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UNDERSTANDING THE FINANCIAL LITERACY AND RISK PROFILE OF SELF-EMPLOYED PERSONS

International studies have found that SEPs tend to be more financially literate and risk-seeking than employees, as they need to manage uncertain income streams in their work. Would such a trend hold in Singapore as well? In this issue, we utilise data from the first wave of the Retirement and Health Study[1] (RHS) to investigate the differences between SEPs and employees in their financial literacy and risk appetite levels. Segmentation analysis was also conducted to identify archetypes of SEPs and employees based on these two attributes.

BACKGROUND

International studies have found that SEPs tend to be more financially literate and risk-seeking than employees[2], as they are more likely to have the financial knowledge and ability to manage uncertain income streams in self-employed work. Given the diverse demographics and work backgrounds of SEPs, we examined whether these two attributes could also be observed in SEPs in Singapore.

COHORT OF INTEREST

This study compared two groups of RHS Wave 1 respondents – SEPs and employees:

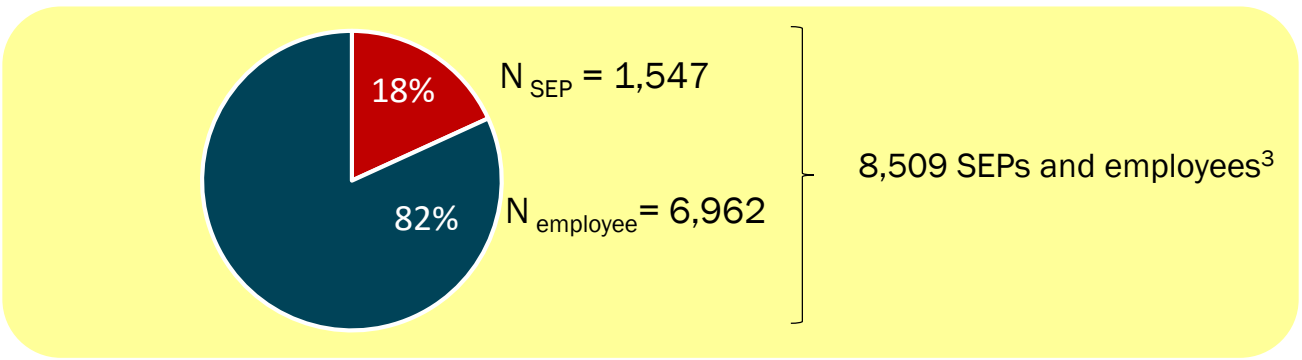


Figure 1: Proportion of SEPs and employees in the sample

[1] *The RHS is a longitudinal study of Singaporeans and Permanent Residents aged 45–85 years old (age at 2014) and their spouses. The first wave was conducted between July 2014 and June 2015, with a total of 15,100 respondents and 7,700 spouses/partners.*

[2] Cumurovic and Hyll, 2016; *Cramer et al. ,2002; Ekelund et al.,2005 ; Caliendo et al., 2014*

[3] *This comprises respondents who, at the point of interview, 1) were employees or SEPs, 2) had a CPF account, and 3) did not utilise a proxy to answer the survey. Respondents who held SEP and employee jobs concurrently were excluded from the sample.*

COMPARING THE FINANCIAL LITERACY AND RISK AVERSION OF SEPs AND EMPLOYEES

To compare the levels of financial literacy and risk aversion between SEPs and employees, two indices, a Financial Literacy Index and a Risk Aversion Index, were generated based on proxies utilising variables in the RHS[4]. It was found that SEP status was associated with a wider distribution of financial literacy and risk aversion scores as compared to employees, controlling for other factors like demographics[5]. This implied a higher level of heterogeneity among SEPs in terms of financial literacy and risk appetite.

