Dynamic switching behaviour of asset classes of Australian Superannuation investment options.

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Abstract

We assess the switching behaviour of asset classes across four broad investment options of Australian superannuation funds over a monthly sample period of 28 years, from January 1990 to December 2017 across different fund size. We identify the most prominent asset class which contributes to the performance of the investment options and what factors triggers the switch in the investment options. We find that the smaller funds tend to be more active in switching to aggressive options and the larger funds are more conservative since they are mostly in the balanced option. However, in period of volatility, the large fund are the risk seekers and tend to switch their asset classes and hence their investment strategies. The asset classes which value add to the performance of the investment options is the equity market and bonds markets, however, domestic equity market seems to add more value to the returns as compared to the international equity market. Overall, investment in the real estate does not add value to the returns of the investment options and this is the case across all fund size. We equally conclude that the main factor which drives the switch for the larger funds is the volatility of the equity markets (both domestic and international markets).

JEL classification:

Keywords: Superannuation investment stratifies, asset allocation, switching, performance

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1. Introduction

Using a sample of 28 years, ranging from January 1990 to December 2017 and including 1220 investment options from various Australian pension funds (hereafter referred as superannuation funds), the objective of our analysis is to assess the monthly dynamic switching of asset allocation across the investment options held by superannuation funds. We extend our analysis to consider the different fund size, that is we consider the weighted proportion of assets held based of fund size .In particular, we focus on the following research questions: (i) What is the likelihood that superannuation funds switch from one investment strategy to another and how long do they stay in one specific strategy?, (ii) which asset classes has the most significant contribution to the performance of the investment strategy?, and (iii) what factors impacts on the superannuation decisions to switch from one investment options to another one?.

Assessing the investment strategy and asset classes of Australian superannuation funds is of importance given that the Australia superannuation fund industry accounts for $2.6 trillion[2] of assets and hence the way in which these assets are invested has a significant influence on the final benefits to its members. The motivation of this study, hence stems from the challenges that the Australian superannuation system is faced with, for instance longevity risk, low balance of retirement income, among others. We assess the drivers of investment returns over a long period of time and how investment strategies seem to have shifted over the years and includes a variety of asset classes that superannuation funds invest in. From a market perspective, while market timing or the investments an investor picks can be argued to be the determinants of portfolio success, the most important determinant is asset allocation,[3] that is how we construct

[2] https://www.apra.gov.au/media-centre/media-releases/apra-releases-superannuation-statistics-march-2018
[3] See Australian Financial Review, Dec 2018, https://www.afr.com/personal-finance/superannuation-and-smsfs/get-asset-allocation-right-and-your-portfolio-will-look-after-itself-20181217-h197oe

a portfolio is the most important factor. Superannuation funds in Australia provide investors with various ways in which their superannuation balance can be invested. For instance, they can offer broad investment strategies, which include labels like conservative, balanced, growth or they can simply provide investors with a variety of asset classes. Hence, it becomes very important to assess the asset allocation of the superfunds as they are the key drivers of the investment returns which help the investor build on the retirement nest- egg. Over the recent years, it has become more necessary to review the investment returns, even in the case of the most well-diversified multi-asset portfolios, given that we have had significant periods of volatility in terms of the financial market crises as well as in the current market conditions where we have non-conventional monetary policy and a low yield environment.

Further, over the years, the Australian Superannuation fund industry has expanded the investment beyond the domestic barriers and are known for active investment. The types of investments that a super fund can invest in include nearly an unlimited range of assets and asset classes including shares – both Australian shares and international shares. Australian shares often pay franked dividends and generate franking credits. International shares can be hedged or unhedged, which means that movements in the Australian dollar when investing overseas can be considered (hedged) or not considered (unhedged). Other types of investments in superannuation include cash, term deposits and other fixed interest investments such as Australian bonds and international bonds (including corporate bonds). Superannuation funds can invest in infrastructure investments both in Australia and internationally, private equity and invest via hedge funds. Superannuation funds can invest in listed property investment and direct property. With the variety of assets classes which are on offer in the market and with the different valuations reported, the need for proper assessment of asset allocation to generate better returns is of increasing importance and requires further investigation. Hence in this study, we focus on the historical monthly asset allocation of Australian superannuation funds and

assess the dynamic tactical asset allocation and the switching pattern across different superannuation fund size.

The importance of tactical asset allocation has been highlighted in the literature mostly for the large pension funds. Brinson, Hood and Beebower (1986) are among the first studies which analyse the importance of asset allocation in a portfolio. They use data from 91 large US pension plans over 1974-1983 and found that investment policy (the selection of asset classes and their normal weights) dominated investment strategy and explains "explaining on average 93.6 per cent of the variation in total return, although investment strategy can result in significant returns, these are dwarfed by the return contribution from investment policy,". These results have been further confirmed by Brinson, Singer and Beebower (1991). A recent study by Vanguard (2017) titled "The global case for strategic asset allocation and an examination of home bias", confirms that funds in US, Canada, UK, Australia and Japan were "proportionally much the same in the degree to which asset allocation was found to explain return variability over time and the dispersion of returns across funds. In the Australian literature, there are only a few studies which investigate the asset allocation of superannuation funds

Benson, Gallagher and Teodorowski (2007) analyzed the asset allocation strategies within the Australian equities, fixed interest and listed property classes of funds and concluded that there is significant 'momentum investing' undertaken by fund managers. There are a few papers which look into the question of market timing, for example, Sinclair (1990) evaluated market timing and stock selection for Australian pooled superannuation funds invested in multiple asset classes; Gallagher (2001) assess the market timing and security selection capabilities of Australian pooled superannuation funds over 8 years from January 1991 to December 1998 and evaluates the performance for the three largest asset classes within

diversified superannuation funds and their contribution to overall portfolio return. He concludes that that Australian pooled superannuation funds do not exhibit significantly positive security selection or market timing skill. Other US based studies find that the performance of the fund is very important for the investment choice of members, see for example, Sirri and Tufano (1998), Goetzmann and Peles (1996) and Lynch and Musto (2003). In the Australian context, Gharghori, Sujoto, and Veeraraghavan (2008) found little evidence that Australian investors can identify high performing superannuation funds. Further, Faff, Gallagher and Wu (2005), using a sample of 135 months, assess the tactical asset allocation of Australian superannuation funds. They conclude that active managers have been unable to deliver investors with superior returns through tactical asset allocation. The most value enhancing asset class is domestic equities and international shares and domestic fixed interest does not rally add value to fund performance They equally suggest that the factors that affect changes in asset allocation is mainly domestic equities.

