Ageing, Inequality, and Australia's Natural Rate of Interest

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Abstract

This study applies a shift–share decomposition to examine how changes in Australia's income and age distributions since the 1990s have influenced private savings and wealth accumulation using data from the Household Expenditure Survey and the Household, Income and Labour Dynamics in Australia Survey. Decomposition results show that both inequality and ageing have contributed to the increase in asset demand over the period in which the natural rate of interest has fallen. Rising income inequality has increased household saving rates and wealth-to-income ratios. Population ageing has partly offset higher savings but accounted for nearly half of the growth in aggregate wealth in recent decades. Overall, most of the rise in household saving and wealth ratios (around 85% and 63%, respectively) was driven by behavioural changes within households rather than compositional changes across household groups.

Keywords: natural rate of interest; inequality; demographics; shift-share.

Statement of Originality

I hereby declare that this submission is my own work and to the best of my knowledge it contains no material previously published or written by another person. Nor does it contain any material which has been accepted for the award of any other degree or diploma at the University of Sydney or at any other educational institution, except where due acknowledgment is made in this thesis.

Any contributions made to the research by others with whom I have had the benefit of working at the University of Sydney is explicitly acknowledged. I also declare that the intellectual content of this study is the product of my own work and research, except to the extent that assistance from others in the project's conception and design is acknowledged.

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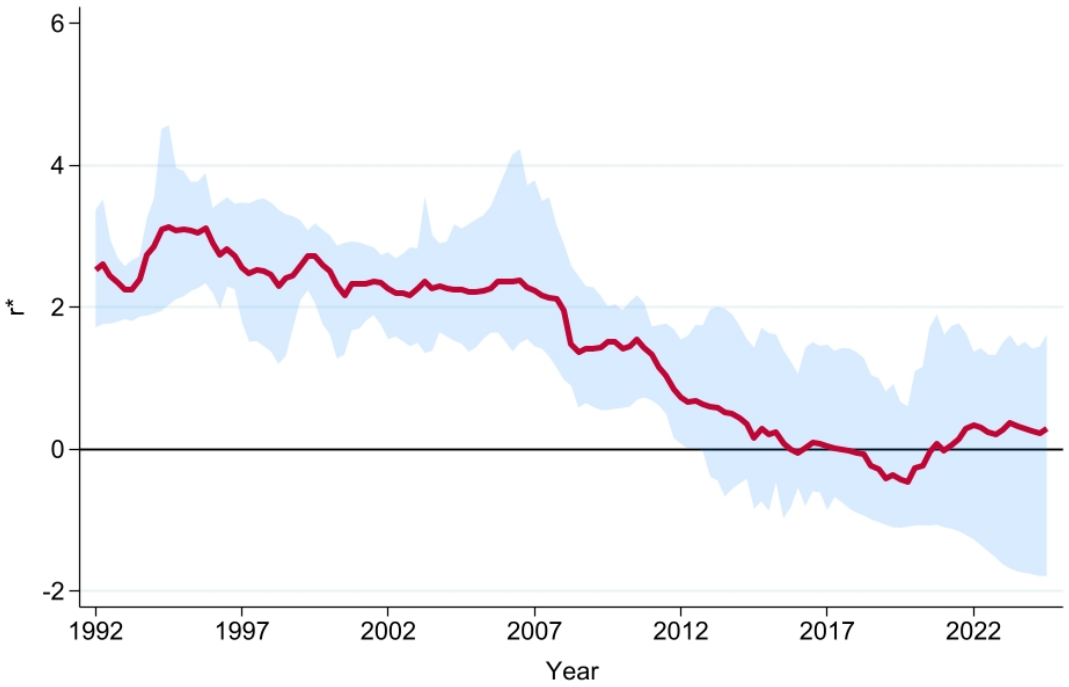
Lastly, I acknowledge the use of generative AI (Claude, via https://claude.ai/, and ChatGPT, via https://chatgpt.com/) in drafting the STATA code used in this study.

Contents

1 Introduction

Estimates indicate that the natural rate of interest, commonly denoted r*, has fallen to significantly low levels in recent decades in a number of countries, including Australia (see Figure 1). Much of the existing literature on the decline in r* centres on an increased demand for assets arising from long-term structural changes like population ageing and inequality that have exerted downward pressure on interest rates. This paper contributes to this literature by using a shift-share approach to quantify the effects of income inequality and population ageing on savings and asset demand in Australia during the period in which r* has declined.

Figure 1: RBA estimate of Australia's real neutral interest rate



Note: Red line is the average of seven model estimates of Australia's neutral interest rate. Shaded blue area is the range of available estimates across all seven models. Source: RBA.

The concept of the natural rate of interest is most often attributed to Knut Wicksell (1898) who defined r* as the rate of interest that would equate saving and investment with stable prices. Today, r* is commonly considered to be driven by structural factors that affect savings and investment (from a flow perspective), or asset demand and supply (from a stock perspective).

Although not directly observable, both theoretical understanding and empirical estimates suggest that r* is capable of substantial movement over time. These movements may have significant implications for the economy and policymakers. A structurally low r* may constrain the effectiveness of monetary policy as real rates become closer to the effective lower bound. A low r* also raises concerns over the possibility of asset bubbles from heightened risk taking, and the threat of secular stagnation.

Given its significance, considerable attention has been devoted to understanding the causes of the recent fall in r*. Although international research has identified several structural drivers, how these forces operate in Australia remains unclear (see, for example, the uncertainty expressed in speeches from the RBA by Ellis (2022) or Kent (2024)). Hence, providing stronger empirical evidence on the key factors that have influenced r* in Australia remains a meaningful and relevant contribution to the literature.

In this study, I focus on the roles of population ageing and income inequality on savings and asset demand, approaching the drivers of r* from the perspectives of both flows and stocks.[1] These two factors are studied in the literature as structural forces that may have placed sustained downward pressure on r* in the US and globally by increasing household saving and wealth accumulation. However, changes in the income and age distribution in Australia are not identical with those elsewhere, suggesting the role that these factors may have had on Australia's r* may also differ. I contribute to the literature by providing empirical evidence for the relative roles of income inequality and population ageing in the fall in r* in Australia using data from the Household Expenditure Survey (HES) and the Household, Income and Labour Dynamics in Australia (HILDA) survey.

I achieve this by decomposing changes in Australia's aggregate household saving-to-income and wealth-to-income ratios using a shift-share design. The shift-share

1. I discuss the limitations of this approach which ignores the effects of population ageing and income inequality on investment and asset supply in appendix A, motivated by a similar discussion in Auclert et al. (2025).

method generates counterfactual predictions of how private savings and wealth would have evolved had only one factor changed, such as income inequality or population ageing, holding all other variables constant. The results from this method allow for a direct comparison of the relative contributions from inequality and demographic shifts to r* via savings and asset demand. The income inequality and demographic components capture compositional effects, reflecting how changes to the relative incomes and population shares of households groups have affected savings and wealth. The within-group component measures behavioural changes, indicating whether households, regardless of age or income, are saving more or accumulating greater wealth than in the past.

Overall, the shift-share results suggest that both ageing and inequality have played a role in increasing demand for assets in Australia. The results from the shift-share decompositions indicate that rising income inequality has increased saving rates and wealth-to-income ratios by a small amount, reflecting the small amount of growth in income inequality in recent decades. Population ageing has partly offset higher savings, but accounted for nearly half of the growth in aggregate wealth since the early 2000s.

The initial variation in saving-to-income and wealth-to-income ratios across the distribution of households plays a large role in determining the significance of shifts in the age and income distributions across time on aggregates. If one household group has a particularly high saving-to-income ratio or wealth-to-income ratio to begin with, it would be expected that a subsequent increase in relative income or population share for this group will have a large effect on aggregate changes. Similarly, groups which experience large increases in relative incomes or population shares will be expected to contribute relatively more than groups which experience smaller increases.

Saving rates vary far more across the income distribution than across the age distribution, with the top 10% of income earners in each age group saving approximately 3-4 times as much of their incomes than the next 40% while the bottom 50% of income earners in each age group dissave. As a result, the savings

shift-share decomposition predicts that income inequality was a much stronger driver of the increase in household savings between the early 1990s and mid 2010s relative to the effect of population ageing.

The wealth shift-share decomposition finds population ageing to be significant in the rise of aggregate household wealth-to-income from 2002 to 2022. Wealth-to-income ratios rise monotonically with age but exhibit a far weaker relationship with income. As such, the increase in income inequality is found to have a smaller, but still positive role.

Another result from both the saving and wealth shift-share decompositions is the large effect of within-group changes to savings and wealth on aggregates. Across the sample periods, almost all within-age income groups experienced an increase in saving-to-income and wealth-to-income ratios. The strongest increases were for older households and low-income households. The within-group component proved to be the principal driver of changes in both decompositions, surpassing the contribution of compositional shifts. This result suggests that factors other than the increase in income inequality and population ageing have driven increases in aggregate savings and wealth and the decline in r*.

1.1 Related literature

Demographic changes have been studied extensively as one potential catalyst of changes in r* through changes to household savings and wealth accumulation. Population ageing, brought about by declining fertility rates and longer lifespans, may increase aggregate saving if households move into age groups with higher average savings and seek to fund longer retirements. Additionally, some have suggested that the movement of the Baby Boom generation through the life-cycle, as a particularly large birth cohort, has also had a significant effect on aggregate saving and wealth. Auclert et al. (2025) find that the changing age distribution in a range of countries has increased wealth-to-income ratios and driven down global rates of return. Evidence from other studies also suggest that demographic changes

place significant downward pressure on r* and may continue to do so in the coming decades.[2]

Rising income inequality is considered to be another possible contributor to the fall in r*. High-income earners are expected to save a relatively larger proportion of their incomes and hold more wealth than low-income earners. Therefore, if more income was to shift to the top of the income distribution, aggregate savings and wealth would be expected to increase. Many studies have attributed part of the decline in r* to a rise in income inequality globally, and in the US, including Rachel and Smith (2017), Mian, Straub and Sufi (2021), and Peruffo and Platzer (2022).