ARCHETYPES OF SEPs AND EMPLOYEES

To better understand the heterogeneity of individuals, we grouped our sample based on their financial literacy and risk aversion index scores using cluster analysis[6]. Here, we found 4 literacy-risk archetypes :

	Financial Literacy	Risk Aversion
 **Adventurous Guru** *Financially literate, risk-tolerant*	High (4.59 score)	Low (-2.03 score)
 **Conservatives** *Financially literate, risk-averse*	High (4.94 score)	High (13.64 score)
 **Middle Man** *Moderate levels of literacy and risk appetite*	Moderate (2.05 score)	Moderate (0.34 score)
 **Uninitiated** *Cluster without any investment*	Low (-0.89 score)	Moderate (--0.06 score)

[4] *The indices were generated using Principal Components Analysis. Please refer to Annex A for details and results*

[5] *Regressions were applied to compare the index scores between SEPs and employees. Please refer to Annex B for details and results.*

[6] *Please refer to Annex C for details on the methodology.*

DISTRIBUTION OF ARCHETYPES BY SEPs AND EMPLOYEES

The table below shows the proportion of each archetype within SEPs and employees. We found that there was a higher proportion of SEPs in archetypes with higher levels of financial literacy compared to employees, regardless of their risk appetite. The difference was mainly driven by a greater share of SEPs in the Middle Man archetype. It was also observed that while the majority of both SEPs and employees belonged to the Uninitiated archetype, the proportion of SEPs in the Uninitiated archetype was lower than that for employees.

Proportion of SEPs and employees in the four archetypes

Archetypes	SEP	Employee
Adventurous Guru	4.5%	4.0%
Conservatives	0.5%	0.3%
Middle Man	27.0%	21.6%
Uninitiated	68.1%	74.1%

More financial literate: 32%

More financial literate: 26%

Results from the segmentation analysis indicate that while most individuals were in the Uninitiated archetype, a **greater proportion of SEPs** belonged to the **more financially literate archetypes.**

DEMOGRAPHICS AND WORK PROFILES OF SEP IN THE 4 ARCHETYPES[7]

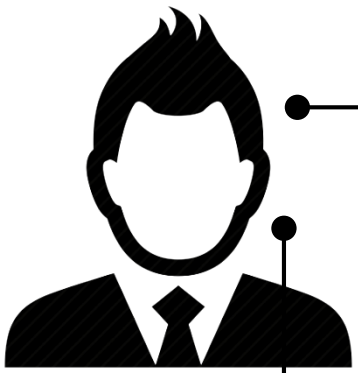
Focusing solely on SEPs, we found that SEPs in the two archetypes with the highest levels of financial literacy (i.e. Adventurous Guru and Conservatives) tend to be:

Conservatives

Adventurous Guru

Younger

About 60% of the individuals in the Adventurous Guru and Conservatives archetypes were aged 55 years and below. By contrast, around 50% of the Middle Man and Uninitiated archetypes were aged 55 and below.



Male

More than 80% of individuals in the Conservatives and Adventurous Guru archetypes were males. By contrast, the proportion of males for Uninitiated and Middle Man archetypes was lower at around 70%.

In Professional, Managerial, Executive, or Technical (PMET) occupations

More than 50% of individuals in the Adventurous Guru and Conservatives archetypes were in PMET occupations. By contrast, less than 30% of individuals in the Middle Man and Uninitiated archetypes were PMETs. Notably, among the four archetypes, Adventurous Guru had the largest proportion of those from the **Finance & Insurance Activities** industry.

[7] *Please refer to Annex D for detailed statistics*

ECONOMIC OUTCOMES OF SEPs IN THE FOUR ARCHETYPES

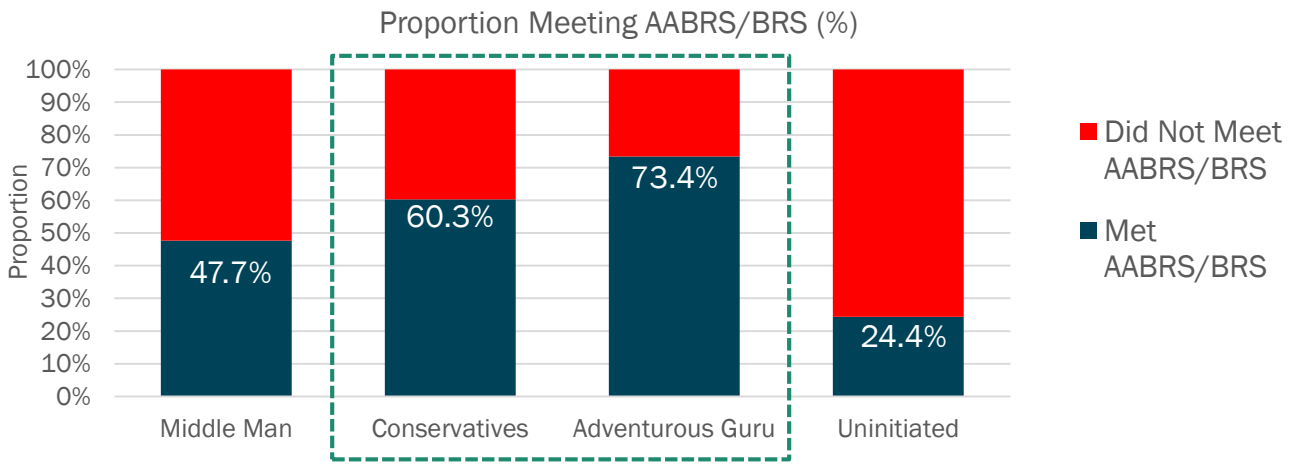
To compare SEPs' economic outcomes between the four archetypes, we utilised four measures: total income, total wealth, AABRS / BRS attainment, and monthly financial resource[8].