While Faff, Gallagher and Wu (2005) look into the asset classes and their contribution to the performance of funds, our study is different in that we focus on an extended period of time which includes the Global Financial Crisis(GFC) and also a period where the Australian superannuation fund has had significant growth in size. The GFC has had a significant impact on the Australian superannuation returns. Gerrans (2012) assessed the behaviour of investors over the GFC period across five superannuation funds. He concludes that an overwhelming number of investors did not change their investment strategy in response to the crisis. Further, Gerrans, Faff, and Hartnett (2015) tested the individual financial risk tolerance during the crisis using a risk tolerance survey. The results showed that the crisis had an impact on the investors, however, the results were inconclusive in terms of how the crisis has an impact on asset allocation decisions. Hence our contribution to the Australian superannuation literature can be summarised as follows; (1) we assess the switching behaviour across asset classes of Australian

superannuation investment options by defining four broad categories of investment options namely, aggressive, growth, balanced and conservative options; (2) we extend the period of analysis to assess how period of volatility, like the GFC, impacts on the switching behaviour across asset classes by using 336 months of asset allocation; (3) we extend our analysis by further considering the switching behaviour across fund size, that is we consider the weighted proportion of growth and defensive asset across fund size (it should highlighted that most portfolio determinants studies focus only on large funds); (4) we assess what are the most prominent asset class which contribute to the performance of the investment options; and finally (5) we assess the factors that drives the switch in asset classes, hence the switch in investment options.

Our key results can be summarised as follows: (1) the smaller funds tend to be more active in switching to aggressive options and they tend to be more active during stable periods, however they look passive during the GFC; (2) the larger funds are more conservative since they are mostly in the balanced option. In contrast to the smaller funds, they tend to be more active in volatile periods when switching between balanced and growth options and have a passive asset allocation during stable periods; (3) the asset classes which value add to the performance of the investment options is the equity market and bonds markets, however, domestic equity market seems to add more value to the returns as compared to the international equity market-overall, investment in the real estate/property does not add value to the returns of the investment options and this is the case across all fund size; (4) the main factor which drives the switch for the larger funds is the volatility of the equity markets (both domestic and international markets).

The remainder of this paper is structured as follows. Section 2 describes the data employed. Section 3 outlines the empirical framework and section 4 details the results of the analysis for the switching patterns across funds sizes over time, the performance of the investment options

and the factors that affect the switch across the investment option. The final section concludes the paper.

2. Data

The data in this paper is sourced from the Morningstar Direct database. The sample is 28 years, ranging from January 1990 to December 2017(336 months of data), and the original sample consists of 1220 investment options from various Australian superannuation funds. A brief explanation of the data is as follows: the data provide details of the investment options held by the superannuation funds (e.g., Retail Employees Superannuation Pty Ltd- REST Super). We obtain the monthly percentage of asset allocation across the asset classes for the thirteen investment options[4] that REST Super has. For each of the 13 investment options for REST Super, we have access to the percentage allocated to the following asset classes; cash, domestic and international shares, domestic and international fixed income securities, as well as listed (domestic and international) listed and unlisted property on a monthly basis for the 28 years. For REST Superannuation, we therefore can assess the historical changes in percentage as to when the investment managers change allocation across each of the asset classes over time on a monthly basis.

The objective of this study is to assess the dynamic switching of asset allocation across the investment options held by the superannuation funds. However, with the variety of labels used across the sample of 1220 investment options, in order to bring in some uniformity in the labels used to classify the investment options, we re-define the investment options to only four mostly widely used labels in the market. Our data enables us this classification given we have the historical monthly asset allocation for each of the investment options for each of the

[4] REST Superannuation has the following investment options: REST Super Australian Shares, REST Super Balanced; REST Super Basic Cash; REST Super Bond; REST Super Capital Stable; REST Super Cash; REST Super Cash Plus; REST Super Core Strategy; REST Super Diversified; REST Super High Growth; REST Super Overseas Shares; REST Super Property; REST Super Shares

superannuation funds. To re-classify the investment option, we follow the classification provided by the Australian Securities and Investment Commission (ASIC) and classify the assets in terms of the percentage of the weighted average growth asset they hold on a monthly basis[5]. In order to work out the weighted average growth assets for each investment options, we first classify the asset classes into defensive and growth assets. The defensive assets include cash and fixed income securities (domestic and international). The growth assets that we consider include, shares (domestic and international) and property (both listed and unlisted). Australian superannuation funds provide investors with a variety of investment options that can suit the investment profiles of investors, including a mixture of growth assets up to a 'high growth option', where investors have the option of investing up to 100% in growth assets, such as shares and property. Further, our data allows us to focus on the time-varying switching behaviour of the investment strategies. Hence, we aggregate the percentage of growth assets in one time- varying categorical value of s_t . Each value of s_t represents one broader investment option. Hence following the classification of ASIC, effectively, therefore, $s_t = \{1,2,3,4\}$ for each of the labels we use. The aggressive option (also known as high growth), s_t =1, where the percentage of growth asset is between 85-100 %; in the growth option, s_t =2, where the percentage in growth assets is between 71-84 % (and the rest in defensive assets); the balanced option, where s_t=3, , where the percentage in growth assets is between 31-70 % (and the rest in defensive assets); and the conservative option, s_t= 4, the percentage of growth asset is between 1 and 30%(and the rest in defensive assets).

We enhance our analysis by considering not only the percentage of growth but rather the aggregated investment strategy of all Australian Super Fund, s_t, based on the weighted proportion of growth asset using fund size. Morningstar Direct equally provides information

[5]See: https://www.moneysmart.gov.au/superannuation-and-retirement/how-super-works/super-investment-options

on the fund size. The total assets value is obtained for the period January 1990 to December 2017 for each of the Superfunds. For instance, for REST Super, we have the total assets for the fund on a monthly for the sample period. Cummings (2016) examines the relationship between fund size and performance for superannuation industry sectors in Australia. He suggests that members benefit more from larger superannuation funds for three reasons: (i) larger funds provide more diversification as they have a wider asset class base, (ii) larger funds avoid the scale diseconomies in investment returns documented in studies of equity mutual funds and (iii) larger funds can spread fixed operating costs over a larger asset base. As such in our analysis, we assess the dynamic switching behaviour of investment options using the weighted proportion of growth assets using fund size to be able to assess if there is a difference between the smaller and larger fund in the pattern of switching across investment options over time. Table 1 provides the summary statistics of the quintiles (Q1 to Q5) based on the monthly total assets of the funds (the figures are in thousands). The smallest quintile, Q1, range from $ 58000 which is for Suncorp Group Ltd as of December 2016 to a maximum of $ 11,799,999,000 for AMP group (total assets as at November 2013). The average total assets for quintile 1, the smaller funds, is $1,601,698,000. The largest total asset base in the fifth quintile, Q5 is $ 98,392,478,687,000 which is for the month December 2017 for Australian Super. The average total asset for the large funds is $ 1,421,546,890,000.