Taken together, these studies highlight population ageing and rising inequality as two central forces behind the long-run decline in r*. However, empirical evidence on these mechanisms within Australia remains limited. This study contributes to these bodies of research by analysing how ageing and shifts in inequality have influenced r* in the Australian economy through asset demand and household saving.

Most prior research on Australia's r* has taken a global perspective on the factors influencing its decline. Morley and Wong (2025) find that while domestic factors do affect Australia's r*, global r* and other forces, particularly those originating from the US, have been the dominant driver of its decline since the Global Financial Crisis. The importance of global r* on the domestic natural rate is supported by similar evidence from other small, open economies.[3] Other studies in Australia attribute a large part of the fall in r* to an increase in risk aversion among domestic households and firms (McCririck and Rees 2017). However, evidence for the relative importance of factors influencing Australia's r* is still quite limited (Ellis (2022); Kent (2024)). Hence, providing stronger empirical evidence for the

2. See Eggertsson, Mehrotra and Robbins (2019) and Gagnon, Johannsen and Lopez-Salido (2021) for the US, Papetti (2021) for the Euro area, Han (2024) for Japan, and Ademmer and Rush (2024) for a number of OECD nations.

3. See Kirkby, Lockyer and Coleman (2025) for New Zealand, Armelius et al. (2023) for the Scandinavian nations, Burgert et al. (2025) for Switzerland, and Kuncl and Matveev (2023) for Canada, amongst others.

domestic drivers of Australia's r* is a meaningful and relevant contribution to the literature.

My methodology is most similar to that of Bauluz and Meyer (2024) who use a shift-share design to decompose the increases in aggregate wealth-to-income and aggregate private savings in the US into contributions from changes in income inequality, age demographics, and within-group saving and wealth profiles. I apply a similar design, with altered age and income partitions, to Australian household-level data.

Mian, Straub and Sufi (2021) also study household saving rates with a shift-share design but compare the effects of income shifts across age groups and within-age income groups separately and without accounting for the role of changing population shares as I do in my approach. Results from their income shift-share suggest that income inequality had a larger influence on r* than population ageing in the US between 1950 and 2019.[4] Beudry, Kartashova, and Meh (2023) study both wealth and savings through a shift-share approach but, like Mian, Straub and Sufi (2021), only account for changes in income shares and not population shares. Auclert et al. (2025) use a shift-share decomposition to analyse the effect of the population's age composition alone on aggregate wealth-to-income. The approach I employ expands upon that of Auclert et al. (2025) by allowing income and wealth of groups to vary over time, in addition to population shares, to compare the relative importance of each factor.

The rest of the paper proceeds as follows. In section 2, I describe my empirical methodology including the data and shift-share design used to study household savings and wealth. Results are reported in section 3. Section 3.3 contains results from the savings shift-share, and results from the wealth shift-share are reported in section 3.4.

4. Appendix B.2 presents results from this income shift-share approach using data from the HES. Similar to the findings from Mian, Straub and Sufi (2021), the income approach finds that rising income inequality had a greater effect on household saving-to-income ratios than population ageing in Australia.

2 Methodology

2.1 Data

Data on Australian private savings used in this study comes from the HES collected by the Australian Bureau of Statistics (ABS). The HES provides the longest, nationally representative, micro-level time series on household expenditures, incomes, and socio-demographic characteristics. The relevant and available survey years for my study are 1988/89, 1993/94, 1998/99, 2003/04, 2009/10 and 2015/16. Using microeconomic, rather than aggregated, data allows for the study of changing saving behaviours of various household groups over time to assess the relative importance of changes in age and income structures on Australia's r*. Each survey wave includes population weights to align the data with population aggregates. This study applies these weights throughout to ensure that the HES data reflects aggregate demographic trends.

Following Finlay and Price (2015) who also use HES data to examine household saving in Australia, I calculate household saving as the difference between disposable income and goods and service expenditure. This definition only reflects active household saving and excludes capital gains or losses.

The HES represents the best available micro-level data for the analysis of household saving trends in Australia, albeit with some limitations. It is a relatively shorter and more infrequent time series than used in other studies on the role of demographics and inequality elsewhere on household savings and wealth.[5] Income

5. Past research in the US which decomposes changes in savings and wealth such as Bauluz and Meyer (2024) uses the Survey of Consumer Finances Plus (SCF+) data from by Kuhn, Schularick and Steins (2020). This provides microeconomic data on age, wealth, and income of US households from 1950 onward. Studies which use SCF+ data in a shift–share framework typically average variables over several decades and examine changes across broad time horizons. This is not feasible with the available Australian data, making estimates more sensitive to base-year selection, and short-term fluctuations that may not accurately represent long-term trends. Additionally, the richer SCF+ data allows for a synthetic approach to calculate household savings from information on the changes in wealth between periods, inheritances, and valuation effects. This approach provides a more accurate estimate of household saving than is possible from the HES.

data taken from HES is also limited by slight methodological changes between survey waves in the early 2000s. However, primary alternatives - the HILDA survey and Survey of Income and Housing (SIH) - cover shorter time frames and do not provide sufficient information on household expenditures to reliably estimate changes in household saving rates across time.

Data for the wealth shift-share comes from the HILDA survey which provides annual, household-level data from personal interviews and self-completed questionnaires on a range of economic and social indicators since 2001. Data for household wealth is only collected every four survey years beginning in 2002. As such, I use data from the six survey waves containing the wealth module between 2002 and 2022. The key variables from HILDA used in the wealth shift-share decomposition are age of household head, household disposable income and net household wealth. Population weights are to represent all households within the HILDA sample.

Similar to the data from the HES, data from HILDA is limited by its relatively short sample period and infrequent collection of wealth data. Wealth data from HILDA is also prone to extreme values and potential understatement, particularly at the very top and bottom of the distribution, which can distort measures of aggregate wealth and W/Y ratios. That being said, it provides the best available data on household wealth in Australia. Trimming the extreme 1% of household net worth-to-income ratios mitigates the influence of outliers while preserving the overall distribution, following the practice in other studies which use HILDA wealth data. An alternative to HILDA for data on wealth in Australian households is the SIH conducted by the ABS between 2005-06 and 2019-20. I prefer data from HILDA over SIH for its slightly longer sample period and consistent collection of information on household wealth.[6]

6. In Appendix C.1, I use data from the Survey of Income and Housing (SIH) conducted by the ABS between 2005-06 and 2019-20 to check robustness of baseline results from HILDA.

2.2 Saving shift-share decomposition

Approaching the drivers of r* firstly from the flow perspective, I evaluate the relative contributions of changes in the income and age distributions on aggregate private savings in the Australian economy using microeconomic data from the HES. My approach is most similar to the decomposition used by Bauluz and Meyer (2024) as their design allows for the most direct comparison of the contributions from shifts to the income and age distributions in changing the aggregate saving ratio. I use a different decomposition method from Mian, Straub and Sufi (2021) which uses only shifts in income and studies age and income groups seperately as a robustness check in Section 4.2.

I begin by defining the aggregate private saving ratio at time τ as

$$\frac{S_\tau}{Y_\tau} = \sum_i \frac{\bar{s}_{i\tau}}{\bar{y}_{i\tau}} \cdot \frac{\bar{y}_{i\tau}}{\bar{y}_\tau} \cdot \frac{N_{i\tau}}{N_\tau} \tag{1}$$

where $\frac{\bar{s}_{i\tau}}{\bar{y}_{i\tau}}$ is the ratio of average saving to average income for group i, $\frac{\bar{y}_{i\tau}}{\bar{y}_\tau}$ is the ratio of average income for group i to the average income of all groups, and $\frac{N_{i\tau}}{N_\tau}$ is group i's share in the population.

From this definition, I decompose the change in the aggregate private saving-to-income ratio between period 0 and period τ in the following way:

$$\begin{aligned}
\frac{S_\tau}{Y_\tau} - \frac{S_0}{Y_0} = &\sum_i \underbrace{\left[\frac{\bar{s}_{i\tau}}{\bar{y}_{i\tau}} - \frac{\bar{s}_{i0}}{\bar{y}_{i0}}\right]}_{\text{saving profile}} \cdot \frac{\bar{y}_{i0}}{\bar{y}_0} \cdot \frac{N_{i0}}{N_0} \\
&+ \sum_i \frac{\bar{s}_{i0}}{\bar{y}_{i0}} \cdot \underbrace{\left[\frac{\bar{y}_{i\tau}}{\bar{y}_\tau} - \frac{\bar{y}_{i0}}{\bar{y}_0}\right]}_{\text{relative income}} \cdot \frac{N_{i0}}{N_0} \\
&+ \sum_i \frac{\bar{s}_{i0}}{\bar{y}_{i0}} \cdot \frac{\bar{y}_{i0}}{\bar{y}_0} \cdot \underbrace{\left[\frac{N_{i\tau}}{N_\tau} - \frac{N_{i0}}{N_0}\right]}_{\text{population share}} + \gamma
\end{aligned} \tag{2}$$

By using a shift-share decomposition, it is possible to evaluate the relative contribution of changes to each component in equation (2) towards the change in the aggregate private saving ratio across a particular period. This is done by

leaving two components fixed to their values in period 0 and multiplying them by the change in the third component between periods 0 and τ. In doing so, the decomposition provides an "all else equal" estimation of how the observed changes in saving profiles, relative incomes and population shares for each group would have contributed to aggregate saving over the test period. The residual term γ captures all higher-order interaction effects that arise when saving profiles, relative incomes, and population shares change simultaneously across groups, beyond the linear decomposition components.