Key Insights: SEPs in archetypes with the highest financial literacy levels (i.e. Adventurous Guru and Conservatives) tend to have better economic outcomes in terms of (i) higher median income & wealth, and (ii) higher AABRS/BRS attainment, as compared to the other archetypes.

Income & Wealth

Income & Wealth *(Median)*	Middle Man	Conservatives	Adventurous Guru	Uninitiated
Total Income	$3.7k	$7.8k	$10.2k	$2.0k
Total Wealth	$620k	$908k	$1,851k	$284k

AABRS/BRS Attainment



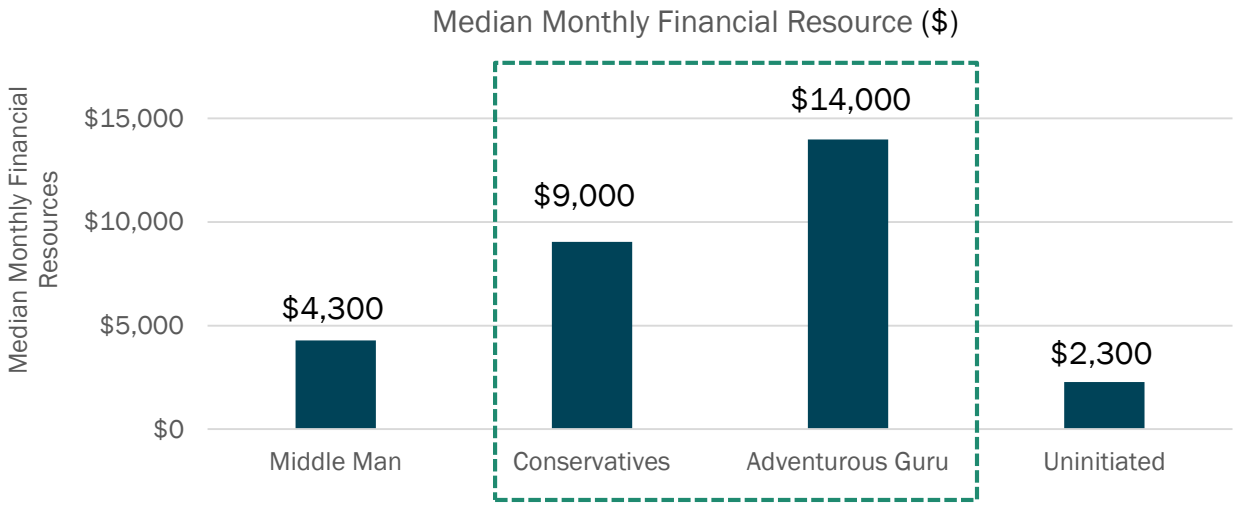
[8] *Definitions:*

- *Total Income refers to sum of work income and non-work income*
- *Total Wealth refers to sum of housing wealth, CPF balances and other non-housing wealth.*
- *AABRS refers to the age-adjusted Basic Retirement Sum (BRS) which applies to members aged below 55. It refers to the OA+SA balance to be on-track to attain the BRS at age 55. AABRS/BRS attainment was used as a proxy here for retirement adequacy. To account for the drawdowns by members above Payout Eligibility Age (PEA), the analysis is based on only respondents below the PEA.*
- *Based on OECD's Framework for Integrated Analysis for Income and Wealth (2013)*

Monthly Financial Resource

Apart from income and wealth, we also computed monthly financial resource (sum of total income and annuitised non-housing wealth) to better understand SEPs' financial adequacy. Monthly financial resource depicts the amount of financial resources one could tap on monthly for their expenditure needs, without tapping on housing wealth.

