Do Australian Lifecycle Funds De-Risk Over Time?

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Abstract

This study examines the investment strategies of lifecycle funds since their inclusion as a default retirement investment option in Australia in 2014. Contradictory to the investment mandate, we document that lifecycle funds have increased allocations in growth assets over time. We find that this is driven by fund series investing less in growth assets in the early period, consistent with fund companies catering to the market demand for larger risk exposure. On the other hand, we do not find evidence that the reduction of interest rates can explain the increase in growth asset allocations.

JEL Classification: G12, J32

Keywords: Default investment, MySuper, lifecycle funds, Stronger Super Reform

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1. Introduction

The Stronger Super Reform of 2011 allowed Australian superannuation companies to use lifecycle funds as a MySuper product[1] for defined contribution (DC) plans after 2014. Although lifecycle funds are marketed as an investment vehicle that de-risks as investors age, we find that many of them have substantially increased (decreased) investment allocations in growth (defensive) assets between 2014 and 2020. This suggests that the actual practice of lifecycle funds is inconsistent with the risk-reduction mandate, which exposes employees using lifecycle funds to more risks than expectations.

Among many others, Bodie, Merton, and Samuelson (2002) and Cocco, Gomes, and Maenhout (2005) suggest that the optimal share invested in equities should be decreasing over life because of the shortening streams of human capital income and reducing labor supply flexibility. Motivated by these theoretical studies, Wells Fargo Investment introduced the first lifecycle fund (also known as target-date funds (TDFs)) in 1994 in the US. In 2006, the US Pension Protection Act (PPA) included TDFs as one of the qualified default investment alternatives for 401(k) plans. Since then, the total assets under the management of US TDFs have grown rapidly and exceeded US$1.8 trillion in June 2021. Because of the success in the US pension market, the popularity of TDFs is increasing globally.[2]

In this study, we analyse the MySuper database prepared by the Australian Prudential Regulation Authority (APRA). The database is publicly available and contains the fund company profile, asset allocation targets, investment performance, and fees of all MySuper products in the period between Q1 2014 and Q4 2020. Fund companies can choose from

[1] The word "MySuper" refers to default superannuation products. Since 1 January 2014, only fund companies offering a MySuper product are eligible to receive default superannuation contributions relating to new employees. More details are available at: https://treasury.gov.au/programs-and-initiatives-superannuation/mysuper

[2] See the media coverage eg., https://www.pionline.com/article/20180319/PRINT/180319895/europeans-seeing-funds-as-solution-to-dc-dilemma and https://www.investmentmagazine.com.au/2014/03/target-date-funds-the-start-of-a-big-adventure/.

offering a balanced fund or a series of lifecycle funds as the MySuper product. Our sample includes 32 lifecycle fund series and 103 balanced funds, respectively. We find that the total assets under the management of MySuper products have increased from AU$ 343.6 billion in 2014 to AU$ 727.4 billion in 2020. Furthermore, the market share of lifecycle funds has increased from 20.7% to 32.3%. The statistics suggest that the importance of both MySuper products and lifecycle funds has increased considerably over time.

Our main analysis focuses on the asset allocations of lifecycle funds. We classify the reported asset classes into three groups: growth assets, defensive assets, and other assets. Growth assets include listed and unlisted equities, properties, infrastructures, and commodities; defensive assets include cash and fixed income securities; other assets are those that are not classified as growth or defensive assets, which typically include hedge funds, leased assets, and investments with oversea managers.

We then examine the glide path of lifecycle funds. The glide path of a lifecycle fund shows the gradual change of investment mix in stocks, bonds, and cash equivalents as investors age. As the investment strategy of a lifecycle fund is to de-risk as investor age, the growth asset glide path should be downward sloping, which we can confirm in our sample. We find that lifecycle fund series on average invest 86% in growth assets for investors below forty-one years old and 37% for investors above seventy years old. More interestingly, we document a substantial upward shift in the average growth asset glide path. For example, the average growth asset allocation for investors above seventy years old has increased from 28% to 42% from 2014 to 2020. Such a pattern is primarily driven by the investment in international equities, which has increased from 7% to 16%. The results suggest that lifecycle fund series have adopted a riskier and more internationally diversified strategy in the recent period.

Next, we explore two explanations for why lifecycle funds increase allocations in growth assets. Overall, we document evidence best in line with the catering hypothesis that fund companies increase growth asset allocations in response to market concerns related to the risk-reduction design of lifecycle funds. The Productivity Commission of Australia expressed the concern publicly: "The inclusion in MySuper of lifecycle products is questionable given the foregone returns they pose for many members' balance.". We first show that the fund flow of lifecycle funds is only sensitive to raw returns rather than risk-adjusted returns, suggesting the risk-taking incentives of fund managers mainly concentrate in the systematic risk component. Furthermore, we predict and confirm that lifecycle funds with lower initial growth asset allocations are more likely to increase growth asset allocations in the later period. On the other hand, we do not find evidence corroborating the low-interest-rates hypothesis that fund companies increase growth asset allocations in response to the drop of interest rates.

Our paper is related to the growing literature on pension fund investments, in particular, the design of lifecycle funds. Many recent studies have examined the investment strategies of US TDFs in the past two decades (such as Elton, Gruber, Souza, and Blake, 2015; Balduzzi and Reuter, 2019; and Mao and Wong, 2020). To the best of our knowledge, we are the first to examine the lifecycle fund market in Australia. Our finding is opposite to Mao and Wong (2021) who document a downward shift of TDF glide paths in the US market. This suggests that the design and management style of lifecycle funds can be affected by the individual circumstances of each country. Due to the growing importance of lifecycle funds around the globe, more studies are needed to understand the markets outside the US.

Furthermore, our paper underlines potential inefficiencies inherent in the Australian MySuper superannuation system. Since its introduction in 2014, the MySuper system is not without controversy. Russell Mason of Deloitte described the system as one of the greatest wastes of time as most MySuper products were simply converted from existing fund options. The Australian Productivity Commission suggested that lifecycle funds should be deleted from the MySuper system due to their limited upside return potential and the difficulty for regulators to compare lifecycle funds with balanced funds. Adding to the discussion, our study highlights that the actual investment practice of lifecycle funds is inconsistent with the risk-reduction mandate, implying that investors might be exposed to unexpected risk.

2. Literature on target-date-funds

After the Pension Protection Act (PPA) of 2006, which included TDFs as one of the qualified default investment alternatives for 401(k) plans in the US, the size of the US TDF market has grown tremendously. As of June 2021, the total assets under the management of US TDFs have exceeded US$1.8 trillion. Because of the increasing importance of TDFs, the efficiency of the TDF market and the TDF design have captured much attention from researchers. Elton, Gruber, Souza, and Blake (2015), Balduzzi and Reuter (2019), and Mao and Wong (2020) examine the risk and return profiles of TDFs. They find a trend of increased idiosyncratic risk in the US TDF market after the PPA of 2006, which can be explained by agency problems in the market. On the other hand, Brown and Davies (2020) suggest that TDFs are cost-inefficient due to the funds of funds structure. They find that the investment strategies of TDFs can be mimicked using ETFs at a substantially lower cost. Overall, previous studies show that despite the increasing importance of TDFs, the frictions in the market can be harmful to investors' welfares. While most existing TDF studies focus only on the US TDF market, our study aims to examine the efficiency of a similar product in Australia, namely the lifecycle funds.

3. Australian superannuation fund industry

As of Q4 2019, Australia had the fourth-largest pension investment pool in the world, valued at US$2.1 trillion[3]. Similar to the PPA in the US, the Australian government announced the Stronger Super Reform in 2011, which allowed fund companies to use lifecycle funds as a MySuper product. In this section, we highlight some stylized features of the Australian pension fund system.