I include fifteen groups in my baseline study created from five age groupings and three income groupings to capture heterogeneity in group characteristics and behaviours. Ages are provided as ranges in the HES data, so households are categorised into the following bins using the age of household head: ages 20-34, 35-44, 45-54, 55-64, and 65-69. These age partitions are similar to those used in other studies such as Finlay and Price (2015). Households are then divided into the top 10%, middle 40% and bottom 50% of income earners within each age group. These income groups are chosen to best capture changes in the income distribution, with a particular focus on the way incomes move towards the top of the distribution, following Bauluz and Meyer (2024) and Mian, Straub, and Sufi (2021).

I define the pre-period 0 as the average of HES data in the 1988-89 and 1993-94 survey waves. By averaging across two waves, I obtain more reliable estimates of group-level saving profiles and compositional characteristics by limiting the effect of transitory fluctuations and measurement errors. Similarly, the post-period τ in my baseline study is the average of the 2009-10 and 2015-16 HES survey waves.

There are some limitations to the shift-share method, however, beyond those stemming from the data used for the study. The results of the shift share cannot completely capture the effects of population ageing on savings (or wealth) since the component capturing demographic change only measures changes to population shares. For example, as a result of ageing, households may choose to increase their savings, regardless of age or income, in order to save for what they anticipate to be a longer retirement. The results are also highly sensitive to the base period

chosen for study. In Appendix B.1, I test the robustness of the results from my baseline decomposition by comparing them with results from decompositions across different group partitions and time periods. I also compare baseline results using the approach from Bauluz and Meyer (2024) with results from the alternative shift-share approach used by Mian, Straub and Sufi (2021).

2.3 Wealth-to-income shift-share decomposition

To study the effect of income inequality and ageing on wealth-to-income ratios, I use a similar decomposition to that described in Section 2.2 applied to household data from HILDA. Obtaining results on both household savings and wealth allow for a comparison between the flow and stock perspectives of the drivers of r*.

I define the aggregate wealth-to-income ratio at time τ as

$$\frac{W_\tau}{Y_\tau} = \sum_i \frac{\bar{w}_{i\tau}}{\bar{y}_{i\tau}} \cdot \frac{\bar{y}_{i\tau}}{\bar{y}_\tau} \cdot \frac{N_{i\tau}}{N_\tau} \tag{3}$$

where $\frac{\bar{w}_{i\tau}}{\bar{y}_{i\tau}}$ is the ratio of average wealth to average income for group i, $\frac{\bar{y}_{i\tau}}{\bar{y}_\tau}$ is the ratio of average income for group i to the average income of all groups, and $\frac{N_{i\tau}}{N_\tau}$ is group i's share in the population. The change in the aggregate wealth-to-income ratio from period 0 to period τ can then be decomposed as follows:

$$\begin{aligned}\frac{W_\tau}{Y_\tau} - \frac{W_0}{Y_0} = &\sum_i \underbrace{\left[\frac{\bar{w}_{i\tau}}{\bar{y}_{i\tau}} - \frac{\bar{w}_{i0}}{\bar{y}_{i0}}\right]}_{\text{W/Y profile}} \cdot \frac{\bar{y}_{i0}}{\bar{y}_0} \cdot \frac{N_{i0}}{N_0} \\ &+ \sum_i \frac{\bar{w}_{i0}}{\bar{y}_{i0}} \cdot \underbrace{\left[\frac{\bar{y}_{i\tau}}{\bar{y}_\tau} - \frac{\bar{y}_{i0}}{\bar{y}_0}\right]}_{\text{relative income}} \cdot \frac{N_{i0}}{N_0} \\ &+ \sum_i \frac{\bar{w}_{i0}}{\bar{y}_{i0}} \cdot \frac{\bar{y}_{i0}}{\bar{y}_0} \cdot \underbrace{\left[\frac{N_{i\tau}}{N_\tau} - \frac{N_{i0}}{N_0}\right]}_{\text{population share}} + \gamma\end{aligned} \tag{4}$$

This decomposition allows for the study of the relative contribution of changes in each component towards the overall change in the aggregate wealth-to-income. As before, the decomposition yields an "all else equal" estimation of how the observed changes in wealth-to-income profiles, relative incomes and population shares for

each group would have contributed to aggregate wealth-to-income over the test period.

Once again, I include fifteen groups created from five age bins and three income bins. Year 0, the pre-period, is set as 2002 in my baseline decompiosition. This is the first year in which data on household wealth is available from the HILDA survey. The post-period, year τ, is 2022 - the most recent survey year for the HILDA wealth module. Appendix C.1 reports results for alternative specifications of the wealth-to-income shift-share to check the robustness of baseline results.

3 Results

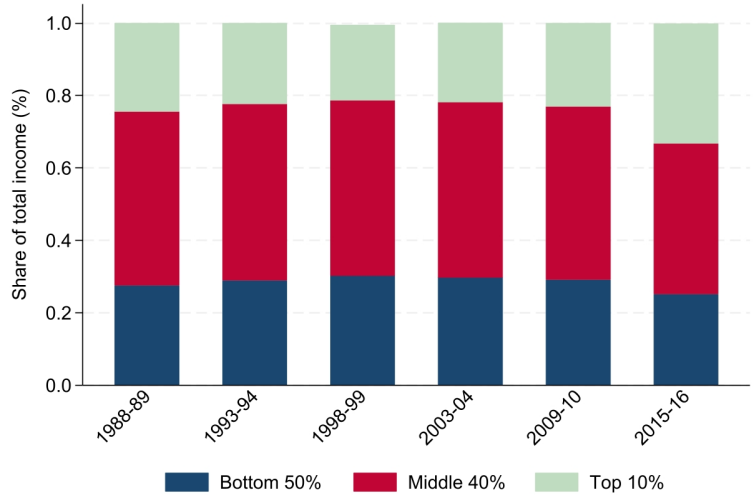
3.1 Income inequality

A rise in income inequality since the 1970s and 1980s has been widely documented in the US and other advanced economies (e.g. Piketty and Saez (2003), Kuhn, Schularick and Steins (2020), Hoffman, Lee and Lemieux (2020)). Evidence suggests that income inequality was declining in Australia prior to 1979 but has been increasing since that time in keeping with global trends albeit to a lesser extent (Kennedy et al. 2017; Fenna and Tapper (2015)).

Figure 2 shows the evolution of income shares for within-age income groups for each of the HES survey years. The stacked bar chart demonstrates an increase in the share of income held by the top 10% of income earners within each age group from 24% of total income in 1988-89 to 33% in 2015-16.

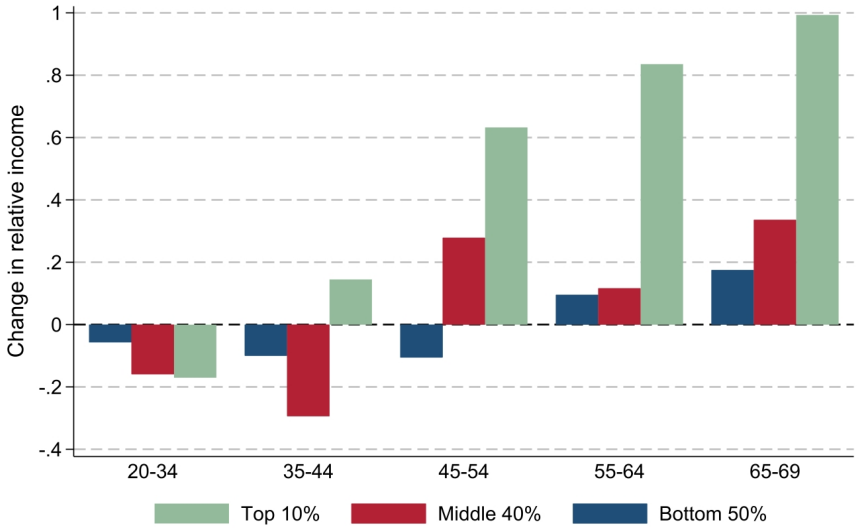
Figure 3 displays changes in the ratio of income of each age and income group relative to average income between 1988-89 and 2015-16. The top 10% of income earners for the majority of age groups all experienced an increase in their relative income across this period, with the increase more pronounced for older households. Conversely, changes in relative income are much smaller, and in some cases negative, for younger households and low income-earning households. Similar results are found from the HILDA survey data for changes between 2002 and 2022 (see column 5 of table 5).

Figure 2: Income shares by within-age income group



Note: Income shares from each wave of the Household Expenditure Survey, 1988-89 to 2015-16. Households are grouped by the top 10%, middle 50%, and bottom 40% of income earners within each age group.