We calculate the value-weighted proportion of growth asset using fund size using the following formula

$$Proportion\ of\ Growth\ Asset_t = \frac{\sum_{f=1}^{N} Fund\ Size_{f,t} \times Proportion\ of\ Growth\ Asset_{f,t}}{\sum_{f=1}^{N} Fund\ Size_{f,t}} \qquad (1)$$

We classify the investment options in the four labels highlighted earlier by using the weighted proportion of growth assets relative to the fund size. Figure 1 shows the proportion of weighted average growth assets across the five quintile and Figure 2 shows the investment

options of the superannuation's funds over time. It should be noted that s_t=1 represents the Aggressive options and s_t = 4 represent the conservative option. Both figures indicate that the smaller funds, in Q1, tend to be more active in switching to the aggressive options and they are more active in a relatively stable period. In contrast they seem to be quite passive in volatile period for example, the global financial crisis (GFC) 2007-2009. The larger funds in quintile 5, Q5 indicate that they are more conservative given they are mainly in the balanced option, s_t=3. In contrast to the smaller funds, in volatile periods, that is the period leading to the GFC and up to 2010, (see Figure 2), they tend to be more active and switch from balanced option to more growth options, s_t = 2, but otherwise they have a more stable strategy during the stable periods. We equally provide some further summary statistics, in table 2, on the weighted proportion of growth assets in each quintile as well the corresponding weighted average returns. We obtain the monthly price index for each of the investment options from which we can derive the weighted average return across each quintile. Table 2 supports the figures presented earlier with the monthly weighted average growth percentage as highest in Q1 at 75.63% compared to an average of 62.88% for the larger fund. The corresponding monthly weighted average returns also reflect the higher level of risk by holding more in growth asset with the mean of 0.58% for the smaller size funds in Q1 and a mean of 0.53% for the larger size funds in Q5.

3. Modelling Framework

The preliminary analysis of the data discussed in section 2 provides us with some indication on the behaviour of Australian superfunds across the four investment options. To further investigate the likelihood that superannuation funds remain in an investment strategy over the sample period and how long do they stay in that specific strategy, we calculate the duration and the probability that the overall Australian superannuation industry stays in each of the investment options:

$$Average\ duration\ (s_t = m) = \frac{\sum_{d=1}^{D_m} Duration_d\ (s_t=m)}{D_m} \quad (2)$$

$$Probability\ (s_t = m) = \frac{\sum_{t=1}^{T} I\ (s_t=m)}{T} \quad (3)$$

where m denotes the investment options (i.e., m can be 1, 2, 3 and 4 corresponding to aggressive, growth, balance and conservative options), D_m is number of time that the overall Australian super industry switches to the investment option m. Duration is measured in months.

In addition, we investigate the probability that Australian super funds switch from one investment option to another option by constructing the transition probabilities among options as follows:

$$p_{i,j} = \frac{n_{i,j}}{\sum_{m=1}^{4} n_{i,m}} \quad (4)$$

where, $p_{i,j} = Probability(s_{t+1} = j | s_t = i)$, that is, probability that super funds switch their investment from strategy *i* at time *t* to strategy *j* at time *t+1*. $n_{i,j}$ is number of times that super funds switch their investment strategy *i* to *j*.

In our next analysis, we assess how market conditions affect the performance of superfunds in each investment options across the different quintiles. The performance of the Australian superfunds is largely affected by the performance of the asset classes that they invest in. The objective of any superfund is to be able to maintain the return that they are providing to its members and hence the Australian superfund invest largely in shares (domestic and international), bonds (domestic and international) as well as they invest largely in infrastructure and unlisted property to achieve their goal of stable flow to investors. Hence, some common factors that affect the returns include the Australian equities, international equities, Australian Bonds and property among others. We therefore employ the observable Markov Regime Switching model specified as followed,

$$r_t = \varphi_{(s_t)} + \beta'_{(s_t)} X_t + \varepsilon_t \qquad \varepsilon_t \sim N(0, \sigma^2_{(s_t)}) \quad (5)$$

where, r_t is the value-weighted return of Australian super funds at time t. X_t is a vector of explanatory variables that represents market conditions affecting the super funds' performance. X_t includes the price changes of market indices representing asset classes that Australian fund invested in. In our study we use the ASX all ordinaries index, the MSCI world index, the Australia 10-year government bond index, and the Australian house price index to characterize the domestic equity, international equity, domestic bond and domestic property market, respectively. We obtain the Australian house price index data provided by CoreLogic via the Securities Industry Research Centre of Asia Pacific (SIRCA) platform, while other indices are collected from Datastream. We present the summary statistics of the control variables in Table 3. Hence, in our model, we allow for all parameters (including the variation of error term, σ) are regime dependent. That is, effect of market conditions on superannuation funds performance are different among investment options. This follows economic intuition, which indicates the sensitivity of different investment strategies to changes in market conditions are different due to their different level of risks.

In addition to the markets' impacts on performance of superfunds, it is also important to understand how the market conditions affect the funds' decisions to rebalance their portfolio. Following this understandings, policy makers and investors can foresee reactions of the superfunds given a change in the market conditions. It is intuitive to conjecture that not only changes in market performance but also the changes in risk level of the market can affect the superfunds' decisions on portfolio rebalancing. In the next analysis, therefore, we explore the marginal impact of market conditions (including both return and risk aspects) on the probability that super funds will stay in an investment option. Given that most of observable investment options are in the balanced option and the growth investment option across the different quintile, we model the probability that the fund will stay in these two options using a probit model, which can be specified as follows

$$\Pr(s_t = m) = \Phi(\alpha_m + \theta'_m Z_t) \qquad (6)$$

where Z_t is the vector of explanatory variables that collect all proxies of market performance included in X_t as well as the risk level of corresponding markets considered in Eq. (5). To proxy the time-varying risk level of a market *i*, we estimate conditional volatilities extracted from AR(1) - GARCH(1, 1) model proposed by Bollerslev (1986) as follows[6]:

$$\begin{cases} r_{it} = \varphi_i + r_{it-1} + \epsilon_{it} & \epsilon_{it} \sim iid\ (0, \sigma_{it}) \\ \sigma_{it} = \alpha_i \sigma_{it-1} + \beta_i \epsilon_{it-1} \end{cases} \qquad (7)$$

By using the probit model shown in Eq. (6), θ_m represents the marginal impact of market conditions on the probability of the superfunds will stay in the investment strategy *m*. In our model (6), we hence consider the two observable states, $s_t = 2$, (growth options) and $s_t = 3$, (balanced option) due to the majority of the observations in these two options as discussed earlier.