3.1 For-profit vs not-for-profit fund companies

Unlike in the US, where pension funds are usually run by for-profit mutual fund families, not-for-profit funds constitute a significant fraction of the Australian market. Australian pension funds typically fall into one of the following categories: industry funds, public sector funds, corporate funds, and retail funds. Retail funds are for-profit products that are usually run by banks or investment companies; industry, public, and corporate funds are not-for-profit funds that are offered to employees from a certain industry, the government, and a certain company, respectively.[4] According to the statistics from the Association of Superannuation Funds of Australia in 2019, industry funds, public sector funds, corporate funds, and retail funds each constitutes 36%, 32%, 3%, and 28% of the pension fund market.[5]

Previous studies show that for-profit and not-for-profit funds are different in fee structures, investment strategies, and corporate governance. For example, Ainworth, Akhtar, Corbett, Lee, and Walter (2016) show that for-profit funds charge significantly higher investment fees and administration fees, harming investors' welfares. Cummings (2016) shows that not-for-profit funds tend to leverage on their size advantage to invest more in relatively illiquid asset classes, such as properties and private equities, which provides diversification

[3] The information is from Wills Tower Watson Global Pension Asset Study – 2020.
Source: https://www.willistowerswatson.com/en-AU/News/2020/02/global-pension-assets-on-the-up
[4] The choice of fund rules enabled employees to choose their own pension funds since 1 July 2005. After that, industry funds were no longer required to be industry-specific, and most became open to the public.
[5] These figures do not include funds with less than 5 members and the balance of statutory funds.

benefits to investors. Liu and Ooi (2018) argue that for-profit funds are more prone to agency issues as they find that outsourcing is negatively associated with the performance of for-profit funds, but the effect is insignificant among not-for-profit funds.

3.2 The design of Australian lifecycle funds

When implementing the lifecycle investment strategies, Australian fund companies typically choose between the member-cohort approach and the member-switching approach. Fund companies that adopt the former approach usually set up a series of funds for investors of different ages. For example, Common Essential Super offers Lifestage 1945-49, Lifestage 1950-54, …, Lifestage 2000-04 for investors who were born in different years. Such a design is similar to US TDFs. On the other hand, fund companies that adopt the member-switching approach usually rely on the existing investment options offered by the companies and switch members from the more aggressive ones to the more conservative ones when they reach certain ages.

4. Data description and summary statistics

4.1 Sample construction

Our primary data source is the APRA's quarterly MySuper statistics.[6] The database contains the fund company profile, asset allocation targets, investment performance, and fees of all MySuper products in the period between Q1 2014 and Q4 2020.[7] Using APRA's data, we construct a sample of lifecycle fund series and a sample of balanced funds, respectively. Among the lifecycle fund series sample, we find that the number of funds offered varies by series from a low of 2 to a high of 41. Series that offer too few funds rarely adjust portfolio

[6] Source: https://www.apra.gov.au/quarterly-superannuation-statistics
[7]The Stronger Super reforms of 2011 requires that employers must transfer employees' default pension contributions into a MySuper account after 1 January 2014. Thus, we start our sample from 2014 despite the original data contains some observations in 2013.

allocations, which is inconsistent with the lifecycle investment principle. Thus, we drop series that offer less than four funds. We also find that some companies offer the same investment strategy to different employers' MySuper plans. To avoid duplicate observations, we combine fund series that are from the same fund company and have identical asset allocation targets for all asset classes.

Table 1 summarizes the size and the number of fund series in our sample. Panel A shows that the total assets managed by lifecycle funds have increased from AUD 71.25 billion to AUD 234.30 billion from 2014 to 2020, while the total assets of balanced funds have increased from AUD 272.35 billion to AUD 493.12 billion. This implies that the market share of lifecycle funds has increased from 20.7% to 32.3%. We also find that the total number of MySuper funds have reduced from 111 to 79 due to mergers.[8] Panel B compares the share of for-profit and not-for-profit lifecycle funds, it shows that the number of for-profit funds is about two times larger than that of not-for-profit funds and their market share has increased from 23.9% to 46.8% between 2014 and 2020. Lastly, Panel C shows that not-for-profit funds dominate in the market of balanced funds, with a market share of 97.6% in 2020.

[Table 1 inserts here]

4.2 Measuring fund beta and flow

APRA-regulated funds are required to disclose quarterly portfolio allocations in the following asset classes: listed and unlisted equities, fixed income securities, cash, commodities, infrastructures, properties, and others. Following industry practices, we classify the reported asset classes into three groups: growth assets, defensive assets, and other assets. Growth assets include listed and unlisted equities, properties, infrastructures, and commodities; defensive

[8] KPMG estimates that the number of APRA-regulated funds will shrink to half its current size in 2029. Source: https://home.kpmg/au/en/home/insights/2020/06/superannuation-industry-mergers-transformation.html

assets include cash and fixed income securities; other assets are those that are not classified as growth or defensive assets, which typically includes hedge funds, leased assets, and investments with overseas managers.[9] Because the detailed portfolio holdings and the within-asset-class investment styles are unobservable in the APRA's data, we estimate CAPM using a rolling window of eight quarters to obtain fund alphas and betas as alternative measures of performance and equity risk exposure of a fund. For the CAPM regressions, returns of the ASX200 index and the 3-month Australian bank bill are used as the market return and risk-free rate, respectively. Furthermore, we follow Sirri and Tufano (1998) to calculate fund flow as the change in TNA excluding any changes as a result of fund investment returns:

$$Flow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} \times (1 + r_{i,t})}{TNA_{i,t-1}}$$

Where $TNA_{i,t}$ and $r_{i,t}$ are the total net asset and after fees return of fund i in quarter t, respectively.

4.3 Summary statistics

Our baseline sample covers 32 lifecycle fund series from 2014 to 2020. We winsorize all continuous variables at the 1 and 99 percentiles to mitigate the effects of outliers. As it is natural that lifecycle funds for investors at different ages will exhibit different portfolio allocations and returns, we sort funds into five groups based on the maximum allowable age of investors. Table 2 reports the mean values of all variables for each age group. We find that the average allocation in growth assets gradually fall from 85.9% for investors below the age of 41 to 36.7% for investors above the age of 70. Listed equities constitute the largest component of growth assets, ranging from 64.4% for investors younger than 41 to 24.3% for investors older than 70. Allocations in fixed income securities and cash rise from 8% to 38.1% and 2% to 17.9% as

[9] The other investment allocation of our sample funds ranges from a low of 0% to a high of 55%, with an average of 6.29%.

investors age. The difference in asset allocation is reflected in fund returns. For example, the average quarterly return of investors younger than 41 is 2.1%, while that of investors older than 70 is 1.1%. Furthermore, the average investment fee and admin fee are 0.13% and 0.14% of the total asset under management (TNA), which add up to a total fee of 0.27%. The average TNA of lifecycle funds is AUD 677.5 million. Both the fees and size of lifecycle funds are unrelated to investors ages.

[Table 2 inserts here]

5. Evolution of lifecycle fund glide paths

In this section, we compare the glide paths of lifecycle funds in 2014 and 2020. Panels A to C of Figure 1 present the growth asset, defensive asset, and other asset glide paths, respectively. Firstly, we find that the average growth asset (defensive asset) glide paths in 2014 and 2020 are downward (upward) sloping, suggesting that lifecycle funds gradually de-risk as investors age. On the other hand, lifecycle funds have shifted the growth (defensive) asset glide path upward (downward), implying that they have increased investments in growth assets and reduced investments in defensive assets over time. For example, lifecycle funds for investors above the age of 70 (below the age of 41) on average invest 28% (84%) in growth assets in 2014 and 42% (89%) in 2020. The results show that lifecycle fund series have adopted riskier investment strategies in the recent period and the change is more pronounced among lifecycle funds that are for close-to-retirement investors.[10]

[Figure 1 inserts here]

[10] In unreported tests, we find that the increase in growth asset allocations happened gradually from 2014 to 2020.

