%	
65–70	20%	
Education		
Less than secondary	20%	
Secondary	42%	
Post-secondary	38%	
Financial literacy score (scale 0–3)	2.03	0.96
Invest in stocks using private monies	34%	
Manage HH finances	84%	
Longer-term financial horizon	39%	
Confident about knowledge on HH finances	73%	
Homeowner	87%	
Risk tolerance (scale 0–1)	0.14	0.34
Currently working	64%	
Fully retired	15%	
Fair/poor health	34%	
Total net wealth ('000 s)	$1,186	$1,720
Median total net wealth ('000 s)	*$674*	
Annual Income	$63,147	$145,921
Median Annual Income	*$30,000*	
Currently participate in CPFIS		
CPFIS-OA or -SA	16.0%	
CPFIS-OA only	14.0%	
CPFIS-SA only	6.9%	
Dollar invested in CPFIS		
Total CPFIS balance	$11,738	$58,483
CPFIS-OA balance	$8,880	$40,079
CPFIS-SA balance	$2,858	$19,382
N =	*7,076*	

Source: Author's calculations based on data from the 2015/16 Singapore Life Panel.
Notes: HH = household. Dollar values are expressed in Singapore dollars (S$). One S$ approximately equals 0.7 US$.

about one third (34%) reporting fair/ poor health.

Approximately 16% of the sampled respondents made an active investment choice by self-investing their pension monies through the CPFIS. These 1133 persons have a positive total dollar CPFIS balance, while the remaining 84% of the sample simply left their savings invested in the government-run default fund and have zero CPFIS investments. Among those who participate in the CPFIS scheme, the mean dollar amount invested is $11,738 (see bottom of the Table). We also observe that the funds deployed for self-investment are largely drawn from members' OA accounts rather than their SA accounts: average balance in CPFIS-OA is $8880 while that in CPFIS-SA is $2858. This is not surprising since the CPFIS-SA offers a narrower selection of financial products and instruments, in addition to requiring a higher savings threshold. A detailed breakdown shows that 647 persons of the 1,33 CPFIS enrollees use CPFIS-OA only, 117 use CPFIS-SA only, and 369 use both CPFIS schemes.

Univariate analysis of variables associated with CPFIS investment

Table 3 shows the level of CPFIS investment by selected personal attributes. This univariate analysis shows that being male, younger, and more educated are associated with higher total CPFIS balances (sum of CPFIS-OA and CPFIS-SA balances) among DC plan participants aged 50 and above. For instance, the mean total CPFIS investment balance for males is $14,835 whereas that for females is only $8880. The

Table 3
Unadjusted level of CPFIS investment by selected personal attributes.

	Total CPFIS balances ($)	CPFIS-OA ($)	CPFIS-SA ($)
Gender			
Male	14,835	11,221	3614
Female	8880	6719	2161
Age bands			
50–54	18,689	13,963	4726
55–59	12,962	9925	3038
60–64	9040	6757	2283
65–70	3348	2680	668
Education			
Less than secondary	1220	1031	188
Secondary	6722	4693	2029
Post-secondary	22,817	17,629	5187
Financial literacy score			
0	1976	1508	467
1	5644	3961	1682
2	11,044	8018	3026
3	17,424	13,625	3798
Invest in stocks using private monies			
No	6446	4885	1561
Yes	21,966	16,600	5366
Manage HH finances			
No	5084	3581	1503
Yes	12,964	9856	3108
Longer-term financial horizon			
No	9148	6794	2353
Yes	15,840	12,182	3658
Confident about knowledge on HH finances			
No	8389	5818	2571
Yes	12,985	10,020	2965

Source: Author's calculations based on data from the 2015/16 Singapore Life Panel.
Notes: HH = household. Dollar values are expressed in Singapore dollars (S$). One S$ approximately equals 0.7 US$.

unadjusted differences in average dollar CPFIS investment across education categories is especially large. Respondents with post-secondary education have $22,817, on average, invested in the CPFIS scheme. This is about three-folds that of the average balance among those with secondary education ($6722) and almost 19 times higher than the average balance among individuals with less than secondary education ($1220).

Interestingly, the other main explanatory variables identified in our study also demonstrate positive associations with the level of total dollar CPFIS investment. Respondents who have longer-term financial planning horizons, experience in stocks or mutual funds investment outside of the pension system, experience in managing household finances, and who self-report being knowledgeable about household finances are associated with larger total CPFIS balances. Average CPFIS investments vary across all four tiers of financial literacy evaluated; for example, those who answered all three questions correctly report substantially higher CPFIS investments ($17,424) than those who answered only one or two questions correctly ($5644–$11,044).