Monthly Financial Resource = Total Income + Annuitised Non-housing Wealth[9]



Key Insights: SEPs in archetypes with the highest financial literacy levels (i.e. Adventurous Guru and Conservatives) tend to have higher monthly financial resource as compared to the other archetypes.

Furthermore, we found that among SEPs with similar characteristics, an improvement in financial literacy was associated with an increase in monthly financial resources[10].

This suggests that economic outcomes of SEPs have a positive relationship with their financial literacy levels, conditional on other factors that might affect their monthly financial resources (e.g. education and income). Hence, improving financial literacy levels could potentially enhance their economic outcomes and hence retirement adequacy.

[9] *Non-housing wealth is converted into a monthly stream based on 2.5% interest rate and life expectancy of 85 years*

[10] *Based on a linear regression of monthly financial resource on the financial literacy index score, controlling for housing type and demographics. On average, each unit increase in the financial literacy index was associated with a statistically significant increase of 14.7% in monthly financial resources. To further illustrate, increasing the financial literacy index score of an average 'Uninitiated' SEP to 'Middle Man' levels was associated with a 30.2% increase in monthly financial resources. However, the relationship is not causal – the (causal) effect might be over-estimated due to reverse causation, as one may diversify financial assets (which was proxy for financial literacy) only after a certain level of wealth. Nevertheless, other studies have found that financial literacy, as measured directly, is positively associated with economic outcomes (Koh et al., 2017; Hastings et al.,2013)*

TAKEAWAYS

This study seeks to gain a better understanding of SEPs' and employees' financial literacy and risk aversion patterns. First, Financial Literacy and Risk Aversion indices were generated based on RHS variables that were suitable proxies. These indices were then used to cluster SEPs and employees of similar attributes together, forming 4 distinct archetypes:

- **Adventurous Guru**: Financially Literate, risk-tolerant
- **Conservatives**: Financially Literate, risk-averse
- **Middle Man**: Moderate levels of literacy and risk appetite
- **Uninitiated**: Cluster without any investment

From the analysis of these archetypes, we found that there was a **higher proportion of SEPs in archetypes with higher financial literacy compared to employees**, regardless of their risk profile.

Profiling SEPs within these archetypes, we observed that **individuals in archetypes with higher financial literacy scores tend to have better economic outcomes** (in terms of income, wealth, AABRS/BRS attainment etc.). This suggests that improving the financial literacy of SEPs might enhance SEPs' economic outcomes, and hence overall retirement adequacy. Initiatives such as the Lifetime Retirement Investment Scheme (LRIS) could also help SEPs with lower financial literacy levels (e.g. Uninitiated) achieve better economic outcomes, by creating avenues for them to take the first step of investing.

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OVERVIEW: THREE-STEP APPROACH TO UNDERSTANDING SEPs

Even though the RHS does not directly measure financial literacy and risk aversion, this study used other relevant variables within the RHS to proxy for the two attributes, creating indices representing an individual's financial literacy and risk appetite levels.

The study also went beyond a simple comparison of average scores for SEPs and employees as there might be significant differences in financial literacy levels and risk aversion among SEPs. To better understand SEPs as a group, segmentation and profiling analyses were conducted to develop different archetypes, as well as to identify the characteristics of SEPs within each archetype.

In summary, a three-step approach was used to understand SEPs:

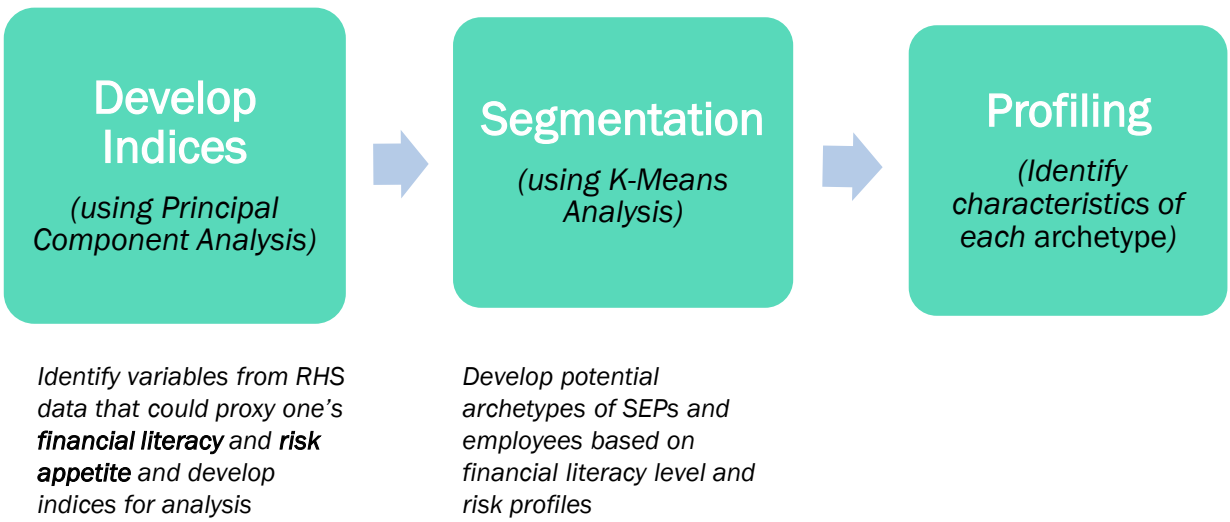


Figure A : Three-Step Approach to understand SEPs

PRINCIPAL COMPONENT ANALYSIS (PCA) METHODOLOGY

Principal Components Analysis (PCA) is a mathematical procedure that transforms a number of (possibly) correlated variables into a smaller number of uncorrelated variables called **Principal Components**. The two purposes of PCA are:

1. To determine the respective weights for the variables used to generate the indexes
2. To generate uncorrelated indices from the initial set of variables, which means that the indices are measuring different dimensions of the data.

Before the generation of indices, variables pertaining to the **choice and ownership of different financial instruments** were used to gauge the financial literacy and risk aversion levels of RHS respondents. Firstly, the extent to which an individual diversifies his financial portfolio is known to be associated with various levels of financial literacy. For example, a study found that individuals who had higher financial literacy scores tend to hold a more diverse range of investments in Singapore[1]. Secondly, an individual's holdings of less risky assets is indicative of his inclination towards risk. Therefore, variables pertaining to one's asset diversity and holdings of varying risk assets were used to develop indices that measure financial literacy and risk aversion levels.

Educational attainment has been found to be a suitable proxy for financial literacy in several studies[2], due to its high correlation with measures of financial literacy. Hence, one's level of qualification was also included in the construction of the indices.

Next, we applied PCA to generate the two indices. PCA transforms a number of (possibly) correlated variables into a smaller number of vectors describing its primary constituents, so as to enable easier and more meaningful interpretation of the data. Figure B below lists down the proxies identified from the RHS to generate index values for the financial literacy and the risk aversion indices:

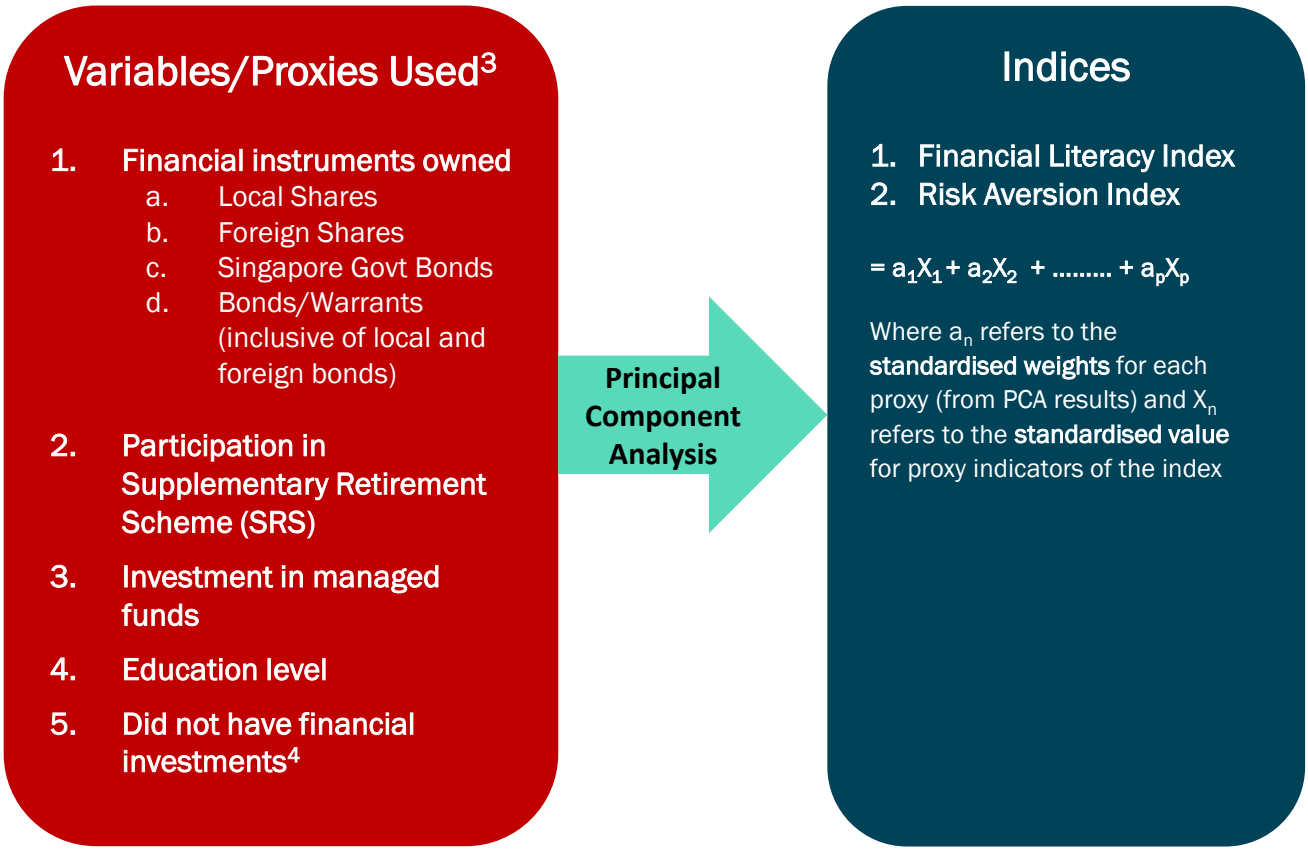


Figure B: Generating Indices Using Principal Component Analysis (PCA)

[1] Koh et al., 2017

[2] *Hastings et al.,2013; Johnson et al.,2004; Lachance, 2014*

[3] *All variables are in binary form (e.g. local shares = 1 indicates investment in local shares, while local shares = 0 indicates no investment in local shares) except for education level, which is a coded variable [1 = primary and below, 2 = secondary, 3 = post secondary (A Level, ITE and diploma) ,4 = university (Bachelor degree, Master degree, Ph. D.)]*

[4] *'Did not have financial investments' is a binary variable created from the combination of items 1 to 3 (on Fig. B), whereby 'Did not have financial investments' = 1 if one did not own any of the financial instruments listed in item 1, did not participate in SRS and had no investment in managed funds; otherwise 'Did not have financial investments' = 0*

The PCA algorithm assigned weights to each variable, which were then used to obtain the financial literacy and risk aversion indices by aggregating the initial set of variables. The contributing weights of each variable to both indices were indicated in the table below:

Variable	Weight of variable in Financial Literacy index[5]	Weight of variable in Risk Aversion index[5]
Local shares	0.47	0.09
Foreign shares	0.28	-0.45 [7]
Bonds, warrants	0.25	-0.18
SGS bonds	0.10	0.85
SRS	0.30	-0.04
Managed Funds[6]	0.35	0.12
Education Level	0.33	-0.13
No Investment	-0.55	-0.10

For the financial literacy index, the positive weights highlighted above align with the general finding that higher levels of literacy are associated with higher qualifications and greater participation in various financial instruments.

The second group of variable weights can be taken to reflect the risk aversion of the individual, as **foreign shares, bonds and warrants are subjected to foreign exchange risks** while **SGS bonds have relatively lower risk as they are backed by the Singapore Government.** Hence, the level of participation in either would proxy one's risk aversion.

[5] *These two composite indices accounted for almost half (45.7%) of variation in the data. This suggests that the two indicators alone are able to explain a significant proportion of variance amongst the 8 variables*

[6] *'Managed Funds' refer to financial investments that are managed by a relationship manager or portfolio manager or in unit trusts, group investment funds or other managed funds.*

[7] *Shares can be more risky investment instruments than bonds, and foreign shares / bonds are subject to foreign exchange fluctuations compared to local shares / bonds, which could represent an additional risk factor compared to local shares/bonds. SGS bonds are an instrument with relatively lower risk as they are backed by the Singapore Government*

ANNEX B

COMPARISON OF FINANCIAL LITERACY AND RISK AVERSION BETWEEN SEP AND EMPLOYEES: RESULTS FROM REGRESSION MODELLING

To compare the levels of financial literacy and risk aversion between SEP and employees, we regressed the financial literacy and risk aversion indices against employment status (SEP or employee), while controlling for other attributes like income and demographics (race, age and gender). Results are shown in the table below.