Figure 2 reports the investment allocations of lifecycle funds in the sub-asset classes of growth assets, including Australian equities, international equities, and other growth assets. Other growth assets include properties, infrastructures, commodities, and unlisted equities. Panel A shows that the investment allocations of lifecycle funds in Australian equities have only increased slightly between the two periods. For example, the Australian equity investment for investors below the age of 41 is 31% in 2014 and 34% in 2020, respectively. The difference between the two periods is larger for close-to-retirement funds. On the other hand, panel B shows that the average international equity allocations of lifecycle funds have increased substantially for all age groups from 2014 to 2020. The average international equity allocation for investors below the age of 41 (above the age of 70) has increased by 10% (9%). Panel C shows that the investment strategy of lifecycle funds in other growth assets has remained quite stable over time. In sum, our results suggest that lifecycle funds in Australia have adopted a more internationally diversified strategy in the recent period, which is the primary driver of the upward shift in the growth asset glide path.

[Figure 2 inserts here]

6. Fund-level summary

In the previous section, we show that the average glide path of lifecycle funds is negatively sloping but has shifted upward over time. These two effects offset each other, thus the actual fund-level asset allocation changes over time require further investigations. Also, the change in the average glide path might be driven by newly joined fund series or shifts made by existing series. To better understand the market, in this section, we examine the change of investment allocations at the fund-level.

We start by creating some variables that capture the time-series changes of asset allocations of each lifecycle fund. *Δ Growth* is the difference between a fund's growth asset allocation in year *t* and that in year *t-1*.[11] *Decrease_dummy* (*Increase_dummy*) takes the value of one if the growth asset allocation of a fund in year *t* is smaller (larger) than that in year *t-1*, or zero otherwise. *5%_decrease* (*5%_increase*) is an indicator variable taking the value of one if the growth asset allocations of a fund reduce (increases) by more than 5 percentage points from year *t-1* to year *t*. *Δ Growth| Decrease_dummy* (*Δ Growth| Increase_dummy*) refers to the change of growth asset allocations from year *t-1* to year *t* if the *Decrease_dummy* (*Increase_dummy*) equals one. *Δ Growth| 5%_decrease* (*Δ Growth| 5%_increase*) refers to the magnitude of the growth asset allocation decrease (increase) from year *t-1* to year *t*, given that the decrease (increase) is greater than 5 percentage points.

We expect *Δ Growth* to be negative for member-cohort funds as they are marketed as an investment product that de-risks over time. On the other hand, *Δ Growth* of member-switching funds should be zero. Because, instead of adjusting the portfolio allocations of each fund in the series, member-switching series move investors from more aggressive funds to more conservative ones as they age. Thus, we do not expect the growth asset allocations at the fund-level to reduce over time.

Table 3 reports the summary statistics of our variables for both member-cohort and member-switching fund series. Firstly, we find that the average *Δ Growth* for the entire sample is 0.005, suggesting that lifecycle funds on average invest 0.5% more in growth assets every year. As our sample covers 7 years from 2014 to 2020, this implies that lifecycle funds on average invest 3.5% more in growth assets from the start to the end of the period. The change is economically large and is stronger among member-cohort series which are supposed to de-risk over time. Furthermore, we find that only 26.8% of the fund-year observations exhibit negative *Δ Growth*, suggesting that most lifecycle funds do not de-risk annually. More

[11] The investment strategy of lifecycle funds is to de-risk as investors age, but the actual frequency of portfolio adjustment is unobservable. Thus, we focus on the annual changes of the asset allocations rather than the quarterly changes based on the assumption that lifecycle funds de-risk at least once a year.

interestingly, 26% of observations exhibit positive *Δ Growth*, implying an increase in growth asset allocations.

[Table 3 inserts here]

Comparing fund-year observations that increase growth asset allocations with those that decrease growth asset allocations, we find that that average *Δ Growth* for the two groups are 5.1% and -3.2%, respectively. Also, we find that while 9.6% observations exhibit an increase in growth asset allocations by more than 5 percentage points, only 6% observations exhibit a decrease in growth asset allocations by more than 5 percentage points. The findings suggest that lifecycle funds are more likely to make a large increase in growth asset allocations than a large decrease. In sum, although lifecycle funds are marketed as an investment product that de-risks as investors age, many of them increase growth asset allocations over time, implying that the actual practice is opposite to the investment mandate.

7. Why have lifecycle funds become more risk-taking over time?

7.1 Hypotheses development

We propose and test two potential explanations to understand the incentives of fund companies to increase the risk of lifecycle funds. Firstly, since the adoption of lifecycle funds as a default investment option in the Australian superannuation system in 2014, many criticisms have been raised due to the limited upside potential of the risk-reduction design of lifecycle funds. For example, Chant, Mohankurmar, and Warren (2014) show that the expected return of lifecycle funds is one per cent per year lower than that of balanced funds. The Productivity Commission of Australia also expressed similar concerns publicly: "The inclusion in MySuper of lifecycle products is questionable given the foregone returns they pose for many members' balance." As public impression about lifecycle funds can affect fund flows and the profitability of fund companies, it imposes pressure on companies to adjust fund risk upward.

On the other hand, past literature has shown that macroeconomic variables can predict asset returns (Fama and French, 1989; Ang and Bekaert, 2007), and investors can benefit by incorporating this information in their asset allocation decisions (Campbell, Chan, and Viceira, 2003; Hoevenaars et al., 2008). Chalmers, Kaul, and Phillips (2013) provide empirical evidence that individual investors react to changing macroeconomic conditions and reallocate their portfolios in response to forecasting variables. The global financial crisis in 2008 has led to a substantial reduction in the interest rates globally. In Australia, the Reserve Bank of Australia (RBA) has reduced the cash rate target from 2.5% to a historical low of 0.1% between 2014 and 2020. Under the low-interest-rates environment, fixed income securities have become a less attractive asset class due to lower expected returns, which provides incentives for fund companies to reduce investments in defensive asset classes.

7.2 Catering hypothesis

We start by identifying the determinants of fund flows to disentangle the incentives of fund managers. We regress fund flow in quarter-*t* on lagged fund flows, performance measures, fund size, and fund fees.[12] All regressions control for age-group by time-fixed effects to ensure that we compare lifecycle funds with similar target horizons at the same time. Columns (1) and (2) of Table 4 show that 1% increase in past quarter and past year returns are associated with 0.50% and 0.41% increase in fund flow, respectively. Columns (3) and (4) show that the coefficients of alpha are statistically insignificant, implying that fund flows primarily respond

[12] In response to the COVID-19 crisis, the Australian government allowed temporary withdrawals from Australian superannuation funds in 2020. Brugler, Kim, and Zhong (2021) show that the policy mainly affects fund flows of superannuation funds with more young and low-income members, implying that the shock has heterogeneous impacts on different funds. In unreported tests, we find that our results are consistent if we exclude observations in 2020.

to raw returns but risk-adjusted returns. In sum, Table 4 confirms that the risk-taking incentives of lifecycle fund managers mainly concentrate in the systematic risk component, which is aligned with our prediction that fund managers might adjust the glide path to attract fund flows.

[Table 4 inserts here]

Next, we predict that those with lower initial growth asset allocations should react more to catering incentives if the market favors funds with higher risk. To verify this prediction, we regress the change of investment allocations in aggregated growth assets, Australian equities, international equities, and other growth assets from year t-1 to t on the level of the corresponding asset allocations in year t-1. All regressions control for age-group by time fixed effects and fund characteristics, such as fees, past returns, flows, and size. From Table 5, we find that the coefficients on past allocations are negatively significant at the 1% level in all columns. The results are also economically significant. The fund with one percentage lower in current growth asset allocations is expected to increase growth assets allocations by 0.08% more in the next year. In sum, the findings suggest that fund series with lower initial investments in growth assets increase growth asset allocations more in the recent period, which is consistent with our prediction.

[Table 5 inserts here]

7.3 Low-interest-rates hypothesis

Finally, if the low-interest-rates environment or other macroeconomic factors affect fund company asset allocation decisions, we expect that both lifecycle funds and balanced funds should adjust the investment strategies by a similar magnitude. Figure 3 reports the average allocations of balanced funds in growth assets, defensive assets, and other assets. Our sample covers 97 balanced funds in 2014 and 2020. We find that balanced funds on average invest 70%

in growth assets, 25% in defensive assets, and 5% in other assets, respectively. Interestingly, the figure shows that the asset allocations of balanced funds have remained largely unchanged from 2014 to 2020, suggesting that the upward shift in growth asset allocations is unique to lifecycle funds. Thus, our results do not support the hypothesis that the low-interest-rates environment is the primary driver of the increase in the risk exposure of lifecycle funds.