These associations observed for total dollar investment hold when univariate analyses are performed on the CPFIS-OA balances and separately, CPFIS-SA balances. Further we analyze the correlations among the variables related to financial decision-making. The pairwise correlation coefficients are low and range from 0.04 to 0.28 (see Table 4). This indicates that the five variables reflect different dimensions of skills, knowledge, and attitudes in financial and investment decision-making, and one measure will be inadequate to help predict whether and how elderly people self-invest in the pension context. To determine the relative effects of various factors on individuals' pension investment choice, we turn to the two-part regression model.

Table 4
Correlation matrix of variables related to financial decision-making.

	(1)	(2)	(3)	(4)	(5)
(1) Financial literacy based on "Big 3" questions	1.00				
(2) Invest in stocks using private monies	0.28	1.00			
(3) Manage household finances	0.06	0.07	1.00		
(4) Longer-term financial horizon	0.07	0.12	0.04	1.00	
(5) Confident about knowledge on household finances	0.13	0.12	0.11	0.24	1.00

Source: Author's calculations based on data from the 2015/16 Singapore Life Panel.

Table 5
Two-part regression model: incremental total CPFIS investment attributable to main explanatory variables accounting for relevant covariates.

Variables	Incremental $ investment		95% CI	P value
Variables related to financial decision-making				
Education				
Less than secondary (ref. cat.)	–			
Secondary	4704	***	(1554, 7854)	0.003
Post-secondary	9559	***	(6185, 12933)	< 0.001
Financial literacy score	381		(−1097, 1859)	0.613
Invest in stocks using private monies	4238	***	(1935, 6541)	< 0.001
Manage HH finances	3787	***	(1034, 6539)	0.007
Longer-term financial horizon	2731	**	(411, 5051)	0.021
Confident about knowledge on HH finances	1157		(−3146, 5460)	0.598
Other covariates				
Female	−3731	***	(−5783, −1680)	< 0.001
Married	−8856	***	(−13615, −4097)	< 0.001
Num. living children	−209		(−1365, 948)	0.724
Age bands				
50–54 (ref.)	–			
55–59	−4727	***	(−7383, −2070)	< 0.001
60–64	−7378	***	(−10372, −4384)	< 0.001
65–70	−11,122	***	(−14761, −7483)	< 0.001
Homeowner	−7120	**	(−12680, −1560)	0.012
Risk tolerance	3388	***	(871, 5906)	0.008
Currently working	2308		(−591, 5206)	0.119
Fully retired	−2100		(−6515, 2316)	0.351
Fair/poor health	−1179		(−3244, 887)	0.263
Net wealth				
Low (ref. cat.)	–			
Middle	4948	***	(3473, 6423)	< 0.001
High	16,125	***	(12725, 19524)	< 0.001
Annual Income				
Bottom quartile (ref. cat.)	–			
Second quartile	−488		(−3330, 2353)	0.736
Third quartile	3407	**	(350, 6464)	0.029
Top quartile	4248	**	(877, 7619)	0.014

Source: Author's calculations based on data from the 2015/16 Singapore Life Panel.
Notes: CPFIS = Central Provided Fund Investment Scheme. Dollar balances from both the CPFIS Ordinary Account and CPFIS Special Account are included in this analysis. Robust standard errors are used to derive the 95% confidence intervals.
***Level of significance P < 0.01. **Level of significance P < 0.05. *Level of significance P < 0.10.

Two-part regression results

Table 5 presents the results from the multivariate two-part regression for total CPFIS investment. Marginal (incremental) effects for the combined model are reported and indicate the estimated average additional dollar investment attributable to each explanatory variable. Corresponding 95% confidence intervals are reported in brackets. Education, experience in stocks investment outside of the pension system, experience in managing household finances, and longer-term financial planning horizon are statistically significant. Education has the largest effect among these financial knowledge variables. After adjusting for all other confounding variables, the marginal effect of secondary education averages $4704 (95% CI 1554–7854) while that of post-secondary education averages $9559 (95% CI 6185–12933). In other words, persons with secondary and post-secondary education have, respectively, about $4704 ($p < 0.01$) and $9559 ($p < 0.01$) more in total CPFIS balances compared to their peers in the reference group (less than secondary education).