Linear Regression Coefficient	Financial Literacy	Risk Aversion
SEP (relative to Employee)	-0.061	0.020

**p<10%, ** p<5%, *** p<1%*

Observation: There were no statistically significant difference between SEPs and employees in terms of financial literacy and risk profile scores

While the above examined the effect of SEP status on the conditional means of the two indices, we also applied quantile regressions to further examine if SEP status had an impact on financial literacy and risk aversion at the 1st, 2nd (i.e. median) and 3rd quartiles, similarly controlling for income and demographics (race, age and gender). Results from the quantile regressions are shown in the table below.

Quantile Regression Coefficients	P25 (1st Quartile)	P50 (Median)	P75 (3rd Quartile)
Financial Literacy Index Score	0.011	0.104***	0.164***
Risk Aversion Index Score	-0.013***	-0.002	0.015***

*p<10%, ** p<5%, *** p<1%

For financial literacy, we found that SEP status largely had a statistically significant impact on the median and 3rd quartile scores, while the coefficient for the P25 regression was not statistically significant. For risk aversion, SEP status had a significant negative effect on risk aversion (i.e. more risk seeking) at lower percentiles (-0.013 at P25), and a significant positive effect on risk aversion (i.e. more risk averse) at higher percentiles (+0.015 at P75).

These findings suggest that SEPs have a wider distribution of financial literacy and risk aversion scores as compared to employees. This implies a higher level of heterogeneity among SEPs in terms of financial literacy and risk appetite.

SEGMENTATION ANALYSIS METHODOLOGY

K-Means Clustering was applied as a data-driven method using computer algorithms to determine natural groups in the data, with the number of groups represented by the variable K. The iterative algorithm assigns each data point to one of the K groups based on the financial literacy and risk aversion scores computed from the PCA analysis.

To determine the optimal number of clusters, we adopted the widely used **Caliński and Harabasz Pseudo-F index** (also known as the variance ratio criterion) (Calinski and Harabasz ,1974). A larger value of the index indicates more distinct clustering of the data points. It is computed based on the following formula:

$$CH(k) = \left[\frac{B(k)/(k-1)}{W(k)/(n-k)}\right]$$

Where *B(k)* = between cluster variation, *W(k)* = within cluster variation, *n* = number of data points/observations, *k* = number of clusters

The Caliński and Harabasz Pseudo-F index values for the various K-Means clustering start options were listed in the tables below.

3 Means

Start Option	Calinski and Harabasz pseudo-F index
Krandom	5501.09
First k	5442.01
Last k	9464.82
random(seed)	868.24
Partition random(seed)	9464.82
Everyk	9464.82
segments	11673.25

4 Means

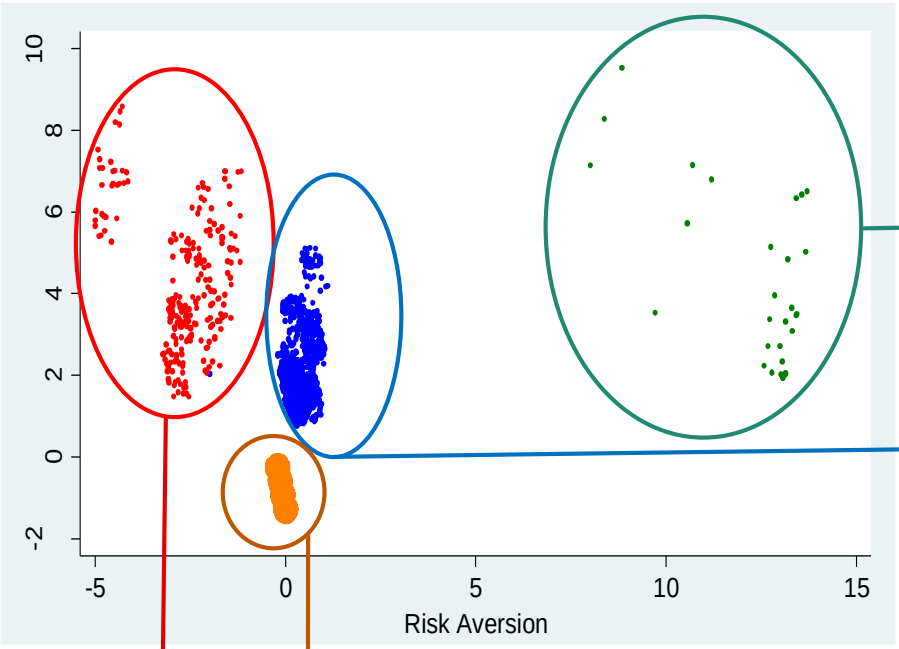
Start Option	Calinski and Harabasz pseudo-F index
Krandom	3686.86
First k	6688.21
Last k	6688.21
random(seed)	7990.21
Partition random(seed)	19363.68
Everyk	6778.37
segments	19363.68