[Figure 3 inserts here]

8. Conclusion

The Stronger Super Reform of 2011 included lifecycle funds as a MySuper product for Australian workers. Since then, the total assets under the management of lifecycle funds have grown tremendously and reached AU$ 234.3 billion in 2020. In this study, we examine the investment strategies of lifecycle funds and reveal an increasing trend in growth asset allocations. To explain this pattern, we find evidence best in line with the catering hypothesis that fund companies increase investments in growth assets to cater to the market demand for higher risk exposure.

Overall, our study makes important contributions to the optimal design of lifecycle funds. Firstly, we highlight that the actual practice of Australian lifecycle funds is not aligned with their investment mandates, which might expose investors to unexpected risks. We call for more attention from relevant regulators to the design and management style of lifecycle funds. Furthermore, the pattern of increased risk-taking of Australian lifecycle funds is opposite to the finding of a recent study, which documents a downward shift in the equity glide path of US TDFs (Mao and Wong, 2021). This suggests that the lifecycle fund market in each country is unique, and more studies are needed to understand the markets outside the US.

Reference

Ainsworth, Andrew, Shumi M. Akhtar, Adam J. Corbett, Adrian D. Lee, and Terry S. Walter, 2016, Superannuation Fees and Asset Allocation, *Working Paper*.

Ang, Andrew, and Geert Bekaert, 2007, Stock return predictability: Is it there? *Review of Financial Studies* 20, 651–707.

Balduzzi, Pierluigi, and Jonathan Reuter, 2019, Heterogeneity in target date funds: strategic risk-taking or risk matching? *Review of Financial Studies* 32, 300–337.

Bodie, Zvi, Robert C. Merton, and William F. Samuelson, 1992, Labor supply flexibility and portfolio choice in a life cycle model, *Journal of Economic Dynamics and Control* 16, 427–449.

Brown, David C., and Shaun Davies, 2020, Off Target: on the underperformance of target-date funds, *Working Paper*

Brugler, James, Minsoo Kim, and Zhuo Zhong, 2021, Liquidity shocks and pension fund performance: evidence from early access, *Working Paper*

Campbell, John Y., Yeung Lewis Chan, and Luis M. Viceira, 2003, A multivariate model of strategic asset allocation, *Journal of Financial Economics* 67, 41–80.

Chalmers, John, Aditya Kaul, and Blake Phillips, 2013, The wisdom of crowds: Mutual fund investors' aggregate asset allocation decisions, *Journal of Banking and Finance* 37, 3318–3333.

Chant, Warren, Mano Mohankumar, and Geoff Warren, 2014, MySuper: A new landscape for default superannuation funds, *Working Paper.*

Cocco, João F., Francisco J. Gomes, and Pascal J. Maenhout, 2005, Consumption and portfolio choice over the life cycle, *Review of Financial Studies* 18, 491–533.

Cummings, James R., 2016, Effect of fund size on the performance of Australian superannuation funds, *Accounting and Finance* 56, 695–725.

Elton, Edwin J., Martin J. Gruber, Andrede Souza, and Christopher R. Blake, 2015, Target date funds: characteristics and performance, *Review of Asset Pricing Studies* 5, 254–272.

Fama, Eugene F., and Kenneth R. French, 1989, Business conditions and expected returns on stocks and bonds, *Journal of Financial Economics* 25, 23–49.

Hoevenaars, Roy P.M.M., Roderick D.J. Molenaar, Peter C. Schotman, and Tom B.M. Steenkamp, 2008, Strategic asset allocation with liabilities: Beyond stocks and bonds, *Journal of Economic Dynamics and Control* 32, 2939–2970.

Liu, Kevin, and Elizabeth Ooi, 2019, When boards use related parties: outsourcing and superannuation fund performance, *Accounting and Finance* 59, 715–746.

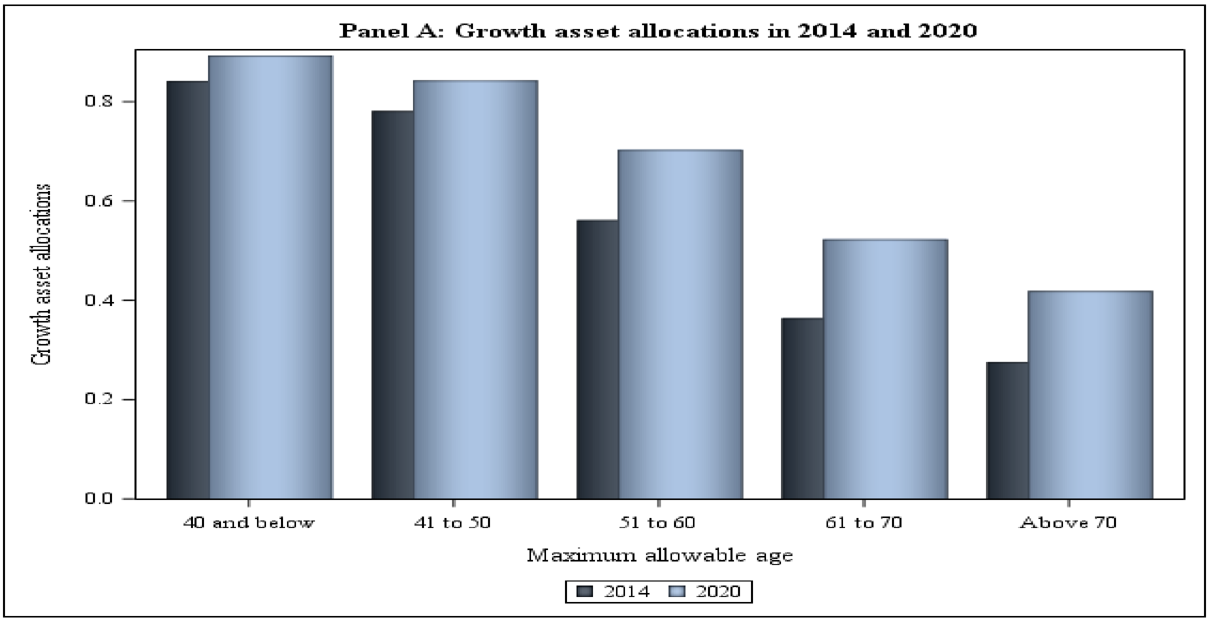
Mao, Mike Qinghao, and Ching H. Wong, 2020, Managerial commitment and heterogeneity in target-date funds, *Working Paper*.