Older respondents who have experience in stocks/mutual investment invest more by approximately $4238 (95% CI 1935–6541). Experience in managing household finances also predict CPFIS participation and investment: those with such experience invest $3787 (95% CI 1034–6539) more than their counterparts who do not manage household finances. Finally, the increased CPFIS investment attributable to having a longer-term financial horizon is $2731 (95% CI 411–5051). Turning attention to other covariates, we find that women invest less than men by about $3731 ($p < 0.01$) while married persons invest less than their peers by about $8856 ($p < 0.01$).[29] The marginal effects associated with the age bands are negative, with older respondents investing significantly less in CPFIS than those who are relatively younger.[30] For instance, those aged 65 and over have an estimated $11,122 less in total CPFIS balances on average compared to those aged 50–54 ($p < 0.01$). The incremental dollar CPFIS investment associated with not owning a home is $7120 ($p < 0.05$), while that associated with being in the top income quartile is $4248 ($p < 0.05$). As expected, both the probability of participating in the CPFIS and the dollar amount of investment conditional on participation increases with wealth levels (marginal effects range from $4948 to $16,125; $p < 0.01$).

Our results highlight education as a key determinant of CPFIS participation and investment among older Singaporeans. Because marginal effects vary over the life course, we perform further analysis by computing the marginal effects of education conditional at the four age bands (50–54, 55–59, 60–64, and 65–70). We find that the marginal effect of education diminishes with age. Specifically, although respondents with higher education invest more through CPFIS than those with lower education at all ages, this difference is much greater for

[29] Note that the (adjusted) incremental effects derived here are smaller than the (unadjusted) differences observed in the earlier univariate analyses. For example, gender differences. Before adjusting for all other control variables, we observe a $5955 ($14,835 versus $8,880) difference in average total CPFIS investment between men and women. The adjusted difference is only $3731.

[30] Current CPFIS withdrawal rules may partly explain the negative association between CPFIS investment and age. As outlined in Section 2.2, active members are allowed to withdraw their CPFIS investments from age 55 onwards if they wish to, conditional on having set aside a stipulated retirement sum. Hence, there may be individuals who have voluntarily liquidated their CPFIS investments (fully or partially) among respondents aged 55 and above in our cross-sectional sample. Separately, a possible reason for the lower CPFIS participation and investment among those in the 55–59 age group (as compared to those in the 50–54 reference age group) could be compulsory annuitization. Mandatory annuitization was rolled out in the CPF system in 2013. Nonetheless, this requirement only applied to a small percentage of our sample (those aged 55–57 at 2015) and it does not require members to liquidate their CPFIS investment (if any) in order to annuitize.

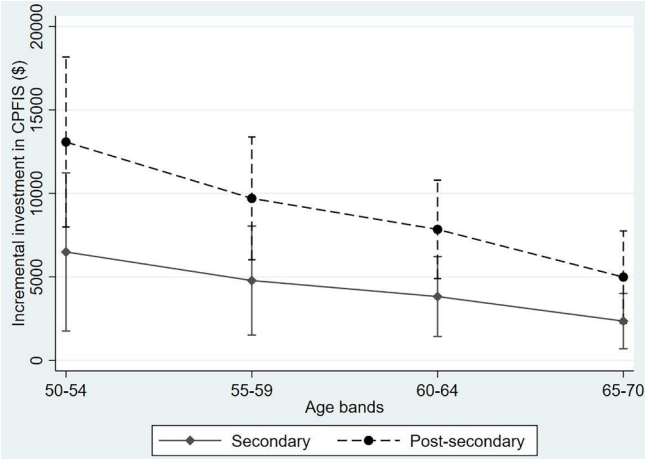


Fig. 3. Average marginal effects of education by age bands. Note: Fitted values are shown for each age group, alongside 95% confidence intervals.

younger-old persons than for older-old persons (see Fig. 3). Focusing first on respondents aged 50–54, we see that those with post-secondary education hold about $13,080 more in CPFIS investments than those with less than secondary education. In contrast, among the age 60–64 group, persons with post-secondary education have only $7850 more in CPFIS investments than those with less than secondary education.

To provide further insights into the factors predicting CPFIS participation and investment, we also report that direction and significance of effects based on the regression output from each estimation stage (see Appendix Table A1). One interesting observation is that the direction of the effect for financial literacy is positive in the first stage (probit) and negative in the second stage (glm) of the regression. These effects are also statistically significant. This implies that whilst financially savvy older Singaporeans are more likely to make an active choice through CPFIS participation, their quantum of CPFIS holdings tends to be lower than those who are less financially knowledgeable. Another key observation is that education, experience in stocks investment, experience in managing household finances, being relatively younger, and currently working are significantly associated with higher CPFIS participation but not amount invested. Conversely, having a longer-term financial planning horizon is significantly and positively associated with size of CPFIS investment but not participation in the program.