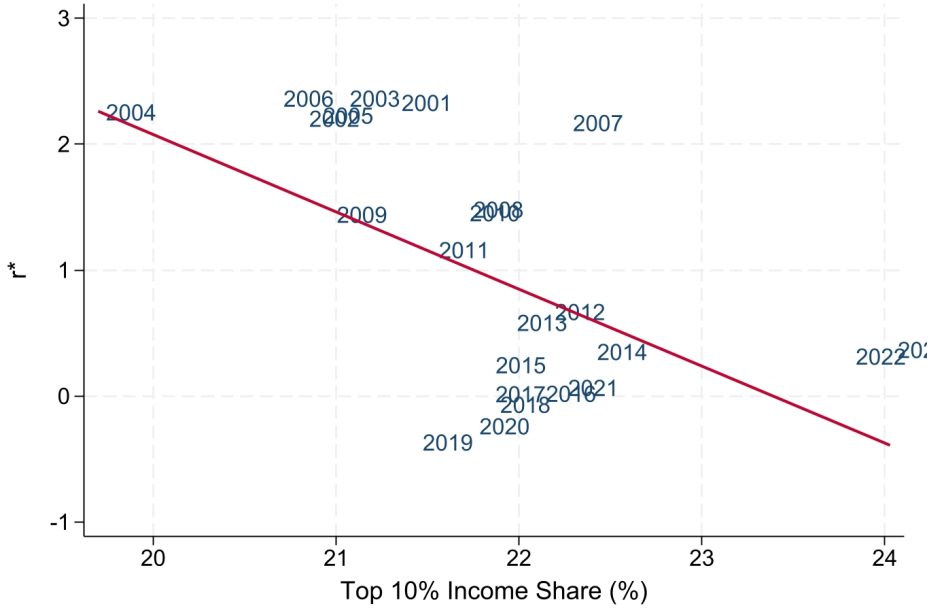
Figure 3: Change in relative income by age and income (1988-89 to 2015-16)



Note: Changes in the relative income component of the shift-share decomposition between the 1988-89 and 2015-16 waves of the Household Expenditure Survey. The relative income component captures the average income of each group of households relative to the average income of all households ($\frac{\bar{y}_{i\tau}}{\bar{y}_{\tau}} - \frac{\bar{y}_{i0}}{\bar{y}_{0}}$).

It is often suggested that a rise in income inequality may increase aggregate saving in the economy. If the distribution of income shifts towards groups with higher saving rates and away from groups with lower saving rates, then the aggregate saving-to-income ratio would be expected to rise. Therefore, and from the results from the HES data, an increase in income inequality would be expected to have the largest positive effect on the aggregate saving ratio if the top 10% of income earners do save more than the middle 40% and bottom 50% of income earners.

Figure 4: Correlation of income inequality and r*



Note: Plot of correlation between income share of the top 10% of income earners within each age group from HILDA and the average estimate of r* from the Reserve Bank of Australia's seven models.

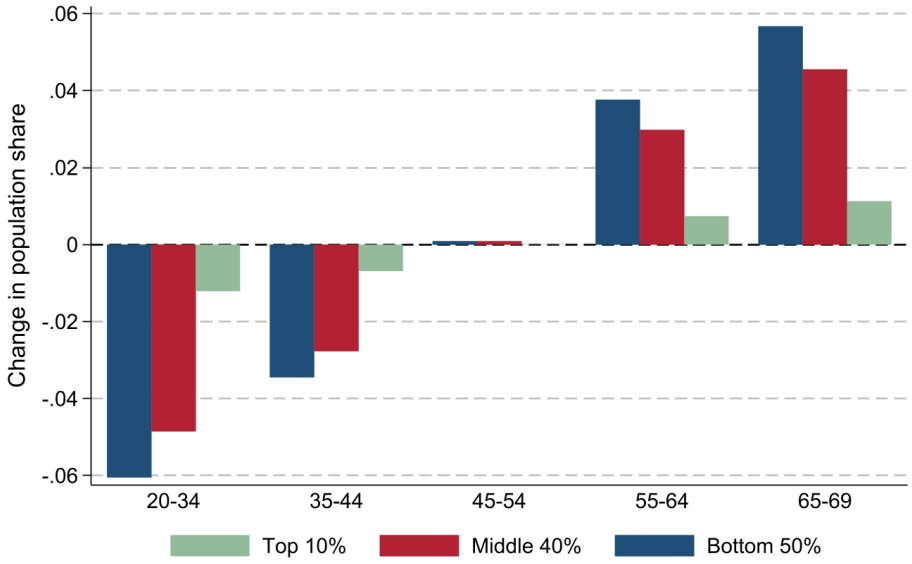
The results from this descriptive analysis suggest that income inequality did worsen across the period during which r* has been declining. The rise in top 10% within-age group income share is plotted against the decline in r* in Figure 4, showing a discernible negative relationship between the two variables.

3.2 Population ageing

Age demographics can have a significant effect on macroeconomic outcomes through changes to the labour force, household preferences, and the institutional environment. Two recent, substantial changes to Australia's age distribution have come from the general ageing of the population and the movement of the Baby Boom generation throughout the lifecycle.

Population ageing is evident in most advanced economies including Australia. A long-term decline in fertility rates paired with increased longevity has meant that the Australian population has shifted towards older age groups. This trend is expected to continue in the coming decades with intensifying effects on the Australian economy.

Figure 5: Change in population shares by age and income groups (1988-89 to 2015-16)



Note: Changes in the population share component of the shift-share decomposition between the 1988-89 and 2015-16 waves of the Household Expenditure Survey ($\frac{N_{i\tau}}{N_\tau} - \frac{N_{i0}}{N_0}$).

The effects of the Baby Boom generation moving through the life-cycle have also been studied, including effects on asset prices and r* (e.g. Mian, Straub and Sufi (2021); Ademmer and Rush (2024)). The Baby Boom generation comprises

individuals born between 1945 and 1964. It was an especially large birth cohort which was followed by relatively smaller cohorts, thus creating a bulge passing through age distribution.

Figure 5 displays evidence of the ageing of Australia's population between 1988 and 2016 from the HES. Evaluating the change in population shares experienced by each age and income group between the 1988-1994 average and 2009-2016 average reveals that shares have declined for the 20-34 and 35-44 age groups, increased for the 55-64 and 65-69 age groups, and remained relatively steady for the middle 45-54 age group. A similar trend is seen in the data from HILDA (see column 5 of table 6).

Figure 6: Correlation of population ageing and r*

Note: Plot of correlation between population share of households aged 60+ from HILDA and the average estimate of r* from the Reserve Bank of Australia's seven models.

The correlation between the population share of those aged 60 and above from HILDA and the average estimate of Australia's r* is plotted in Figure 6. The rise of population share of the 60+ age bin corresponds closely with the decline in r* across the sample period.

3.3 Savings shift-share results

Overall, the results from the saving shift-share decomposition indicate the change in the income distribution alone between the 1990s and 2010s accounted for a small increase in household saving, and the change in the age distribution, when savings and incomes are left fixed, contributed negatively. Additionally, changes in saving profiles alone contributed the most to the rise in aggregate savings across the sample period. These results suggest that within-group effects were far stronger than compositional effects in driving Australian household savings between the early-1990s and mid-2010s. Summary results of the decomposition are reported in Table 1 and detailed results of the decomposition are reported in Table 2.

Table 1: Saving Shift-Share Results

	Contribution (pp)	% of Total
Saving Profiles	5.54	85
Income Inequality	0.36	6
Demographics	-1.11	-17
Residual	1.72	26
Total	6.50	100

Note: This table presents the results of the shift-share decomposition on household saving-to-income as described in equation (2). Period $t = 0$ is the average of 1988-89 and 1993-94 HES survey waves and period $t = \tau$ is the average of 2009-10 and 2015-16. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.2. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate private saving-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate private saving-to-income ratio contributed by each component. Alternative specifications are reported in B.2.

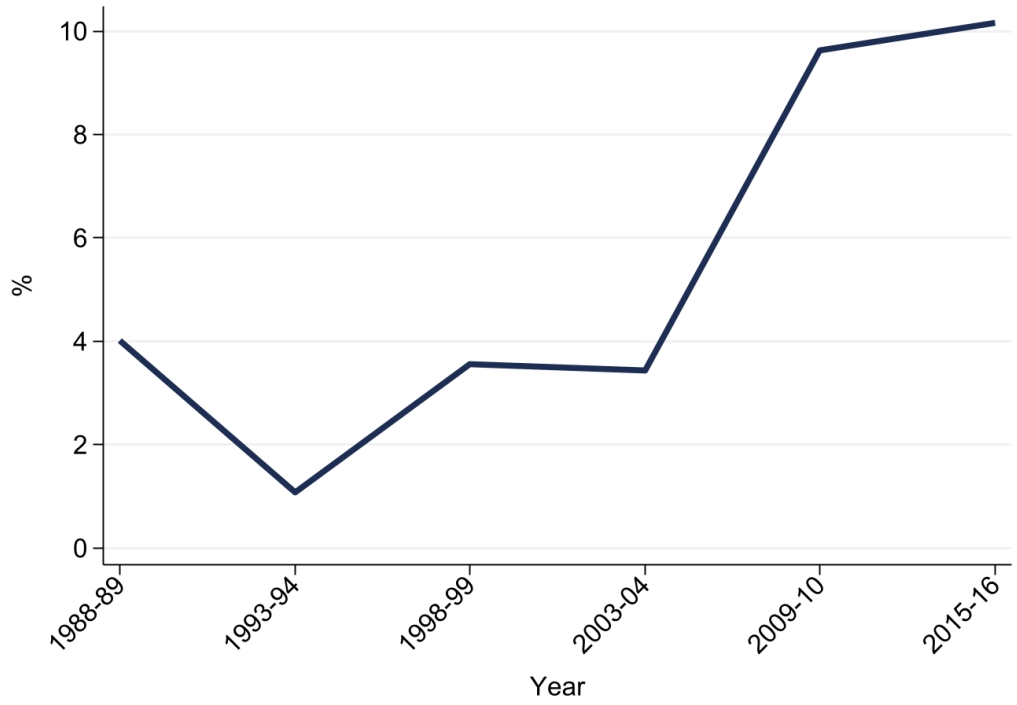
Table 2: Saving Shift-Share Results - 15 Groups