4. Results and Discussion

4.1 Switching behaviour across find size.

We start our analysis by considering the switching behaviour across the different investment strategies for the different fund size. As highlighted in the previous section, we do a quintile analysis. We calculate the duration and probability that the superannuation funds stayed in each of the investment options using equation (2) and equation (3) as detailed in the data section. Table 4 reports the duration and the probability that the superannuation fund stayed in each of the investment option. Panel A reports the total duration in months for each

[6] The optimal lag order is determined by the smallest Akaike Information Criteria, which also passes the serial correlation test for the error term indicating that the models are well specified.

investment options across each of the quintile (Q1 indicating the smallest funds and Q5 the largest), panel B reports the average duration and panel C provide the probability that each of the superannuation stayed in each of the investment option.

Overall, the three panel confirms our observations from Figures 1 and Figure 2. Over the total sample period, panel A indicate that smaller funds represented by quintile 1 and quintile 2 (Q1- average total assets- $ 1,601,698 and Q2 average total assets -$9,035,467), have a more aggressive strategy, with the smallest funds having assets held in the growth strategy for 253 months out of the 336 months and funds in quintile 2 having investment held on the growth option for 230 months. . In contrast the medium to largest funds, quintile 3 to quintile 5 (quintile 3 with average total assets at $ 27,426,107 and quintile 5 with an average total asset at $ 1,421,546,890) hold assets in the growth option for 132 months down to 42 months out of the whole sample. The largest funds seem to hold the investment mostly on the balanced option for most of the time. The medium sized funds, in quintile 3, tend to hold their investment in the balance investment option for 204 months and the largest superannuation funds tend to hold it for at least 291 months in the balanced option. Panel B and panel C further confirms these observations with the average duration in the growth investment option is higher for quintile 1 and quintile 2 at 12.65 and 15.33 and for the largest funds in quintile 5, the largest average duration at 32.33 for the balanced option. The probability that the largest funds will stay in the balance investment option is at 86.6 per cent, while the probability that the smallest fund in quintile 1 will stay in the growth option is at 75.3 percent.

We further calculate the transition probability using equation (4) and the results are reported in Table 5. Table 5 shows the probability that the Australian Superannuation fund switches from the row option in month t to the column option in month t+1. Panel A and Panel B reports the probabilities that the smaller funds will switch their investment strategy monthly. The results here indicate that smaller fund tend to hold more assets in the growth option. In quintile

1, the probability that it will small funds will stay in the growth option is 92.5 percent(Q1) and 93.9% (Q2). For the smaller funds, in quintile 1, the probability that the smaller fund will switch from a balanced option in month t to a growth option in month t+1 is at 22 per cent (in Q2, probability is 12.7 percent). The results of panel E shows the results of the larger funds. Larger funds seem once again to hold most of the investment options in the balanced option with a probability that it will stay in the balanced option at 97.2 percent. The larger fund do not seem to be as volatile as the smaller funds and this is further shown by the probability that a large superannuation fund in a balanced investment option in month t will change its investment strategy to a growth option in the following month, is at 2.8 percent. Panel A and Panel B shows that the smaller funds are more active in the switch in the investment strategy from one month to another. Based on these tables and the figures reported in the previous section , we therefore conclude that (1) the smaller funds tend to be more active in switching to aggressive options and they tend to be more active during stable periods, however they look passive during the GFC(figures 1 and 2) ; (2) the larger funds are more conservative since they are mostly in the balanced option. In contrast to the smaller funds, they tend to be more active in volatile periods when switching between balanced and growth options and have a passive asset allocation during stable periods.

Our results here draw attention to the ongoing debate on active versus passive style of investment. The smaller superannuation funds tend to have a more active style as they are seeking to outperform and get provide a better return. They do so on the ground that if their investment decisions are successful, this can significantly boost the value of the fund. The smaller funds tend to take advantage of the fact that the dominant and concentrated Australian that is the banking and resources sector. The smaller superannuation funds try to add value by taking advantage of the volatile nature of the equity markets and hence focus largely on the equity markets. In contrast, in crisis periods for example, the GFC, and other extreme volatile

periods as shown in our results, the smaller funds tend to be holding off the active switching of asset class as in the volatile period, they can possibly end up with too many decisions which can be risky and unsuccessful, this can have an adverse impact on the value of the superannuation pension fund.

In contrast, the larger funds, with a much larger asset base tend to be more passive and have a stable investment stagy with most of the large funds having a balanced investment strategy over the sample period. Passive strategies involve mainly the replication of a particular index with the objective to match the index return. Recently, it has been reported[7] that in Australia "around 12 per cent of all funds under management in Australia were invested in index funds a decade ago. Now it is almost double that amount, with more than 20 per cent (in excess of $400 billion) invested in funds that track an index, such as the ASX 100, or the ASX 300". Further it has been highlighted that " it's not too far-fetched to say that around 50 per cent – or $1 trillion – of Australia's superannuation savings is following an index, whether explicitly or otherwise, and the other $1 trillion that is being actively managed is under threat." The large superannuation funds in Australia were mostly affected by the GFC and has had a significant impact on the superannuation funds long term investment strategies and asset allocation, see (OECD report, 2015). Importantly, this has promoted increased focus on proper risk management and on less risky investment strategies. However, in periods of volatility in the market, the large superannuation funds seem to be switching the investment strategy as with the large asset base they have they can afford to take advantage of the risk with a view to benefit from the volatility and hence an active approach to investing makes sense in volatile, unpredictable markets for these large funds. With the large asset base that these funds have

[7] See Australian Financial Review: Active vs passive investing: There may be a message in the very long-term picture : https://www.afr.com/business/banking-and-finance/investment-banking/karen-maley-on-the-active-v-passive-investment-20170427-gvu39r

invested largely in other assets in addition to the equity and bond markets and hence they still get the benefits of diversification.

4.2 Impact of asset classes on performance of investment strategies.

Our next research question in this paper is to assess which asset classes has the most significant contribution to the performance of the investment options of the superannuation fund. We obtain the monthly price index for all the investment options in this study and calculate the return. We assess to what extent changes in tactical asset allocation impacts on the performance of the investment options. The strategic asset allocation is reviewed for most superannuation on average every three to five years where the funds consider the expected returns, variances and co-variance of asset classes, see for example, Campbell and Viceria (2002). However, as investment opportunities changes over time, it becomes very important to assess the tactical asset allocation, that is the switch in the asset classes that will reduce the deviation from any long term expected return, see for example, Barberis (2000), Pastor and Stambaugh (2001). In the Australian context, traditionally under the defined benefit scheme, the superannuation funds have been investing largely in the equity and bond markets. With the shift to defined contribution over the years, there has been a shift from the traditional asset classes to investment in alternative asset classes. Further, with the recent non-conventional low- yield economic climate, in order to maximise returns, the superannuation funds have been increasingly investing in properly and infrastructure. The main advantage of non-traditional investments is it can increase the diversification level and provide a more efficient investment mechanism for gaining exposure to certain assets and thereby allowing for improvement in the risk adjusted return of an investment portfolio. The Australian Superannuation funds hold investment in both listed and unlisted property, which his considered as a long term investment