Robustness checks

We conduct three robustness checks. First, to verify the goodness of fit, we use the fitted first- and second-part models to predict the total CPFIS investment for the estimation sample. The predicted total dollar investment is about $11,800 per person, which is relatively close to the actual average of $11,738 per Table 2. Second, we repeat the regression for total CPFIS investment using the financial literacy questions individually in lieu of the combined financial literacy score. We find that none of the three financial literacy variables are statistically significant, however.[31] Thus our main results are robust to this alternative specification of the financial literacy variable.

Finally, we decompose total dollar CPFIS investment by source accounts and replicate the two-part regression analysis for CPFIS-OA investment, and separately, CPFIS-SA investment. Empirical results reveal that our main findings are robust to different types of CPFIS investment (see Appendix Tables A2 and A3). Education, experience in stocks investment outside of the pension system, longer-term financial planning horizon, higher net worth, higher risk tolerance, and currently working for pay, are significantly associated with both CPFIS-OA and CPFIS-SA investments. Experience in managing household finances and higher annual income, however, are only predictive of higher CPFIS-OA balances. Variables that are negatively related to dollar investment in both source accounts include being female, married, and older. Homeownership is negatively associated with CPFIS-OA balances but not CPFIS-SA investment. The results also confirm the relative large independent effect of education on active investment choice among the set of financial knowledge variables evaluated.

[31] Regression results are not reported here for brevity, but available upon request.

Conclusions

The Singaporean CPF is one of the world's oldest and largest national DC systems. This paper explores what factors drive active investment choice among plan participants in the CPF, and assesses the extent to which financial knowledge, experience, and attitudes help predict such choice. With the growth in coverage and value of assets held in DC pension schemes, policy makers have increasingly encouraged members to take a more active role in the management of their retirement savings. In Singapore's context, the government and CPF Board not only set up an alternative investment scheme offering pension investors much latitude and choice since 1986, but also invested substantial effort in refining the scheme over the years. Yet evidence indicates that many plan participants still prefer take the "path of least resistance" and stay invested in the default fund, which in most cases, is a one-size-fits-all scheme designed to suit as broad a range of individuals as possible.

We find that 16% of older DC plan participants actively manage their CPF savings by participating in CPFIS in 2016. The remaining 84% of the sample simply left their savings invested in the government-run default fund and do not have any CPFIS investments. Thus the distribution of total CPFIS investment balances in our sample is skewed with a mass point at zero. These observations are consistent with national statistics: as of 2016, participation rates in the CPFIS is about 24% for CPFIS-OA and 9% for CPFIS-SA. While low levels of active decision-making among pension investors have been observed in the US and elsewhere (Choi et al., 2002; Cronqvist and Thaler, 2004; Bateman et al., 2014), the modest CPFIS participation rates in Singapore's context is particular striking from a societal and policy perspective. First, the CPFIS has been around for more than three decades which suggests the scheme has credibility and members are familiar with it. Second, much policy effort has been devoted to refining the scheme over the years, including tightening of fund admission criteria and clamping down fees and charges. Third, many media reports have highlighted that CPF members do want more flexibility and choices, and in fact, a significant number of CPF members hope to obtain higher returns than the guaranteed rates on their pension savings (Ng, 2014; CPFB, 2017).

Among sampled respondents with positive CPFIS balances, the mean dollar amount invested is S$11,740 (US$8200). These funds are largely drawn from the members' Ordinary Accounts rather than Special Accounts, understandably so because the stipulated minimum savings threshold for the SA is double that of the OA. Also, the menu of permissible financial instruments under the CPFIS-OA (which allows investing in stocks, property funds, corporate bonds, and gold products) is wider than that of CPFIS-SA. Before adjusting for other control variables, we observe that CPFIS balances are higher among those with higher financial literacy scores, level of education, experience in managing household finances, and experience in stocks investment outside of the pension system. Those who self-report they are knowledgeable about household finances and with longer-term financial planning horizons also hold more CPFIS investments. Notably, the set of explanatory variables that relate to financial decision-making used here are broader than those employed in previous studies (e.g. Kristjanpoller and Olson, 2015).