	Base Period ($t=0$)			Changes (Δ)			Contribution to $\Delta(S/Y)$				
	$\frac{\bar{s}_{i\tau}}{\bar{y}_{i\tau}}$	$\frac{\bar{y}_{i\tau}}{\bar{y}_{\tau}}$	$\frac{N_{i\tau}}{N_{\tau}}$	$\Delta\frac{\bar{s}_i}{\bar{y}_i}$	$\Delta\frac{\bar{y}_i}{\bar{y}}$	$\Delta\frac{N_i}{N}$	S. Prof	Inequ.	Demog.	Resid.	Total
Ages 20–34											
Top 10%	0.277	2.082	0.030	0.014	-0.170	-0.012	0.001	-0.001	-0.007	0.000	-0.007
Middle 40%	0.063	1.165	0.122	0.032	-0.159	-0.049	0.004	-0.001	-0.004	-0.002	-0.002
Bottom 50%	-0.233	0.575	0.152	0.131	-0.056	-0.060	0.011	0.002	0.008	-0.006	0.016
Ages 35–44											
Top 10%	0.274	2.437	0.025	0.028	0.145	-0.007	0.002	0.001	-0.005	-0.001	-0.003
Middle 40%	0.076	1.316	0.101	-0.017	-0.294	-0.028	-0.002	-0.002	-0.003	0.002	-0.006
Bottom 50%	-0.204	0.655	0.126	0.061	-0.100	-0.035	0.005	0.003	0.005	-0.003	0.010
Ages 45–54											
Top 10%	0.279	2.885	0.020	0.051	0.633	0.000	0.003	0.004	0.000	0.001	0.007
Middle 40%	0.086	1.484	0.081	0.038	-0.279	0.001	0.005	-0.002	0.000	-0.001	0.002
Bottom 50%	-0.209	0.667	0.101	0.118	-0.105	0.001	0.008	0.002	0.000	-0.001	0.009
Ages 55–64											
Top 10%	0.293	2.323	0.016	0.064	0.836	0.007	0.002	0.004	0.005	0.004	0.015
Middle 40%	0.037	1.068	0.064	0.044	0.116	0.030	0.003	0.000	0.001	0.002	0.006
Bottom 50%	-0.325	0.408	0.081	0.154	0.096	0.038	0.005	-0.003	-0.005	0.003	0.000
Ages 65–69											
Top 10%	0.123	1.581	0.008	0.206	0.994	0.011	0.003	0.001	0.002	0.009	0.015
Middle 40%	-0.116	0.648	0.032	0.143	0.336	0.045	0.003	-0.001	-0.003	0.006	0.004
Bottom 50%	-0.327	0.327	0.040	0.190	0.176	0.057	0.002	-0.002	-0.006	0.004	-0.002

Notes: $\frac{\bar{s}_{i\tau}}{\bar{y}_{i\tau}}$ is group i's average saving-to-average income ratio (saving rate); $\frac{\bar{y}_{i\tau}}{\bar{y}_{\tau}}$ is the ratio of group i's average income to the overall average (income inequality); $\frac{N_{i\tau}}{N_{\tau}}$ is group i's share of the adult population (demographic structure). Changes (Δ) show differences between pre- and post-periods. Contributions show each component's effect on the aggregate saving-to-income ratio. All values are in decimal form.

3.3.1 Aggregate saving-to-income ratio

Figure 7: Aggregate household saving-to-income ratio



Note: Aggregate household saving-to-income ratio across all income and age groups. Estimates are from each survey wave of the Household Expenditure Survey.

As shown in Figure 7, the aggregate household saving ratio in Australia has increased from the 1993-94 HES survey wave to the 2015-16 wave. This is the same period during which estimates suggest Australia's r* has been in decline. The overall U-shape since the late 1980s is consistent with estimates for average household savings from the national accounts. Taking the average of the 1988-89 and 1993-94 survey years as the pre-period 0 and the average of the 2009-10 and 2015-16 years as the post period τ, the aggregate household saving ratio increased by 6.50 percentage points across the sample period.

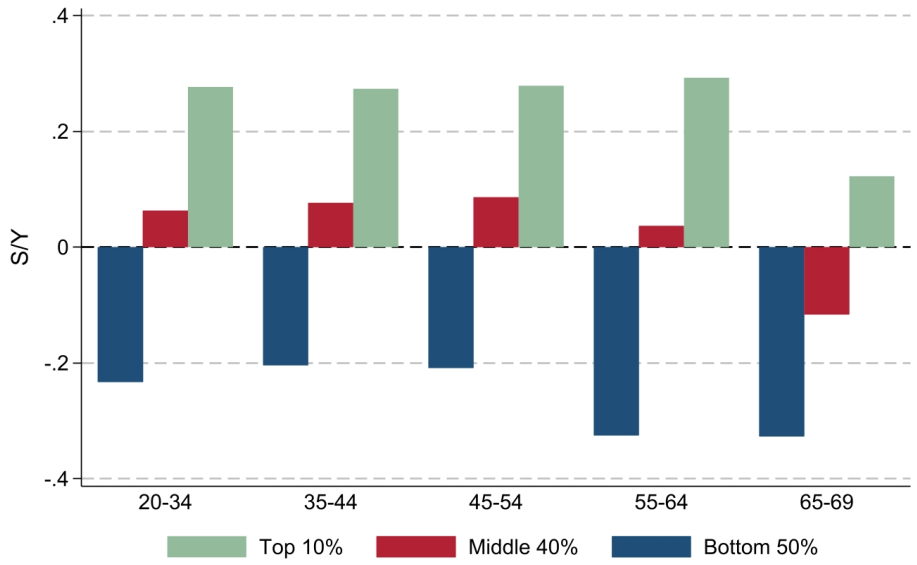
3.3.2 Effects of compositional changes

The income inequality component of the shift share accounts for changes in the relative income of each income and age group, and contributed approximately

0.36 percentage points to the increase in the aggregate private saving-to-income ratio. This represents 6% of the total increase resulting from changes to income distribution in Australia between the pre- and post-periods. The demographics component, which measures the effect of changes to group population shares if saving profiles and income shares remained stable, contributed negatively to the increase. The decomposition finds age demographics to have reduced the aggregate saving ratio by 1.72 percentage points.

The contribution from each of these components depends upon the base saving rate, relative income and population share of each group, and how their relative income has changed (in the case of the income inequality component) or how their population share has changed (for the age demographics component). Base saving rates for each group are reported in column 1 of Table 2 and shown in Figure 8.

Figure 8: Saving rates in 1988-89



Note: Base year (1988-89) average saving-to-income ratios for each age-income group from the Household Expenditure Survey.

Base saving rates vary significantly across the income distribution but minimally when comparing across age groups. A similar trend also observed by Mian, Straub and Sufi (2021) for the US. Given this, changes to the income distribution would be expected to be more significant than changes to the age distribution on the

aggregate saving ratio given the importance of saving rates in the pre-period in the decomposition in equation (2).

Changes to the relative incomes and population shares of groups have been discussed in sections 3.1 and 3.2, and are reported in columns 5 and 6 of Table 2. Of these changes, the most significant are increases in relative income towards the top 10% of income earners for the 45-54, 55-64 and 65-69 age groups, and the shift in population share from the youngest two age groups to the oldest two age groups.

Column 8 of Table 2 reports the contributions towards the change in the aggregate saving-to-income ratio from the income inequality component of each age/income group. The largest contributions come from the top 10% of income earners in the 45-54 and 55-64 age groups. Worsening income inequality has contributed moderately to the increase in private savings as incomes have shifted towards these high-saving groups.

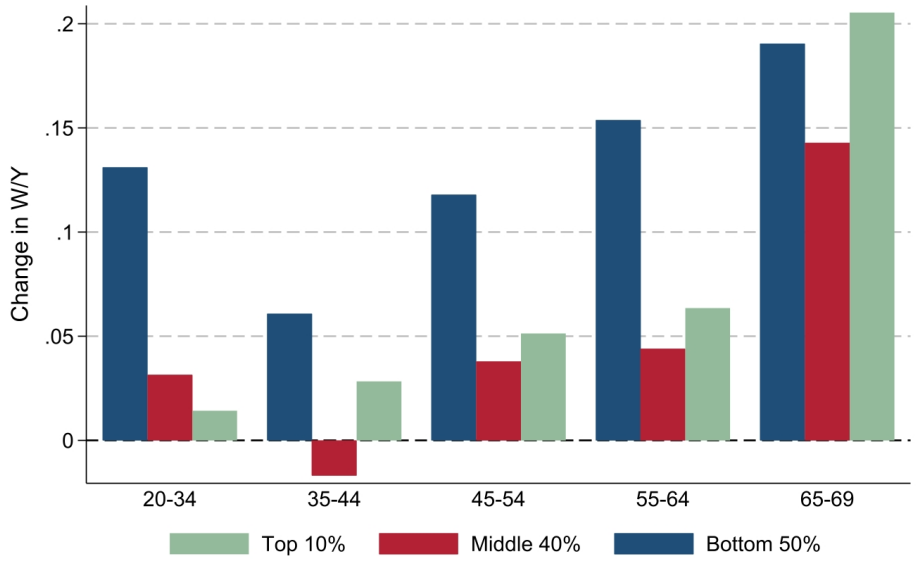
Column 9 of Table 2 reports the contributions towards the change in the aggregate saving-to-income ratio from the age demographics component from each group of households. Since the bottom 50% of income earners in the 20-34 and 35-44 age groups are dissaving, a decrease in their population share creates a positive shift-share effect on overall savings. The increase in population share for the top 10% in the oldest age groups has the same effect. However, the positive effect from these groups is dominated by the negative effect of the population shifting towards the low-saving 65-69 year old group. The shift-share decomposition predicts that the shift in population shares coming from the ageing of Australia's population, were it not accompanied by changes to household saving behaviours or the income distribution, would have decreased the aggregate private saving ratio. This finding is consistent with results for Australia and other countries from Auclert et al. (2025).