which aligns with the longer term investment horizon of investors. Superannuation funds in Australia invest in property given that it includes an income component from rents and capital growth from increases in valuations. While property is less liquid than other assets like equity and bonds, investors receive a return premium as a trade-off for this illiquidity given that property has delivered higher returns with lower volatility. Our dataset provides us with the monthly asset allocation of equity, bond as well as property investment held by Australian superannuation funds. Hence, we assess what are the most prominent factors that contribute to the returns of the investment options and we consider the return on the domestic equity market, the return on the international equity market, the return in domestic bonds and the return based on the monthly house price index. We estimate the parameters using a Markov Switching model to capture the switch across the investment options. We report the results in Table 6 across the five quintiles and due to data availability, we report mostly the performance across the growth (where most of the small funds hold their investment) and the balanced investment options (where most of the large funds hold their investment strategy).

Analysis of Table 6 indicate that the most dominant asset classes which contributes to the performance of the investment options include the equity and bond markets, which are the most important contributors to the performance for the growth and balanced investment options with a positive and significant contribution to the return. These observations are consistent across all quintiles and hence across all fund size. Hence our results are in line with what Productivity Commission report[8] in 2018 which highlight that while larger funds can perform better, they do not always and that there are no conclusive links between size and performance. These findings are equally consistent the Cummings (2016) who finds that fund size has a positive impact on the performance of not-for profit funds but not for retail funds. Our results

[8] See: Investment performance: Mega super funds fail to deliver best returns: http:www.superguide.com.au/boost-your-superannuation/comparing-super-funds-bigger-mean-better-returns.

show that the equity investment (both domestic and international) as asset class is value adding. However, the domestic equity market is the most prominent asset class as compared to the international equity market. Hence, our results of the domestic equity market are consistent with the finding of Faff, Gallagher and Wu (2005). Faff, Gallagher and Wu (2005) address the tactical asset allocation and the performance of funds in Australia. They find that active managers have been unable to deliver investors with superior returns through tactical asset allocation and they conclude that the most successful asset class, domestic equities, has been value-enhancing, international shares and domestic fixed interest have generally detracted value. The domestic equity home bias was largely prevalent pre and even after the GFC in Australia. The period after the global financial crisis was a relatively strong period for the Australian equity market where the performance was relatively better than other global markets because of the continuing demand from a Chinese-induced commodity boom. Home country equity bias Australian investors' strong bias towards local equities has been widely documented, see for example, Steinfort, Rosemary and Alexis Gray (2012). These studies found that the size of the home country equity bias tends to depend on many factors, including familiarity with the home market, local taxation, such as dividend imputation, currency volatility and transaction costs. Our contrasting results with Faff et al. (2005) of the international equity market can be clearly explained by the growing attention of international diversification post GFC and the more recent sample period that we are considering in our study. Post GFC, superannuation funds and investors have started to consider the benefits of investing in the international equity markets. The international equity market provides an opportunity to have access to a more diverse range of sectors as compared to the domestic equity market (mostly driven by the banking and resources sector) . while investing n international equity markets can bring more volatility, it can equally provide hedge against country specific risk.

An interesting observation from Table 6 is that while the superannuation funds invest in property, the returns of the investment options are not positively affected by the return on the house price index. Hence, we conclude that that investment in property are value detracting to the performance of these investment options and the asset class which adds most value is equities. Following the GFC, the superannuation funds started to diversify their portfolio and a fight away from the equity markets to include property investment in their portfolio. The returns of the Australian superannuation funds have been very sluggish post GFC and it is only in the year 2017 that the Australian superannuation funds posted a double-digit return. While the CoreLogic data from SIRCA show that in 2016 the total return from property prices in Australian capital cities doubled in a short period of time, this asset class cannot outperform in the longer term[9]. Recently, the Australian housing market has seen a slowdown in the prices, and this can be attributed to the tougher lending criteria imposed on the banks by Australian Prudential Regulation Authority. Hence the performance of the property can be argued to be short-lived and not sustainable over the longer term. The returns analysis from ratings companies like Chatwest further highlight that the returns of the Australian superannuation funds has been mainly driven by the global equities, which rallied thanks to low interest rates, the expectation of tax cuts in the US and a global economic recovery. Australian shares while being quite concentrated have added more than 10 per cent.

We further run a sub-sample analysis to assess the asset classes which contributed to the returns over the GFC period. We report the results in Table 7. Consistent with the results of the full sample in table 6, the asset class which add more value to the return across all quintiles of the growth investment option is the equity market. Both the domestic and the international equity markets have contributed to the returns. The domestic bond market do not

[9] See: AFR : "Super fund returns outpace property", date 1 Jan 2018: https://www.afr.com/personal-finance/superannuation-and-smsfs/super-fund-returns-outpace-property-20180101-h0bxm5

seem to have the same impact as in the full sample, except for the largest funds in quintile 5 where the domestic bond market is positive and significant. The standard deviation, shish measures volatility, across both tables 6 and table 7 are significant, but volatility is obviously higher with higher parameter estimates in the GFC sample. Hence, our overall conclusion on the asset classes which contribute mostly to the returns of the investment options can be summarised as follows: (1) the asset classes which value add to the performance of the investment options is the equity market and bonds markets; (2) the domestic equity market seems to add more value to the returns as compared to the international equity market-overall and these results seem to be consistent both for the full sample and the GFC analysis; (3) investment in the real estate does not add value to the returns of the investment options and this is the case across all fund size.

4.3 Factors that determine the switch across investment options

The initial data analysis indicates that we do have switching in the asset classes which leads to the switch among the four investment options, see figure 1 and figure 2. Smaller funds, in quintile 1 and quintile 2 indicates that there is more switching between the growth and balanced investment options and this s mostly prior to the GFC period. The smallest fund, in quintile 1 seem to be taking more risk by switching to the aggressive option as well. The medium sized funds switch is mainly between the growth and balanced fund but most of the switch seem to be in the period of 2012 to 2015. The larger funds in quintile 4 and quintile 5 switch mostly between balanced and growth options and this is for the period pre GFC, around the year 2003/2004 to a post GFC to 2010 (for quintile 5). Hence, we assess in this section what really determines these switch across the investment options. We run a model the

probability that the fund will stay in these two options, balanced and growth options, using a multinomial probit model. The results are reported in Table 8.