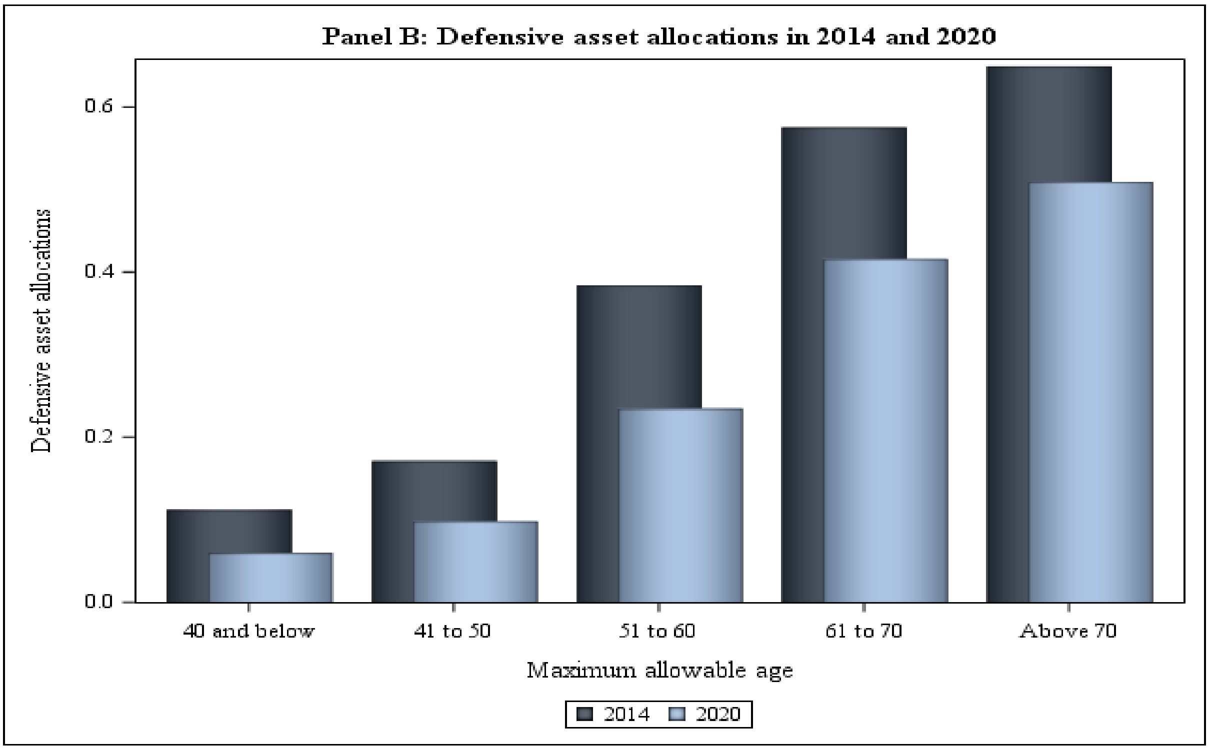
Mao, Mike Qinghao, and Ching H. Wong, 2021, Why have target-date funds performed better in the COVID-19 selloff than the 2008 selloff? *Journal of Banking and Finance, Forthcoming*

Sirri, Erik R., and Peter Tufano, 1998, Costly search and mutual fund flows, *Journal of Finance* 53, 1589–1622.

Figure 1. Time-varying lifecycle fund glide path

This figure reports the average asset allocations of lifecycle funds by the maximum allowable age of investors in 2014 and 2020. Panels A, B, and C presents the allocations in growth assets, defensive assets, and other assets, respectively. Growth assets include listed and unlisted equities, properties, infrastructures, and commodities; defensive assets include cash and fixed income securities; other assets include investments that are not classified as growth or defensive assets, which typically include hedge funds, leased assets, and investments with oversea managers





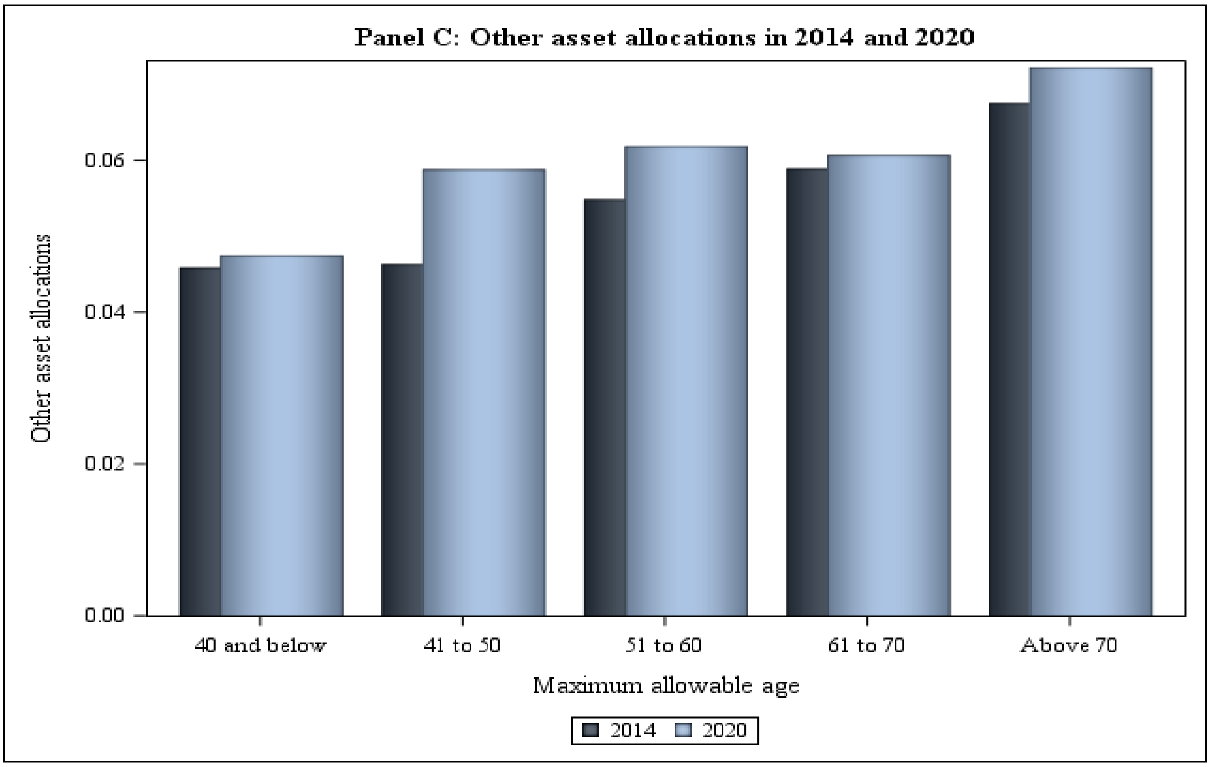
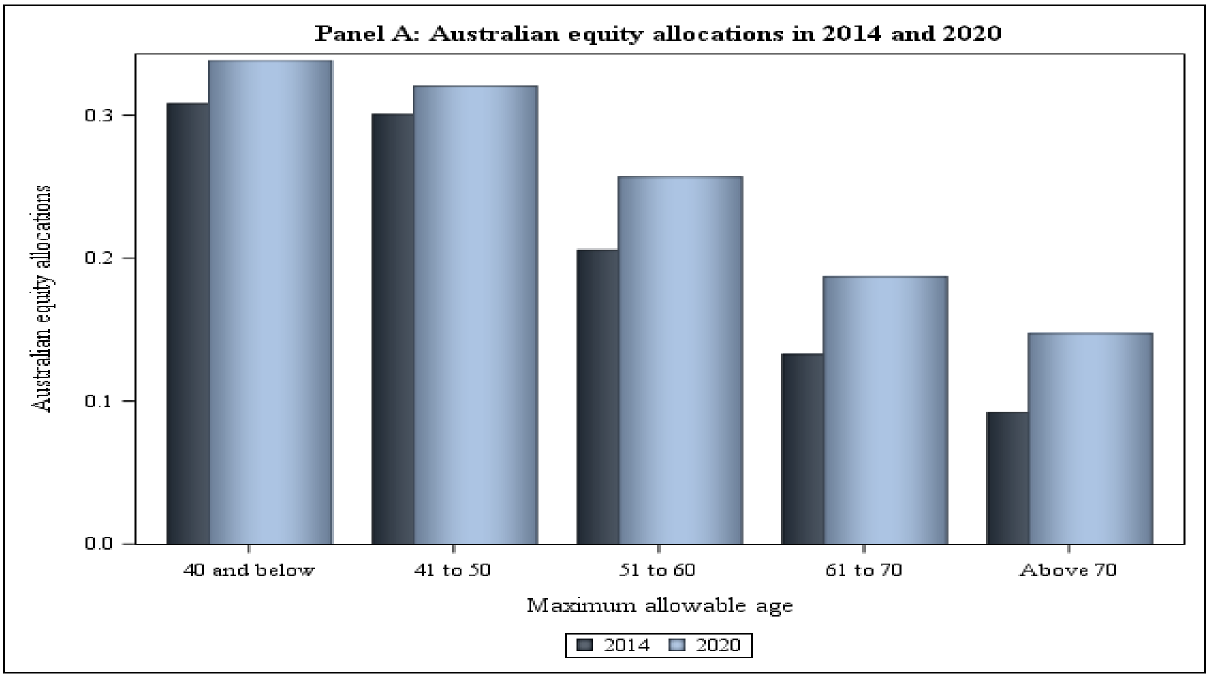
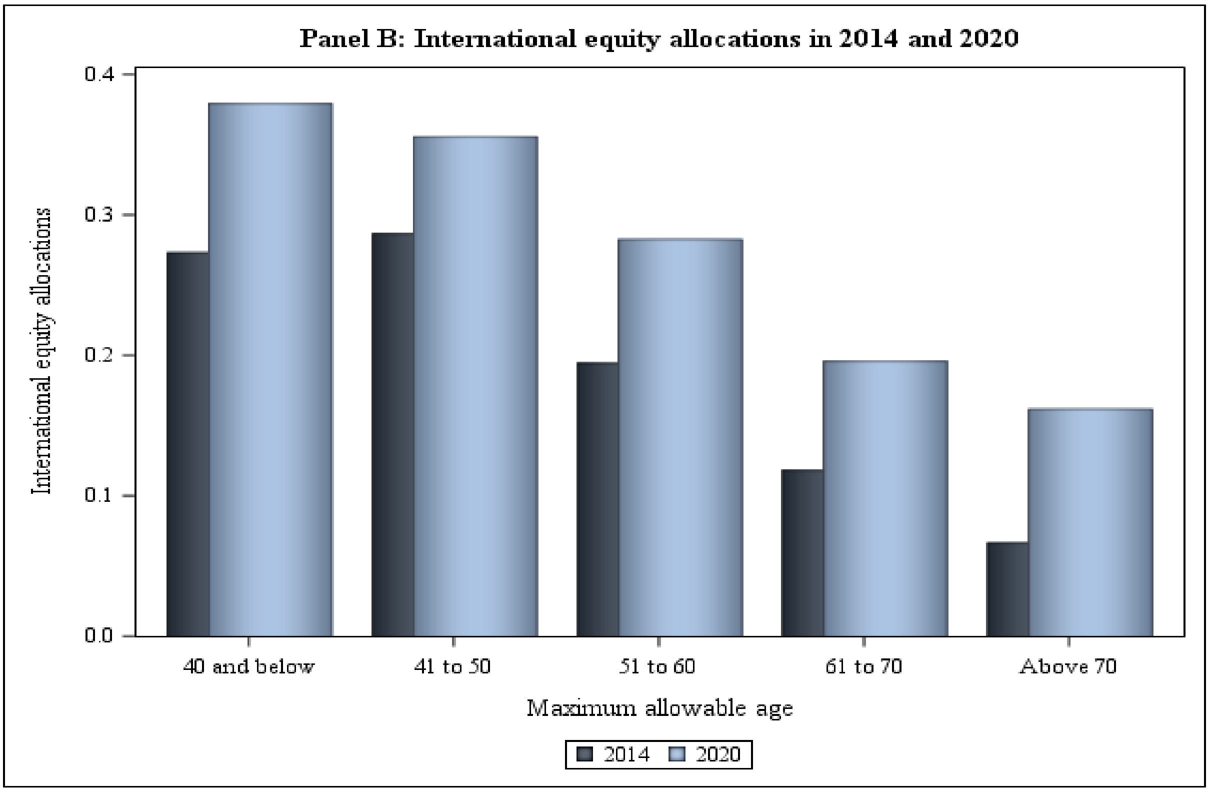