3.3.3 Changes to within-group savings

Of the 6.50 percentage point increase in aggregate household saving-to-income ratios across the sample period estimated from the shift-share decomposition, a

substantial 5.54 percentage points, or 85% of the total increase, was driven by changes to within-group saving behaviours rather than changes in the composition of households along the income and age distributions. These results suggest that factors other than income inequality and changes to age demographics have played a large role in the story of Australian household savings. This finding is consistent with other research on Australian private savings, such as Finlay and Price (2015).

Figure 9: Change in saving rates (1988-89 to 2015-16)



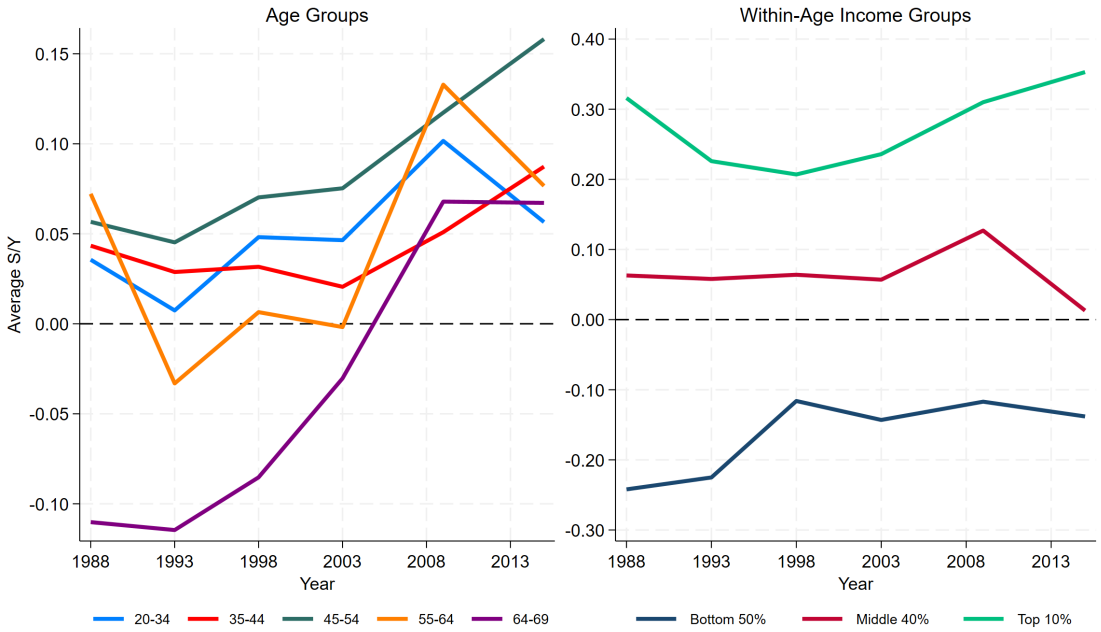
Note: Changes to average saving-to-income ratios for each age-income group between the 1988-89 and 2015-16 waves of the Household Expenditure Survey $\left(\frac{\bar{s}_{i\tau}}{\bar{y}_{i\tau}} - \frac{\bar{s}_{i0}}{\bar{y}_{i0}}\right)$.

A breakdown of changes in group saving-to-income ratios is reported in column 4 of Table 2. Almost all groups experienced a rise in their average saving rate between the pre- and post-periods. The increases were highest for the bottom 50% of the within-age income distribution and for the oldest age groups.

Figure 10 shows the evolution of average saving rates for age groups in the left panel and within-age group income groups in the right panel. The increase in saving rates among household groups by age appears to be a mostly long-term trend and, as expected, is most pronounced for the oldest age group. By contrast,

we see that the increase in savings for the bottom 50% of income earners occurred most substantially between the 1993-94 and 1998-99 HES survey waves.

Figure 10: Average saving rates by age and within-age income groups



Note: The left panel shows changes to the average saving-to-income ratios for each age group between the 1988-89 and 2015-16 waves of the Household Expenditure Survey. The right panel shows the changes to average saving-to-income ratios for each within-age income group.

The decline in global interest rates across the sample period may be one factor affecting household saving behaviours by lowering domestic rates of interest. Aizenman, Cheung, and Ito (2017) find that when nominal rates are near zero and the economy is characterised by well-developed financial markets or an ageing population, the income effect of the low-interest rate environment will dominate and lead to a greater tendency for households to save. As Raghuram Rajan, former governor of the Reserve Bank of India, suggested: "savers put more money aside as interest rates fall in order to meet the savings they think they will need when they retire" (Rajan 2013).

Institutional factors may have also driven part of the within-group move toward higher saving. The Superannuation Guarantee was introduced in Australia in 1992,

requiring employers to make a 3% contribution to their employees' superannuation funds on their behalf. This was later increased to 9% in 2002, and further increases have led to a compulsory contribution rate of 12% in 2025.[7] Both superannuation contributions by employers on behalf of employees and superannuation drawdowns by self-funded retirees are included in the measure of disposable income from the HES. Therefore, much of the increase in household saving, especially for the oldest age groups, may be as a result of compulsory contributions increasing the measure of income used to calculate saving rates in this study.

Another institutional factor may be successive increases in spending on pensions and services which increased incomes and decreased consumption spending for those over 65 years old. Daley and Wood (2014) note that welfare benefits increased for households over 65 more than for any other age groups between 1988-89 and 2009-10. This includes a 20 percent increase in expenditure for the Age Pension between 2003-04 and 2009-10, the same period in which the 65-69 year old age group experienced the largest increase in the average saving ratio.

The observed rise in household saving may also in part reflect stronger precautionary saving motives.[8] Households may have become more willing to forego current consumption to smooth future consumption if they perceived greater future risks or became more risk averse. This is consistent with the largest increase in average $\frac{S}{Y}$ seen among the oldest, and the lowest income-earning households who tend to be far more exposed to financial risk than others.[9]

7. The proportion of workers covered by superannuation has also increased over time. In 1989, before the introduction of the Superannuation Guarantee, only 55% of full-time employees and 18% of part-time employees were covered by superannuation. These increased to 88% and 54% respectively in 1992 with the introduction of the Guarantee. By 1999, 96.9% of full-time employees were covered by superannuation in Australia (Australian Treasury 2001).

8. McCririck and Rees (2017) also argue that risk aversion has had a large impact on the fall in Australia's r*. They emphasise lower firm investment and widening spreads between market interest rates and the cash rate as evidence for households and firms becoming more risk averse.

9. Finlay and Price (2015), in their study on Australian household savings between 2009-10 and 2015-16, find that households with less secure incomes and greater vulnerability to asset price shocks increased their propensity to save across the study period.

The Global Financial Crisis is one event which could have plausibly intensified risk aversion, especially among more vulnerable groups. However, there is no substantial change to average savings-to-incomes for any group around the time of the GFC. This suggests that a sudden change in households' precautionary saving motives may not have been a particularly important factor in driving saving behaviours between 1988 and 2016.

Finally, households may be increasing their savings to finance longer retirements as life expectancies rise. Using a general equilibrium framework, Kulish, Smith, and Kent (2006) examine the impact of rising life expectancies on Australian household savings and find that longer lives will lead to higher household saving rates even if an increase in life expectancy raises the number of years spent working. This exposes a potential limitation of the shift-share approach. Population ageing, and income inequality too, may have have effects on savings and wealth beyond the mere changes to the composition of groups.

3.3.4 Interaction effects

Table 3: Shift-Share Residual Decomposition

	Contribution (pp)	% of γ
Saving Profiles x Income	0.34	20
Saving Profiles x Demographics	0.85	49
Income x Demographics	-0.30	-17
Saving Profiles x Income x Demographics	0.82	48
Total γ	1.72	100

Note: This table presents the components of the residual, γ, from the savings shift-share decomposition. The residual term is the sum of all the higher-order interaction terms of equation (2).

Lastly, the decomposition results reveal that interaction effects captured in γ account for 26% of the total increase in the aggregate saving rate. In Table 3, the

residual is separated into individual interaction effects. The primary contributor to γ is the simultaneous change in saving profiles and the age distribution, accounting for 49% of the residual term. This interaction was predominately driven by the eldest age groups who, as already discussed, experienced the largest positive change in both average saving ratios and population shares.

The joint interaction of all three factors contributes an additional 48% of the residual, indicating that changes in saving propensity, relative income position, and population share for certain groups occurred simultaneously, with each reinforcing the effect of the others. These findings suggest that the increased aggregate saving rate cannot be fully explained by the linear combination of saving profile, inequality, and demographic effects alone; instead, approximately one-quarter of the total change stems from multiplicative dynamics through which these factors amplified each other.