5 Means

Start Option	Calinski and Harabasz pseudo-F index
Krandom	2817.19
First k	6851.75
Last k	5203.42
random(seed)	6049.71
Partition random(seed)	15257.18
Everyk	17828.83
segments	16924.57

The chosen clustering method is **4 means clustering by segments** as it results in more distinct clusters (relatively higher index values as compared to other starting options across 3 to 5 clusters) and more stable clusters compared to the random seed options.

SEGMENTATION RESULT USING K-MEANS CLUSTERING



Conservatives
(n= 31, 0.4%)

Middle Man
(n= 1918,22.5%)

Adventurous Guru
(n= 345, 4.1%)

Uninitiated *(n= 6215, 73.0%)*

DEMOGRAPHICS AND WORK PROFILES OF SEP IN THE 4 ARCHETYPES

Focusing solely on SEPs, we found that:

1. **Younger, male** SEPs were over-represented in the two archetypes with the highest levels of financial literacy (i.e. Conservatives and Adventurous Guru).

Archetypes	Middle Man	Conservatives	Adventurous Guru	Uninitiated	Overall SEP
Age *(% aged ≤55 years)*	53.1%	**55.6%**	**62.3%**	50.0%	51.5%
Males (Females)	72.9% (27.1%)	**94.4% (5.6%)**	**83.0% (17.0%)**	70.4% (29.7%)	71.8% (28.2%)

2. **Professional, Scientific & Technical Activities** and **Legislators, Senior Officials & Chief Executives** were the industry and occupation[1] more commonly found in archetypes with the highest levels of financial literacy (i.e. Adventurous Guru and Conservatives) respectively.

Adventurous Guru

Common Industries :

1. Finance & Insurance Activities (22.4%)
2. Prof, Scientific & Technical Activities (14.1%)
3. Wholesale & Retail Trade (11.0%)

Common Occupations:

1. Legislators, Senior Officials & Chief Executives (26.2%)
2. Admin & Commercial Managers (21.1%)
3. Business & Admin Professionals(20.6%)

Conservatives

Common Industries :

1. Transportation & Storage (36.3%)
2. Wholesale & Retail Trade (23.7%)
3. Prof, Scientific & Technical Activities (23.7%)

Common Occupations:

1. Drivers & Mobile Machinery Operators (29.7%)
2. Admin & Commercial Managers (29.3%)
3. Legislators, Senior Officials & Chief Executives (23.7%)

Middle Man

Common Industries :

1. Wholesale & Retail Trade (23.0%)
2. Transportation & Storage (16.6%)
3. Prof, Scientific & Technical Activities (9.7%)

Common Occupations:

1. Admin & Commercial Managers (17.4%)
2. Drivers & Mobile Machinery Operators (15.4%)
3. Legislators, Senior Officials & Chief Executives (12.5%)

Uninitiated

Common Industries :

1. Transportation & Storage (26.6%)
2. Wholesale & Retail Trade (19.6%)
3. Accommodation & Food Service Activities (10.3%)

Common Occupations:

1. Drivers & Mobile Machinery Operators(24.6%)
2. Sales Workers (12.8%)
3. Admin & Commercial Managers (9.5%)

[1] *Industrial and occupational categories were based on Singapore Department of Statistics' Singapore Standard Industrial Classification (SSIC) and Singapore Standard Occupational Classification (SSOC)*

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