Panel C: Other asset allocations in 2014 and 2020
Other asset allocations
0.06
0.04
0.02
0.00
40 and below
41 to 50
51 to 60
61 to 70
Above 70
Maximum allowable age
2014
2020

Figure 2. Sub-asset class analysis

This figure presents the average asset allocations of lifecycle funds in Australian equities (Panel A), international equities (Panel B), and other growth assets (Panel C) in 2014 and 2020. Other growth assets include investments in unlisted equities, properties, infrastructures, and commodities.





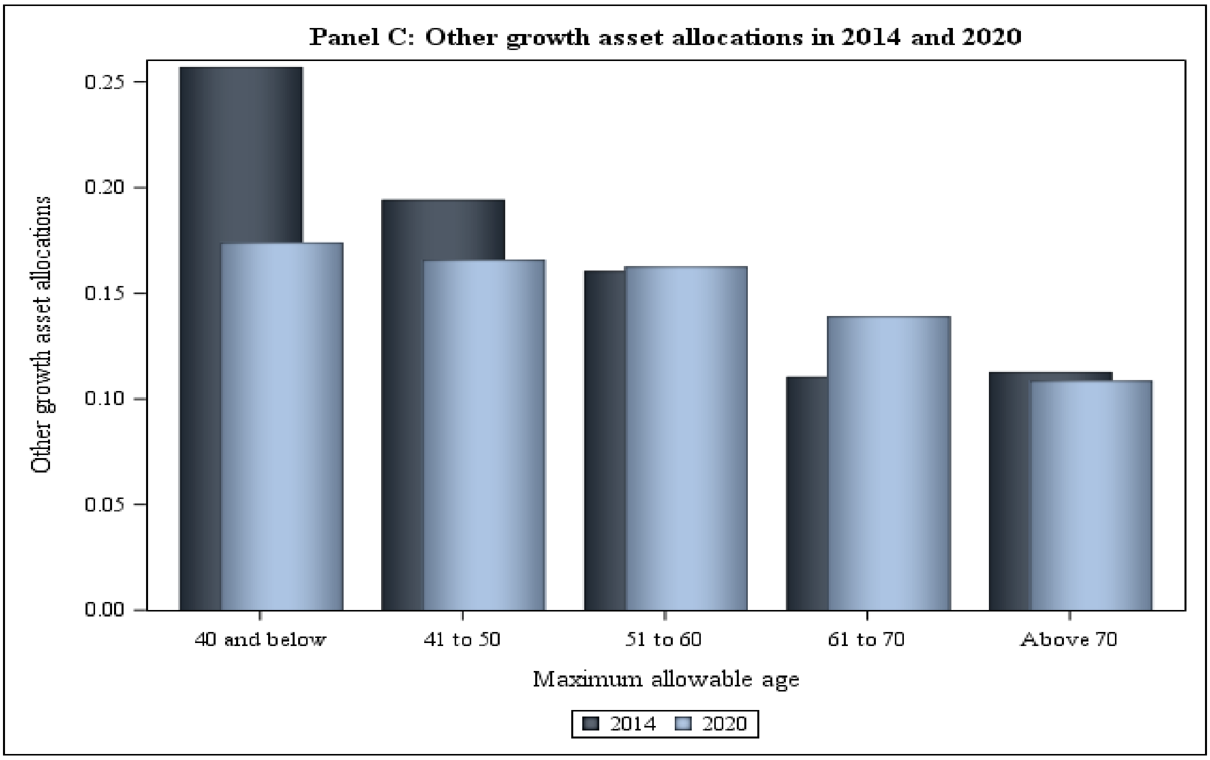

Panel C: Other growth asset allocations in 2014 and 2020
Other growth asset allocations
0.25
0.20
0.15
0.10
0.05
0.00
40 and below
41 to 50
51 to 60
61 to 70
Above 70
Maximum allowable age
2014
2020

Figure 3. Asset allocations of balanced funds

This figure presents the growth asset, defensive asset, and other asset allocations of balanced funds in 2014 and 2020. Our sample contains 97 balanced funds. Growth assets include listed and unlisted equities, properties, infrastructures, and commodities; defensive assets include cash and fixed income securities; other assets include investments that are not classified as growth or defensive assets, which typically include hedge funds, leased assets, and investments with oversea managers