3.4 Wealth shift-share results

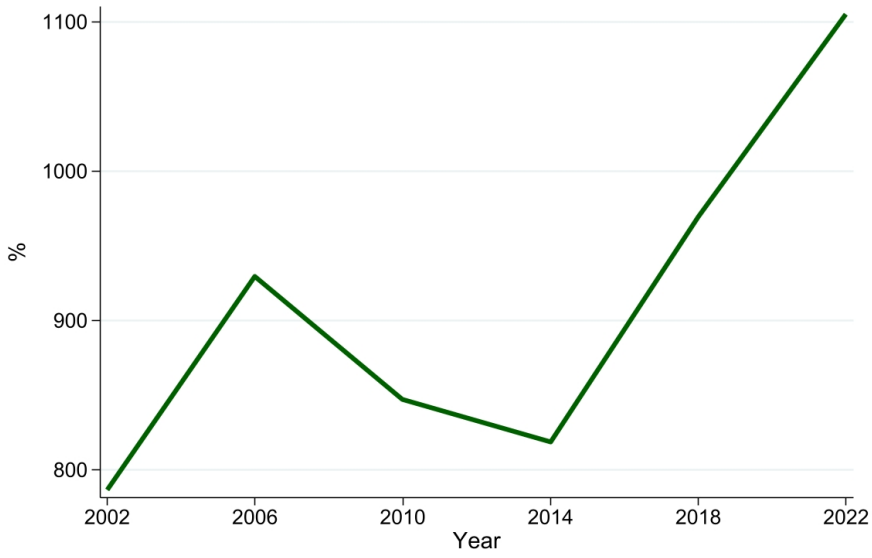
The wealth shift-share decomposition predicts that ageing and inequliaty both contributed to a rise in the aggregate wealth-to-income ratio between 2002 and 2022. The results suggest that changes in both the income and age distributions have contributed positively to the higher aggregate wealth-to-income ratio with age demographics playing a slightly more significant role. The wealth shift-share also indicates that changes in wealth-to-income profiles alone contributed the most to the rise in the aggregate wealth-to-income ratio between 2002 and 2022. Results for the decomposition for the wealth-to-income ratio are reported in Table 4. Detailed results of the contributions from each within-age income group are reported in Table 5.

Table 4: Wealth Shift-Share Results

	Contribution (pp)	% of Total
W/Y Profiles	142.5	63
Income Inequality	20.9	9
Demographics	42.4	19
Residual	19.7	9
Total	225.4	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is the 2002 wave of the HILDA survey waves and period $t = \tau$ is 2022. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.3. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component. Appendix C.1 reports results for alternative time periods and population groupings.

Figure 11: Aggregate Household Wealth-to-Income Ratio



Note: Aggregate household wealth-to-income ratio across all income and age groups. Estimates are from each wave of the HILDA survey containing the wealth module.

Table 5: Wealth Shift-Share Results - 15 Groups

	Base Period ($t=0$)			Changes (Δ)			Contribution to $\Delta(S/Y)$				
	$\frac{\bar{w}_{i\tau}}{\bar{y}_{i\tau}}$	$\frac{\bar{y}_{i\tau}}{\bar{y}_{\tau}}$	$\frac{N_{i\tau}}{N_{\tau}}$	$\Delta\frac{\bar{w}_i}{\bar{y}_i}$	$\Delta\frac{\bar{y}_i}{\bar{y}}$	$\Delta\frac{N_i}{N}$	W/Y Prof.	Inequ.	Demog.	Resid.	Total
Ages 20–34											
Top 10%	4.544	2.169	0.029	0.595	-0.109	-0.004	0.038	-0.014	-0.041	-0.005	-0.023
Middle 40%	3.375	1.160	0.116	0.723	-0.112	-0.016	0.097	-0.044	-0.063	-0.016	-0.026
Bottom 50%	2.572	0.532	0.145	0.919	-0.040	-0.020	0.071	-0.015	-0.028	-0.012	0.016
Ages 35–44											
Top 10%	7.210	2.361	0.025	0.552	0.290	-0.002	0.032	0.052	-0.032	-0.003	0.049
Middle 40%	6.225	1.255	0.099	1.282	0.023	-0.007	0.159	0.014	-0.058	-0.010	0.105
Bottom 50%	5.312	0.625	0.124	1.713	0.005	-0.009	0.133	0.003	-0.031	-0.009	0.095
Ages 45–54											
Top 10%	7.847	2.747	0.024	2.169	0.343	-0.001	0.140	0.063	-0.021	0.008	0.191
Middle 40%	9.087	1.429	0.094	1.545	-0.026	-0.004	0.207	-0.022	-0.050	-0.011	0.123
Bottom 50%	8.495	0.645	0.117	1.049	-0.037	-0.005	0.079	-0.037	-0.026	-0.006	0.009
Ages 55–64											
Top 10%	12.100	2.532	0.016	0.501	0.182	0.004	0.021	0.036	0.129	0.016	0.202
Middle 40%	12.954	1.134	0.066	1.613	0.086	0.016	0.120	0.073	0.241	0.060	0.493
Bottom 50%	14.069	0.415	0.082	3.059	0.039	0.021	0.104	0.044	0.120	0.049	0.318
Ages 65–69											
Top 10%	14.639	1.667	0.007	-1.247	0.224	0.005	-0.014	0.022	0.123	0.003	0.134
Middle 40%	14.261	0.799	0.026	6.121	0.050	0.009	0.125	0.018	0.101	0.060	0.305
Bottom 50%	14.661	0.305	0.032	11.535	0.033	0.014	0.113	0.015	0.063	0.073	0.264

Notes: $\frac{\bar{w}_{i\tau}}{\bar{y}_{i\tau}}$ is group i's average wealth-to-average income ratio (W/Y profile); $\frac{\bar{y}_{i\tau}}{\bar{y}_{\tau}}$ is the ratio of group i's average income to the overall average (income inequality); $\frac{N_{i\tau}}{N_{\tau}}$ is group i's share of the adult population (demographic structure). Changes (Δ) show differences between pre- and post-periods. Contributions show each component's effect on the aggregate wealth-to-income ratio. All values are in decimal form.

3.4.1 Aggregate wealth-to-income ratio

Figure 11 illustrates the increase in the aggregate household wealth-to-income ratio in Australia throughout the decades in which the natural rate of interest has been falling. In the two decades between 2002 and 2022, the data from HILDA suggests that aggregate private wealth-to-income has increased by approximately 225 percentage points.

3.4.2 Effects of compositional changes

Both income inequlity and population ageing have contributed to the increase in asset demand in Australia between 2002 and 2022. The wealth shift-share decomposition results estimates that changes to relative incomes of each group alone would have increased the aggregate wealth-to-income ratio by 20.9, or 9% of the total increase in aggregate $\frac{W}{Y}$. The change in population shares for each group would have increased aggregate $\frac{W}{Y}$ by 42.4 percentage points, or 19% of the total increase between the pre- and post-periods, if wealth-to-income profiles and relative incomes had remained fixed.

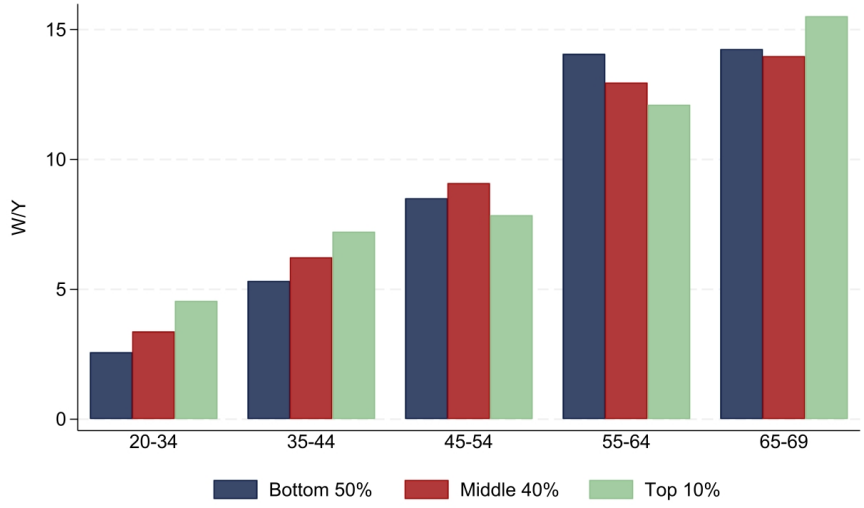
The contributions from population ageing and income inequality depend substantially upon the wealth-to-income ratios of each group in the base year. The average $\frac{W}{Y}$ of each group in 2002 is reported in column 1 of Table 5 and shown in Figure 12.

A clear feature is that average wealth-to-income ratios increase monotonically with age. This is consistent with households accumulating wealth throughout their lifetimes to save for retirement. As incomes lower in retirement, $\frac{W}{Y}$ can increase further even if the household ceases accumulating wealth. This suggests that ageing may have a predictable effect on aggregate $\frac{W}{Y}$: an older population means more households in high wealth-to-income groups, thus ageing would be expected to raise aggregate $\frac{W}{Y}$.

By contrast, wealth-to-income ratios are higher for high-income earners than low-income earners across only three of the five age groups. This demonstrates a more complex relationship between income group and $\frac{W}{Y}$. High income earners will

usually be expected to have greater wealth accumulation, however a higher income naturally raises the denominator in the wealth-to-income ratio making the total value lower. Therefore, the effect of an increase in income inequality on aggregate $\frac{W}{Y}$ is dependent on which age groups experience the greatest developments in inequality. Were younger age groups to experience an increase in income inequality, it could be expected that aggregate $\frac{W}{Y}$ would increase. However, the opposite would be expected were the increase in income inequality to occur among 55-64 year old households.