Our multivariate regression results show that four out of these six main

explanatory factors predict active investment choice. After adjusting for confounding variables, only education, experience in stocks investment, experience in managing household finances, and longer-term financial planning horizon are significantly associated with higher CPFIS balances. The effect of education is largest. Holding other control variables at their mean values, having secondary education increases average CPFIS investments by $4,769, while having post-secondary education increases average balances by $9,411. The marginal effect of education, however, diminishes with age. For instance, those with post-secondary education hold an estimated $13,090 more in CPFIS investments than those with less than secondary education among those aged 50–54 but the difference is only $7,690 among those aged 60–64. This is potentially because the positive effects of formal education in early years wear off over time.

An important conclusion is that having hands-on experience and skills in personal finance prompts active investment choice among pension investors. Individuals who have actual experience in personal finance matters – including managing their households' finances and purchasing stocks or mutual funds – are more likely to partake in CPFIS and devote funds to it. This is not surprising since the CPFIS is essentially a do-it-yourself scheme for people with the expertise and confidence to self-invest. Having a longer-term financial horizon is also predictive of more active management of pension portfolios, controlling on all other variables. This can be rationalized by the fact that a fair proportion of the permitted CPFIS instruments are risky assets (for example, corporate bonds, property funds, and stocks), and thus appeal better to those who invest and/or plan for the long-term.

Our results are also informative on socio-demographic variables that predict active investment choice. DC plan participants aged 50 and above in Singapore who are male, younger, not married, higher risk tolerance, currently working for pay, and higher net worth are more likely to self-invest their pension monies (from both their Ordinary and Special Accounts). Non-homeownership is only predictive of higher CPFIS-OA balances, potentially because those who do not withdraw their CPF-OA savings for housing purchase have substantially more to devote to investment. SA funds cannot be deployed for home purchase. Likewise, higher annual income is only predictive of higher CPFIS-OA balances. These findings are broadly consistent with prior studies (Madrian and Shea, 2001; Cronqvist, 2006; Kristjanpoller and Olson, 2015; Butt et al., 2018) which have demonstrated that gender, age, and income are key determinants of passive versus active choice among DC plan participants in US and elsewhere. Our findings also concur with the earlier findings in Koh et al. (2008) that males and high-income earners generally take on more pension portfolio risk by investing through the CPFIS.

Investment choice of DC plan participants have implications not only for their own financial well-being in retirement, but also the adequacy of pension systems at large. With population aging and increasing life expectancies, policy makers have become more concerned with whether individuals are able to make pension-related decisions that are in their own best interest. The amount of freedom that workers have over the choice of their pension portfolios is a policy question. Clearly, Singapore's experience suggests that the expansion and abundance of investment options in itself does not necessarily motivate active management of pension savings. Some CPF members simply do not care about their locked-in savings while others may assign such monies to a less-important, different mental account, triggering the observed inertia and inactiveness. To address such behavioral biases, the Singapore government has recently announced that it will set up a new CPF investment scheme known as the Lifetime Retirement Investment Scheme offering savers the chance to invest their pension monies in diversified, passively managed, low-cost funds.[32] This additional option in the choice architecture targets pension investors with no time or expertise to self-invest through the CPFIS but who are willing to take on some investment risk in return for higher expected returns from their CPF savings.

Our study has some limitations that future research can remedy. First, CPFIS participation and investment can be dynamic over time. In our cross-sectional analysis, we have focused on older DC plan members who were participating in the CPFIS program in Jan/Feb 2016. It is possible that some of those surveyed may have participated in the CPFIS previously but have since fully liquidated their CPFIS investments and withdrawn from the scheme after age 55. We are unable to identify such persons in the current dataset. Nonetheless, our sampled CPFIS participation rates are somewhat comparable to the national statistics, especially for CPFIS-SA, and this provides some assurance of the external validity of our results. Second, the SLP measures of CPFIS participation and investment are self-reported. This can be subjected to recall bias and some inaccuracies, although we have cross-checked the data to ensure some consistency in responses across waves. Future research on active investment choice in DC pension systems covering longer follow-up periods and with administrative data will be required to investigate further how propensity for non-default choices may change over the life-course and in response to market events such as economic crisis.

[32] The new scheme was announced in 2016 following a two-year review by the CPF Advisory Panel. As of end 2018, the CPF Board is still working on the design and implementation of the yet-to-be-launched scheme (see Fong and Koh (2018) for details).

CRediT authorship contribution statement

Joelle H. Fong: Conceptualization, Funding acquisition, Investigation, Methodology, Formal analysis, Writing - original draft, Writing - review & editing.

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Appendix A. Supplementary data

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