Table 8 shows that for the smaller funds in quintile 1 and in quintile 2, for both investment options, growth and balanced options, the probability to switch does not depend on the return from the investment held in any of the asset classes. The results are not statistically significant. Being small in size, one of the objective that these funds is to ensure that members are attracted to the smaller funds and hence they are not losing business or being potential targets for buyouts or mergers, hence the returns are not the sole reason for them to switch their investment strategies, For the medium to lager size funds, the probability to switch is mainly driven by volatility of the equity market and to some extent the volatility of the bond market, The volatility of the housing market does not seem to be a major factor that causes a switch from the investment option except in quintile 4 where the probability to switch from a growth option is significant and positively impacted by the volatility of the house price index. It should be noted that the probability to switch from a balanced option is negatively impacted by the volatility of the house price index in the balanced option. Similarly, while the volatility of the equity market is one of the key factors that impact on the probability to switch, the signs are different across the two investment options. For the growth option, the domestic market volatility seems to have a positive impact while a negative impact on the balanced option. The volatility of the international equity market has a negative impact on the probability of switching in the growth investment option while a positive impact on the balanced option. While the signs are different, the probability to switch is driven by the volatility of the equity markets, both domestic and international.

5. Conclusion

The type of investment held by superannuation funds in Australia is very important given the variety of asset classes that the superannuation invest, and the contribution of these asset make to the return of the superannuation funds. We analyse the switching behaviour of superannuation funds across asset classes for a monthly period of 28 years from 1990 to December 2017. We aggregate the asset classes in four investment options including aggressive, growth, balanced and conservative investment options and assess that asset allocation activity over time and across different fund size, that is we consider the weighted proportion of assets held based of fund size.

In particular we focus on these research questions: (i) What is the likelihood that superannuation funds switch from one investment strategy to another and how long do they stay in one specific strategy?, (ii) which asset classes has the most significant contribution to the performance of the investment strategy?, and (iii) what really impacts the superannuation decisions to switch from one investment options to another one?. Our key results can be summarised as follows: (1) the smaller funds tend to be more active in switching to aggressive options and they tend to be more active during stable periods, however they look passive during the GFC and in contrast the larger funds are more conservative since they are mostly in the balanced option. The larger funds tend to switch mostly in the volatile periods for instance during eth GFC period. The return from these investment options are largely dependent on the asset classes that the superannuation fuds do invest, However, the asset classes which adds most value to the performance of these investment options is the domestic equity market. International equity and the domestic bond market also contributes significantly to the performance of the investment options. Investment in the real estate that is property market does not add value to the returns of the investment options and this is the case across all fund

size. Finally, we conclude that the main factor which drives the switch for the larger funds is the volatility of the equity markets (both domestic and international markets).

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Table 1: Summary Statistics Fund Size- Total Assets of funds (000s)

Total Assets - (000s)				
Quintile	**Mean**	**Minimum**	**Maximum**	**Std Deviation**
1	1,601,698	58	11,799,999	1,514,110
2	9,035,467	1,889,999	35,399,999	4,343,109

3	27,426,107	9,199,999	94,499,997	10,794,015
4	94,593,764	24,205,246	513,199,998	47,914,560
5	1,421,546,890	92,629,993	98,392,478,687	4,736,111,128

Table 2: Summary statistics of weighted proportion of growth asset and return of Australian superannuation industry

	Weighted proportion of growth asset (%)					Weighted average return (%)				
Quintile	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Mean	75.63	72.29	65.66	63.35	62.88	0.580	0.510	0.545	0.515	0.531
Min	7.08	35.73	33.60	26.30	18.76	-11.440	-10.251	-8.304	-9.532	-8.751
Max	94.04	86.11	79.95	77.83	75.93	5.636	5.072	5.142	4.743	4.489
Std. Dev	8.89	7.92	9.91	13.18	9.02	2.167	2.130	1.923	1.866	1.834
Obs.	336	336	336	336	336	335	335	335	335	335

Table 3: Summary statistics of control variables

Variable	Mean	Min	Max	Std. Dev	Obs.
r_{AUEq}	0.389	-15.088	7.855	3.804	335
r_{MSCI}	0.382	-17.981	9.551	4.011	335
r_{AUBond}	0.213	-8.006	6.442	2.425	335
r_{AUHPI}	0.420	-1.090	2.039	0.562	335
$\hat{\sigma}_{AUEq}$	14.607	6.951	68.573	7.313	335
$\hat{\sigma}_{MSCI}$	17.076	4.219	96.885	13.465	335
$\hat{\sigma}_{AUBond}$	5.883	5.352	11.427	0.836	335
$\hat{\sigma}_{AUHPI}$	0.051	0.032	0.146	0.017	335

Table 4: Duration and probability that Australian superannuation industry stayed in each investment option. This table report the duration and probability on a quintile basis for superannuation finds – Hence Q1 represent the smaller funds and Q5 are the larger funds for the

Note: The average duration in Panel B is calculated as:

$$Average\ duration\ (s_t = m) = \frac{\sum_{d=1}^{D_m} Duration_d\ (s_t = m)}{D_m}$$

And, the probability that Australian superannuation stays in an investment option is calculated as:

$$Probability\ (s_t = m) = \frac{\sum_{t=1}^{T} I\ (s_t = m)}{T}$$

Panel A: Total duration (months) that Australian Super Industry stayed in each option					
Quintile	**1**	**2**	**3**	**4**	**5**
Aggressive (s_t=1)	31	4	0	0	0
Growth (s_t=2)	253	230	132	160	42
Balanced (s_t=3)	50	102	204	172	291
Conservative (s_t=4)	2	0	0	4	3
Total	*336*	*336*	*336*	*336*	*336*
Panel B: Average duration (months) that Australian Super Industry stayed in each option					
Aggressive (s_t=1)	3.10	4.00	0	0	0
Growth (s_t=2)	12.65	15.33	8.80	17.78	5.25
Balanced (s_t=3)	4.17	7.85	13.60	15.64	32.33
Conservative (s_t=4)	1.00	0	0	2.00	3.00
Panel C: Probability that Australian Super Industry stayed in each option					
Aggressive (s_t=1)	9.2%	1.2%	0.0%	0.0%	0.0%
Growth (s_t=2)	75.3%	68.5%	39.3%	47.6%	12.5%
Balanced (s_t=3)	14.9%	30.4%	60.7%	51.2%	86.6%
Conservative (s_t=4)	0.6%	0.0%	0.0%	1.2%	0.9%

Table 5: Probability that Australian superannuation industry switch from one option to another option

This table shows the probability that the Australian Superannuation switches from the *row* option in month *t* to the *column* option in month *t+1*. The "-" means there is no observation that the Australian Superannuation stays in the *row* option. The transition probability is calculated as,

$$p_{i,j} = \frac{n_{i,j}}{\sum_{m=1}^{4} n_{i,m}}$$

where, $p_{i,j} = Probability(s_{t+1} = j | s_t = i)$, that is, probability that Australian superannuation switches from option *i* at time *t* to option *j* at time *t+1*. $n_{i,j}$ is number of times that Australian superannuation switches investment option *i* to *j*.