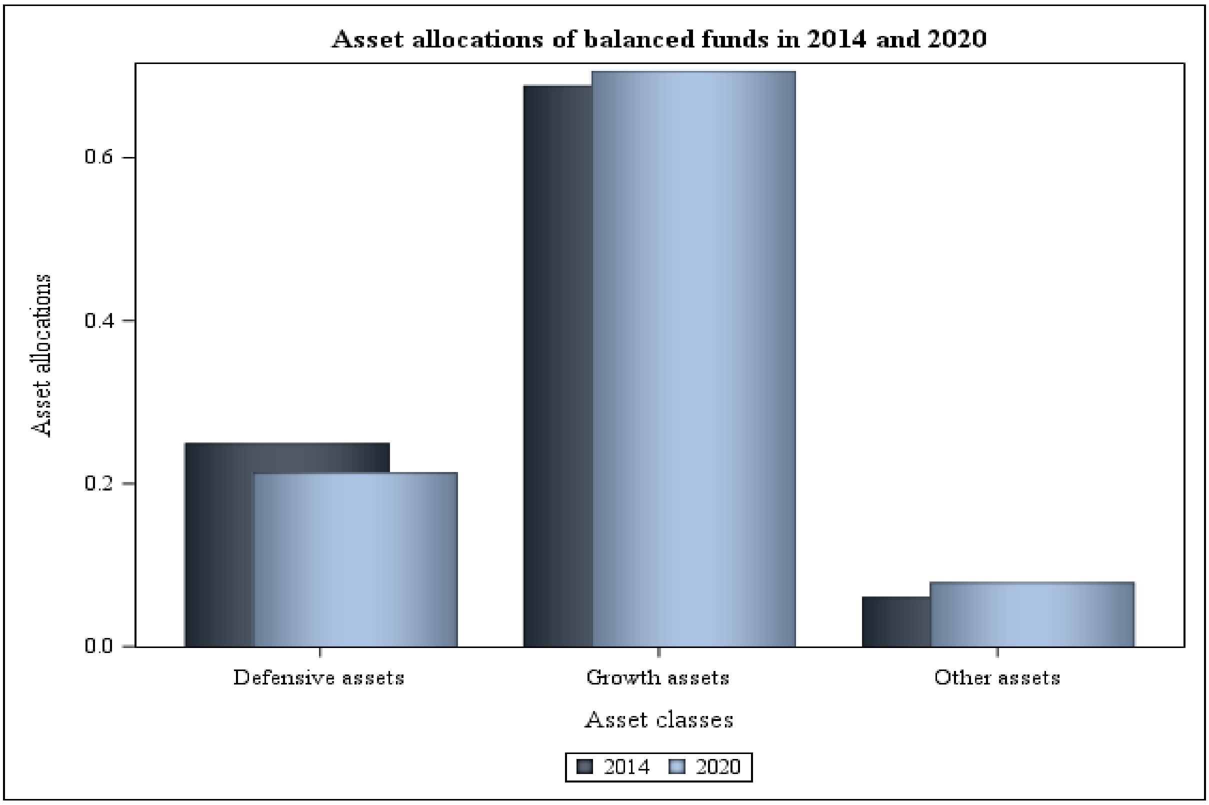


Table 1. Australian MySuper superannuation funds.

This table presents the size of Australian MySuper superannuation funds from 2014 to 2020. Panel A reports the number and total assets under the management of MySuper fund series. Panel B (C) reports the number and total assets under the management of for-profit and not-for-profit lifecycle (balanced) fund series. Our sample includes 32 lifecycle fund series and 103 balanced funds, respectively.

Panel A

	Lifecycle funds		Balanced funds	
	Number	AUM (Billion)	Number	AUM (Billion)
12/31/2014	23	71.25	88	272.35
12/31/2015	24	92.51	86	304.01
12/31/2016	25	121.74	79	353.12
12/31/2017	27	159.03	76	408.91
12/31/2018	26	170.60	67	427.69
12/31/2019	30	228.50	60	488.89
12/31/2020	26	234.30	53	493.12

Panel B

	For-profit lifecycle funds		Not-for-profit lifecycle funds	
	Number	AUM (Billion)	Number	AUM (Billion)
12/31/2014	19	17.01	4	54.24
12/31/2015	19	32.73	5	59.78
12/31/2016	19	51.74	6	70.00
12/31/2017	20	71.13	7	87.90
12/31/2018	18	70.49	8	100.11
12/31/2019	22	109.02	8	119.48
12/31/2020	18	109.65	8	124.65

Panel C

	For-profit balanced funds		Not-for-profit balanced funds	
	Number	AUM (Billion)	Number	AUM (Billion)
12/31/2014	26	9.93	62	262.42
12/31/2015	26	14.31	60	289.70
12/31/2016	21	33.79	58	319.33
12/31/2017	21	38.68	55	370.23
12/31/2018	18	38.30	49	389.40
12/31/2019	16	16.80	44	472.09
12/31/2020	11	11.76	42	481.36

Table 2. Summary statistics

This table reports the mean values of our major variables by the maximum allowable age of investors. Growth assets include equities (both listed and unlisted), commodities, infrastructures, and properties. Defensive assets include cash and fixed income securities. Other assets refer to investments that are not classified as growth or defensive assets, which typically include hedge funds, leased assets, and investments with oversea managers. Investment fees, admin fees, and total fees are presented as a percentage of fund total net assets (TNA). Return is the after-fees quarterly return and flow is the change in fund size, excluding any changes coming from investment return. The sample covers 32 lifecycle MySuper fund series from 2014 to 2020.

	Maximum allowable age				
	Below 41	41 to 50	51 to 60	61 to 70	Above 70
	Portfolio allocations				
Growth assets	0.859	0.812	0.630	0.442	0.367
Listed equities	0.644	0.599	0.448	0.307	0.243
Australian equities	0.319	0.296	0.220	0.155	0.122
International equities	0.323	0.304	0.227	0.152	0.121
Unlisted equities	0.092	0.086	0.061	0.037	0.038
Properties	0.076	0.077	0.070	0.056	0.048
Infrastructures	0.042	0.044	0.048	0.039	0.034
Commodities	0.005	0.004	0.003	0.002	0.002
Defensive assets	0.098	0.140	0.311	0.501	0.572
Cash	0.018	0.028	0.077	0.144	0.179
Fixed income securities	0.080	0.112	0.234	0.358	0.381
Other assets	0.043	0.048	0.060	0.056	0.059
	Other variables				
Investment fees (%)	0.126	0.134	0.141	0.132	0.129
Admin fees (%)	0.154	0.138	0.126	0.142	0.129
Total fees (%)	0.281	0.276	0.270	0.277	0.259
TNA (million)	565.940	919.105	949.961	268.540	396.050
Returns	0.021	0.020	0.017	0.013	0.011
Beta	0.543	0.528	0.385	0.267	0.228
Alpha	0.004	0.005	0.004	0.003	0.003
Flow	0.114	0.052	0.057	0.054	0.054

Table 3. Summary of growth asset allocation changes

This table reports the mean values of variables that measure the changes of growth asset allocations. Δ Growth is the difference between fund i's growth asset allocations in year t and that in year t-1. Decrease_dummy (Increase_dummy) takes the value of one if the growth asset allocation of fund i in year t is smaller (larger) than that in year t-1, or zero otherwise. 5%_decrease (5%_increase) is an indicator variable taking the value of one if the growth asset allocations of fund i reduces (increases) by more than 5% from year t-1 to year t. Δ Growth| Decrease_dummy (Δ Growth| Increase_dummy) refers to the change of growth asset allocations from year t-1 to year t if the Decrease_dummy (Increase_dummy) equals one. Δ Growth| 5%_decrease (Δ Growth| 5%_increase) refers to the magnitude of the growth asset allocation decrease (increase) from year t-1 to year t, given that the decrease (increase) is greater than 5%.