Panel A: Quintile = 1				
Switch from (row) to (column)	Aggressive (s_t=1)	Growth (s_t=2)	Balanced (s_t=3)	Conservative (s_t=4)
Aggressive (s_t=1)	67.7%	29.0%	3.2%	0.0%
Growth (s_t=2)	4.0%	92.5%	3.6%	0.0%
Balanced (s_t=3)	0.0%	22.0%	76.0%	2.0%
Conservative (s_t=4)	0.0%	0.0%	100.0%	0.0%
Panel B: Quintile = 2				
Aggressive (s_t=1)	75.0%	25.0%	0.0%	0.0%
Growth (s_t=2)	0.4%	93.9%	5.7%	0.0%
Balanced (s_t=3)	0.0%	12.7%	87.3%	0.0%
Conservative (s_t=4)	-	-	-	-
Panel C: Quintile = 3				
Aggressive (s_t=1)	-	-	-	-
Growth (s_t=2)	0.0%	89.3%	10.7%	0.0%
Balanced (s_t=3)	0.0%	7.4%	92.6%	0.0%
Conservative (s_t=4)	-	-	-	-
Panel D: Quintile = 4				
Aggressive (s_t=1)	-	-	-	-
Growth (s_t=2)	0.0%	95.0%	5.0%	0.0%
Balanced (s_t=3)	0.0%	5.2%	93.6%	1.2%
Conservative (s_t=4)	0.0%	0.0%	50.0%	50.0%
Panel E: Quintile = 5				
Aggressive (s_t=1)	-	-	-	-
Growth (s_t=2)	0.0%	81.0%	19.0%	0.0%
Balanced (s_t=3)	0.0%	2.8%	97.2%	0.0%
Conservative (s_t=4)	0.0%	0.0%	33.3%	66.7%

Table 6: Effects of market performance on the performance of the Australian superannuation for the FULL SAMPLE

Note: This table reports the estimated parameters for the following Markov-Switching model using the *whole sample*:

$$r_t = \varphi_{(s_t)} + \beta'_{(s_t)} X_t + \varepsilon_t \qquad \varepsilon_t \sim N(0, \sigma^2_{(s_t)})$$

Quintile	**1**	**2**	**3**	**4**	**5**
Aggressive (s_t=1)					
r_{AUEq}	0.391***				

	(0.047)				
r_{MSCI}	0.125**				
	(0.055)				
r_{AUBond}	-0.018				
	(0.041)				
r_{AUHPI}	0.03				
	(0.233)				
$\hat{\sigma}_{(s_t=1)}$	0.534***				
	(0.035)				
Growth (s_t=2)					
r_{AUEq}	0.385***	0.388***	0.327***	0.387***	0.376***
	(0.017)	(0.021)	(0.032)	(0.023)	(0.059)
r_{MSCI}	0.205***	0.205***	0.257***	0.191***	0.224***
	(0.016)	(0.021)	(0.034)	(0.023)	(0.06)
r_{AUBond}	0.085***	0.067***	0.143***	0.077***	0.138***
	(0.018)	(0.022)	(0.033)	(0.023)	(0.053)
r_{AUHPI}	0.056	0.057	0.133	0.053	-0.081
	(0.073)	(0.079)	(0.112)	(0.081)	(0.145)
$\hat{\sigma}_{(s_t=2)}$	0.63***	0.732***	0.728***	0.603***	0.574***
	(0.022)	(0.034)	(0.045)	(0.034)	(0.062)
Balanced (s_t=3)					
r_{AUEq}	0.283***	0.18***	0.297***	0.248***	0.3***
	(0.024)	(0.034)	(0.017)	(0.021)	(0.015)
r_{MSCI}	0.109***	0.214***	0.121***	0.1***	0.139***
	(0.021)	(0.031)	(0.015)	(0.018)	(0.014)
r_{AUBond}	0.078***	0.056	0.043**	0.047**	0.025
	(0.025)	(0.039)	(0.017)	(0.022)	(0.016)
r_{AUHPI}	0.124	-0.279	-0.298***	-0.314***	-0.081
	(0.105)	(0.255)	(0.082)	(0.111)	(0.071)
$\hat{\sigma}_{(s_t=3)}$	0.442***	0.93***	0.621***	0.719***	0.647***
	(0.028)	(0.063)	(0.031)	(0.038)	(0.027)
-2 Log Likelihood	767.30	646.31	673.39	530.24	577.92

Table 7: Effect of the market performance on the performance of the Australian superannuation during the Global Financial Crisis period

Note: This table reports the estimated parameters for the following Markov-Switching model using the *Global Financial Crisis sample*:

$$r_t = \varphi_{(s_t)} + \beta'_{(s_t)} X_t + \varepsilon_t \qquad \varepsilon_t \sim N(0, \sigma^2_{(s_t)})$$

Quintile	**1**	**2**	**3**	**4**	**5**
Growth (s_t=2)					

r_{AUEq}	0.275***	0.372***	0.375***	0.388***	0.391***
	(0.08)	(0.09)	(0.102)	(0.09)	(0.079)
r_{MSCI}	0.346***	0.277***	0.203*	0.188**	0.201**
	(0.073)	(0.083)	(0.098)	(0.083)	(0.08)
r_{AUBond}	0.104	0.125	0.116	0.042	0.221**
	(0.066)	(0.076)	(0.084)	(0.076)	(0.086)
r_{AUHPI}	0.302	0.061	-0.164	0.003	-0.024
	(0.253)	(0.285)	(0.313)	(0.284)	(0.203)
$\hat{\sigma}_{(s_t=2)}$	0.802***	0.931***	1.016***	0.926***	0.644***
	(0.104)	(0.134)	(0.148)	(0.134)	(0.11)
Balanced (s_t=3)					
r_{AUEq}					0.311**
					(0.139)
r_{MSCI}					0.288***
					(0.087)
r_{AUBond}					-0.153
					(0.118)
r_{AUHPI}					-0.963
					(0.97)
$\hat{\sigma}_{(s_t=3)}$					0.562***
					(0.15)
-2 Log Likelihood	27.83	64.67	32.38	64.44	45.08

Table 8: Effect of market conditions on the chance that Australian superannuation stays in an investment option

Note: This table reports the estimated parameters for the following probit models using the *whole sample*:
$$\Pr(s_t = m) = \Phi(\alpha_m + \theta_m' Z_t)$$