	Entire sample		Member-cohort series		Member-switching series	
Variables	N	Mean	N	Mean	N	Mean
Δ Growth	1056	0.005	542	0.006	454	0.002
Decrease_dummy	1056	0.268	542	0.245	454	0.304
Δ Growth| Decrease_dummy	283	-0.032	133	-0.024	138	-0.040
5%_decrease	1056	0.060	542	0.020	454	0.115
Δ Growth| 5%_decrease	63	-0.064	11	-0.064	52	-0.064
Increase_dummy	1056	0.260	542	0.244	454	0.236
Δ Growth| Increase_dummy	275	0.051	132	0.047	107	0.060
5%_increase	1056	0.096	542	0.103	454	0.077
Δ Growth| 5%_increase	101	0.101	56	0.078	35	0.144

Table 4. Flow-performance relationship

This table presents the results of the flow-performance regressions. The dependent variable and independent variable of interest are fund flow in quarter-t and performance measures in quarter- t-1, respectively. Performance measures include one quarter lagged returns and alphas, and one year lagged returns. Other control variables include lagged fund fees and size. All regressions control for age-group by time fixed effects. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Flow	Flow	Flow	Flow
Lag 1 Quarter return	0.498***			0.669***
	(0.160)			(0.210)
Lag 1 Year Return		0.409***		
		(0.118)		
Lag 1 Quarter Alpha			0.375	0.367
			(1.498)	(1.499)
Lag Fund Flow	0.084**	0.046	0.008	0.005
	(0.036)	(0.043)	(0.037)	(0.037)
Log (TNA)	-0.015***	-0.017***	-0.014***	-0.014***
	(0.003)	(0.003)	(0.003)	(0.003)
Total Fees	0.105	0.089	0.078	0.087
	(0.100)	(0.091)	(0.088)	(0.091)
Age_group by time fixed effect	Yes	Yes	Yes	Yes
N	4596	4045	2847	2847
R-squared	0.15	0.15	0.13	0.14

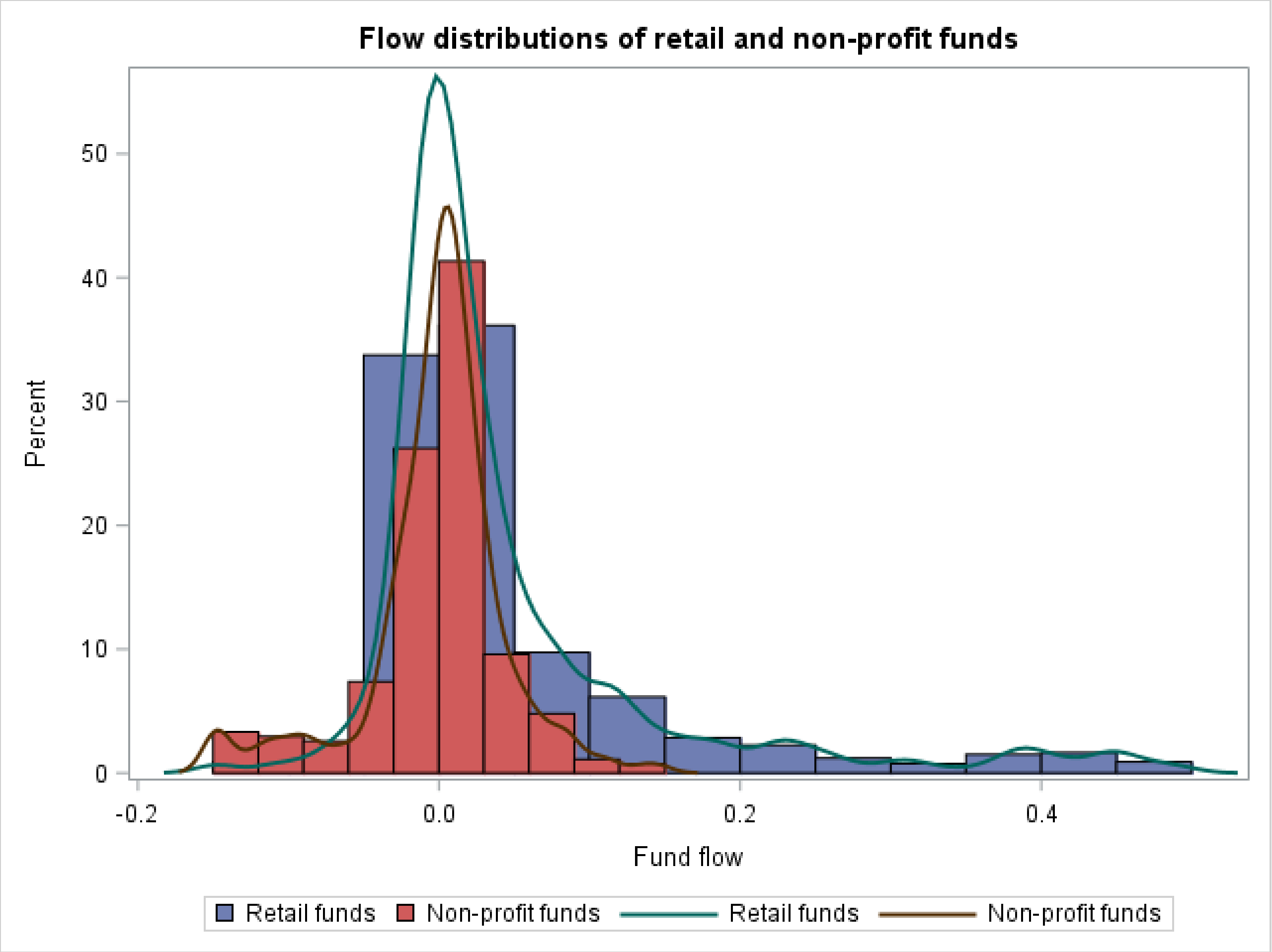
Table 5. Cross-sectional comparison

This table presents the results of the regressions that investigate the relationship between the level and change of lifecycle funds' portfolio allocations. The dependent variables are changes of fund allocations in growth assets, Australian equities, international equities, and other growth assets from year t-1 to t. The independent variable of interest is the level of the corresponding asset allocation in year t-1. Controls include total fees, return, flow, and total net asset (TNA). The sample covers 32 lifecycle fund series from 2014 to 2020. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)
	Δ Growth	Δ Australian equities	Δ International equities	Δ Other growth
Growth (t-1)	-0.078***			
	(0.015)			
Australian equities (t-1)		-0.078***		
		(0.017)		
International equities (t-1)			-0.199***	
			(0.029)	
Other equities (t-1)				-0.099***
				(0.021)
Total fees	-0.085***	-0.043**	-0.023	0.000
	(0.023)	(0.017)	(0.028)	(0.030)
Return	-0.106*	-0.091**	-0.530***	0.573***
	(0.062)	(0.041)	(0.126)	(0.158)
Flow	-0.000	-0.001	0.006***	-0.006*
	(0.002)	(0.001)	(0.002)	(0.003)
Log (TNA)	0.002**	0.001	0.005***	-0.003**
	(0.001)	(0.000)	(0.001)	(0.001)
Age_group by time fixed effects	Yes	Yes	Yes	Yes
Observations	763	763	763	763
R-squared	0.19	0.14	0.24	0.22

Appendix 1. Fund flow of for-profit funds and non-profit funds

This figure presents the fund flow distributions of for-profit and non-profit funds. To avoid large outflow due to withdrawal by retiree, we only include funds with *Max_age* between 40 and 50. We also exclude observations with quarterly fund flow greater than 50% for better graphical presentation. These observations constitute less than 5% of the total sample.



Appendix 2. Comparing for-profit and non-profit lifecycle funds

This table presents the univariate comparison of for-profit and non-profit TDFs. Observations are sorted into eight groups based on *Max_age* and all variables are demeaned within each group. This procedure is equivalent to adding age_group dummies in a regression setting. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)
	For-profit funds	Non-profit funds	Difference
Equity	0.012	-0.027	0.038***
Fixed income	0.021	-0.047	0.068***
Cash	0.008	-0.017	0.025***
Commodity	-0.001	0.001	-0.002***
Infrastructure	-0.014	0.030	-0.044***
Property	-0.007	0.016	-0.023***
Others	-0.017	0.039	-0.056***
Investment fees (%)	-0.023	0.051	-0.074***
Admin fees (%)	0.021	-0.047	0.068***
Total fees (%)	-0.001	0.001	-0.002
TNA (million)	-290.192	647.655	-937.847***
Returns	0.000	0.000	0.000
Flow	0.013	-0.029	0.042***
Alpha	0.000	0.001	-0.001***
Beta	0.016	-0.036	0.052***