Quintile	1	2	3	4	5
Growth (s_t=2)					
r_{AUEq}	-0.035	0.01	-0.039	-0.029	0.016
	(0.032)	(0.03)	(0.03)	(0.029)	(0.039)
r_{MSCI}	0.034	-0.028	0.019	0.017	-0.037
	(0.03)	(0.028)	(0.029)	(0.027)	(0.038)
r_{AUBond}	0.023	-0.033	-0.017	-0.009	-0.05
	(0.032)	(0.031)	(0.031)	(0.03)	(0.039)
r_{AUHPI}	-0.011	0.221	0.103	0.024	0.254
	(0.149)	(0.143)	(0.142)	(0.136)	(0.183)
$\log(\hat{\sigma}_{AUEq})$	-0.537*	-0.113	1.312***	0.492*	0.777**
	(0.286)	(0.273)	(0.285)	(0.266)	(0.366)
$\log(\hat{\sigma}_{MSCI})$	0.165	0.009	-0.867***	-0.418***	-0.741***
	(0.17)	(0.161)	(0.172)	(0.158)	(0.222)
$\log(\hat{\sigma}_{AUBond})$	-0.713	-1.043*	-1.775***	-1.193*	-0.419
	(0.615)	(0.597)	(0.688)	(0.618)	(0.838)
$\log(\hat{\sigma}_{AUHPI})$	0.339	0.082	0.294	0.746***	0.112
	(0.299)	(0.274)	(0.276)	(0.268)	(0.371)
R-Square	4.19%	4.03%	15.29%	7.37%	8.74%
Balanced (s_t=3)					
r_{AUEq}	0.016	-0.012	0.039	0.029	-0.006
	(0.035)	(0.03)	(0.03)	(0.029)	(0.038)
r_{MSCI}	-0.03	0.027	-0.019	-0.017	0.032
	(0.033)	(0.028)	(0.029)	(0.027)	(0.037)
r_{AUBond}	-0.023	0.042	0.017	0.011	0.055
	(0.036)	(0.032)	(0.031)	(0.03)	(0.039)
r_{AUHPI}	-0.144	-0.177	-0.103	0.013	-0.23
	(0.166)	(0.144)	(0.142)	(0.136)	(0.181)
$\log(\hat{\sigma}_{AUEq})$	0.051	0.148	-1.312***	-0.448*	-0.736**
	(0.316)	(0.275)	(0.285)	(0.265)	(0.361)
$\log(\hat{\sigma}_{MSCI})$	0.073	0.02	0.867***	0.391**	0.713***
	(0.188)	(0.162)	(0.172)	(0.157)	(0.219)
$\log(\hat{\sigma}_{AUBond})$	0.304	1.15*	1.775***	1.246**	0.417
	(0.687)	(0.599)	(0.688)	(0.618)	(0.829)
$\log(\hat{\sigma}_{AUHPI})$	-0.169	-0.016	-0.294	-0.702***	-0.102
	(0.324)	(0.275)	(0.276)	(0.268)	(0.367)
R-Square	1.54%	4.52%	15.29%	7.17%	8.52%

Figure 1: Proportion of weighted average growth asset in Australian superannuation industry

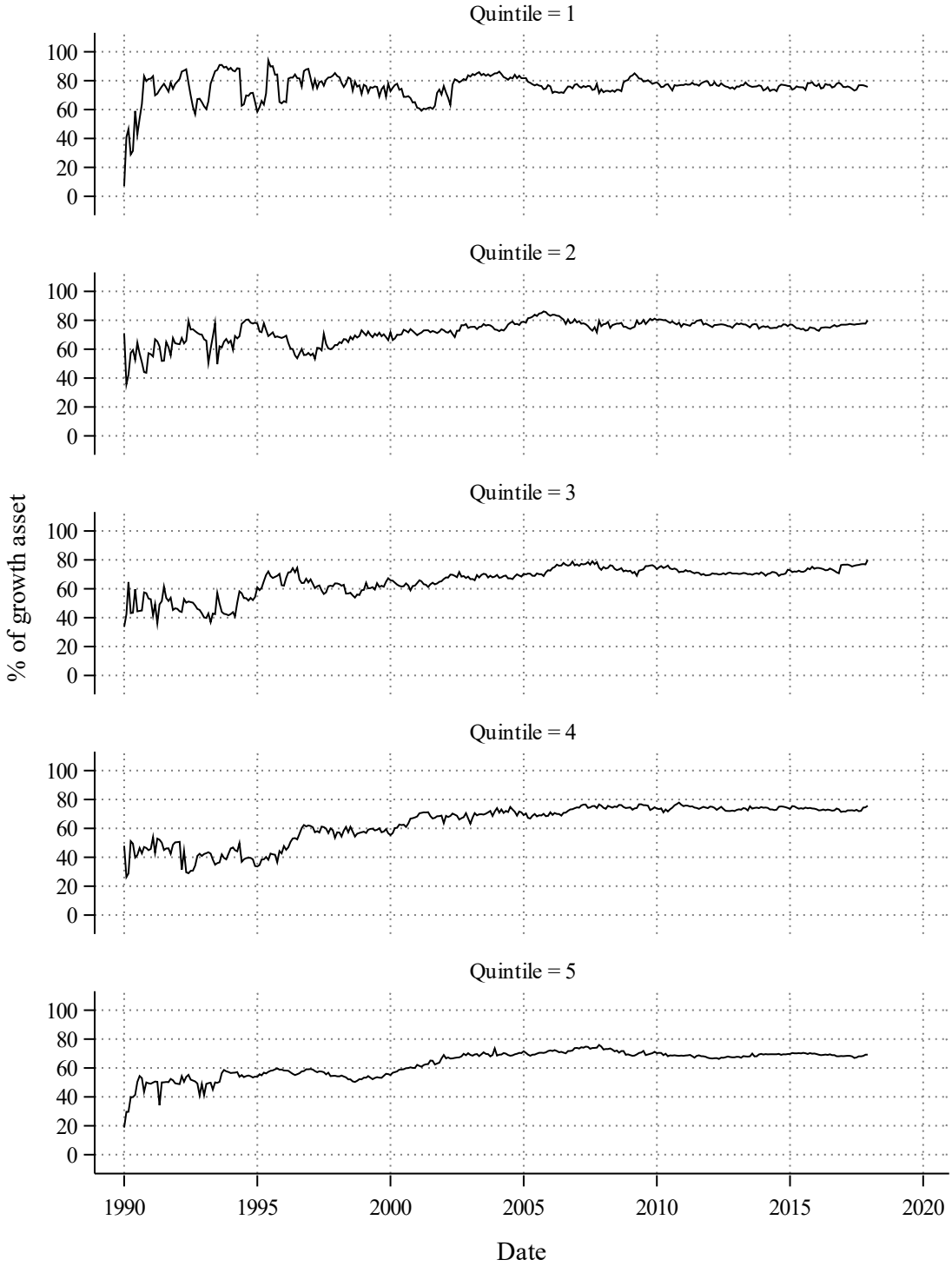

Figure 2: Investment options of Australian superannuation Industry