Figure 12: Wealth-to-income ratios by age and income in 2002



Note: Base year (2002) average wealth-to-income ratios for each age-income group from the HILDA survey.

Changes in relative incomes and population shares across the sample period from HILDA are reported in columns 5 and 6 of Table 5. The trends are broadly similar to those observed in the HES data from the 1990s to 2010s. The largest increases in relative incomes went to the top 10% of income earners in all but the youngest age group, thus suggesting growing income inequality. Changes in population shares are negative for the youngest age groups and positive for oldest age groups.

The contributions from each group towards aggregate wealth-to-income through the income inequality component are reported in column 8 of Table 5. Positive contributions come from most age-income groups, and most of all from the increase in relative income for the top 10% of income earners within the 45-54 age group. Declines in relative income across the 20-34 age bin and the lowest two income groups in the 45-54 age bin contributed negatively to this component.

Column 9 of Table 5 reports the contributions from the age demographics component for each group. As expected, the shift in population shares away from the younger cohorts and toward the older ones renders this component negative for the first three age groups, but positive and substantial for the final two age groups. The effect of population ageing is compounded by the larger initial wealth-to-income ratios of the older age groups.

Taken together, shifts in both the income and age distributions have driven the increase in the aggregate wealth-to-income ratio. However, because older households hold substantially higher wealth relative to income, the demographic shift toward an older population has exerted a greater effect on aggregate $\frac{W}{Y}$ than the rise in income inequality. Appendix C.1 reports results from shift-share decompositions with alternative specifications. Results from these suggest that the significant role of demographics in increasing aggregate wealth-to-income is robust to changes in sample years and various age and income partitions.

Finally, it is worth noting that the flow (savings) and stock (wealth) perspectives appear to yield opposing results for the effect of population ageing on r*. A decrease in savings alone, as estimated by the shift-share decomposition in the previous section, would be expected to place upward pressure on r*, while one would expect the increase in wealth holdings to contribute to the fall in r*. In appendix A, I briefly consider how these two results may be reconciled by accounting for both demand- and supply-side determinants of r*.

3.4.3 Changes to within-group wealth

The wealth shift-share decomposition estimates that 63% of the total increase in the aggregate private wealth-to-income ratio came from the increase in group average $\frac{W}{Y}$ between 2002 and 2022 in Australia. Like in the case of household saving behaviours, this result suggests that changes to wealth accumulation behaviours within age and income groups played a more significant role in driving aggregate wealth-to-incomes than changes to the composition of the age and income groups themselves.

Column 4 of Table 5 shows the change in wealth-to-income profiles of each group between 2002 and 2022. The predicted effect of these changes in $\frac{W}{Y}$ profiles, if relative incomes and populations had not changed, are reported in column 7. Except for the top 10% of income earners in the highest age bin, all groups experienced an increase in wealth-to-income ratios between the pre- and post-periods. Increases were highest for the lowest income groups across most age groups in the working age population.

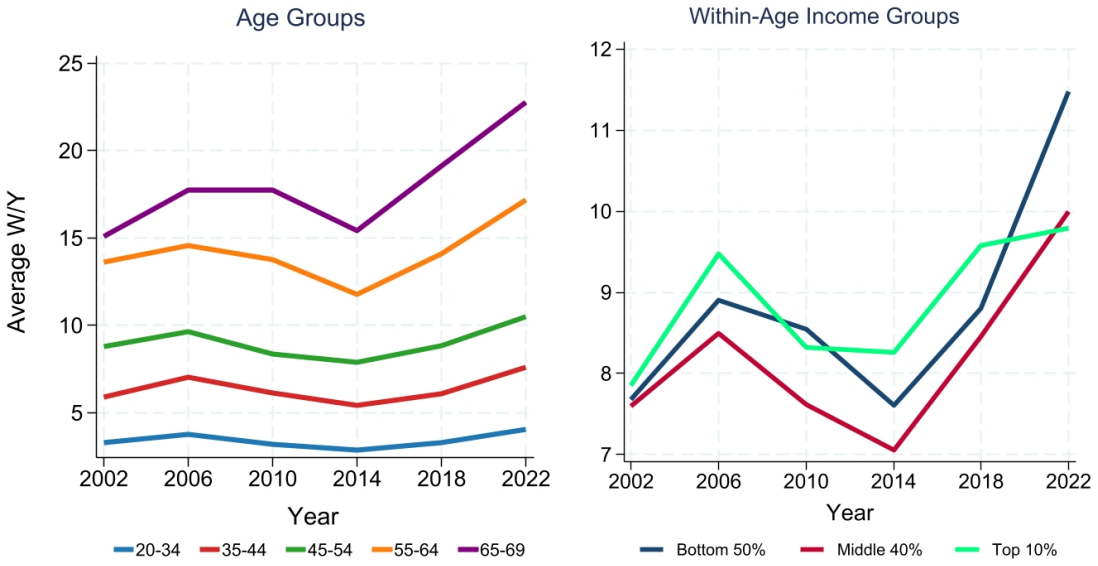
Figure 13 shows the evolution of average wealth-to-income ratios for age groups in the left panel and within-age group income groups in the right panel. The ordering of age groups by wealth-to-income ratios has remained consistent over the two decades to 2022 and the trend increase in average $\frac{W}{Y}$ is clear in the two oldest age groups. From the right panel, the increase in $\frac{W}{Y}$ is most clear for the bottom of the income distribution and much flatter for the top 10% of income earners within each age group.

As the decomposition results find that the rise in the aggregate wealth-to-income ratio in Australia was predominately caused by within-group factors than by the composition of households within income and age groups, it is worth considering what would be driving these within-group changes.

It is possible that the increases in wealth could represent valuation effects which, if unanticipated by households, may have led to wealth holdings becoming above desired levels. If this is the case, the higher wealth-to-income ratios have been brought about by factors other than a change in household saving behaviours.

Rising property prices have also played an important role in Australian household wealth, particularly in recent years. The increase in residential property prices drove two-thirds of the overall increase in real net household wealth growth between December 2018 and December 2021 (Davidson and Bradbury 2022). Lower long-term interest rates brought about by the decline in r*, including global r*, may have also worked to substantially increase asset valuations especially for housing and superannuation investments.[10]

Figure 13: Evolution of wealth-to-income ratios by age and within-age income groups



Note: The left panel shows changes to the average wealth-to-income ratios for each age group between the 2002 and 2022 waves of the HILDA survey. The right panel shows the changes to average wealth-to-income ratios for each within-age income group.

In addition to valuation effects, it is possible that a greater desire across households for wealth holdings contributed to the observed increase in average wealth-to-income ratios within groups. If the increase in $\frac{W}{Y}$ was purely from valuation effects, we would expect to find that the households with high wealth relative to

10. Studies in the US have also found valuation effects to have played a large role in the increase in household wealth-to-income ratios. Bauluz and Meyer (2024) attribute large valuation gains to an asset price boom since the 1980s.

income would also be lowering their rate of saving in order to reduce their wealth (accumulated savings) back to the desired level.

The results from the saving shift-share decomposition in the previous section provide evidence that the majority of Australian households chose to increase their savings relative to their income between the 1990s and 2010s. As noted in section 3.3.3, the within-group increase in savings observed in the HES data was strongest for low-income households and older households[11] - the same groups who increased their average $\frac{W}{Y}$ between 2002 and 2022 according to the data from HILDA. This suggests that households have not been trying to reverse their wealth accumulation by decreasing their savings rates, thus providing evidence that changes to household preferences may have increased the aggregate $\frac{W}{Y}$, perhaps due to the factors discussed at the end of section 3.3.3.

3.4.4 Interaction effects

Table 6: Shift-Share Residual Decomposition

	Contribution (pp)	% of γ
W/Y Profiles x Income	3.88	20
W/Y Profiles x Demographics	7.24	37
Income x Demographics	7.30	37
W/Y Profiles x Income x Demographics	1.30	6
Total γ	19.72	100

Note: This table presents the components of the residual, γ, from the wealth shift-share decomposition. The residual term is the sum of all the higher-order interaction terms of equation (4).

11. Wolff (2025) studies the large rise in wealth of older households in the US between 1983 and 2022 and finds that changes to home ownership, the value of stock holdings, and heterogeneous rise in mortgage debt across age groups have increased relative wealth holdings of older households substantially. It is possible that similar factors have played a role in Australia

The residual term in the wealth shift-share decomposition accounts for only 9% of the increase in aggregate wealth-to-income. As reported in Table 6, the largest contributions come from the interactions between $\frac{W}{Y}$ profiles and demographics, and income inequality and demographics.

4 Conclusion

In the same period that Australia's r* has been in decline, Australian households have increased their savings and wealth relative to household incomes. Two secular trends have also emerged during this time: population ageing and growing income inequality. Both have been considered to be potentially significant drivers of the decline in r* globally and in other advanced economies due to their respective impacts on private savings and wealth accumulation. The results from the shift-share decomposition in this study indicate they may have also played a role in Australia's r*.

The shift-share decomposition of household saving-to-income ratios indicates that the rise in income inequality in recent decades has shifted incomes towards groups of households with higher average saving rates, thereby increasing aggregate private savings. However, unlike other countries such as the US, the increase in income inequality in Australia has been only modest, accounting for approximately 6% of the increase in the aggregate saving-to-income ratio. Meanwhile, population ageing has partially reversed the increase in private savings as more households have reduced their savings as they enter older age brackets.

The results from household wealth-to-income shift-share suggest that both income inequality and population ageing have worked to increase the aggregate household wealth-to-income ratio between 2002 and 2022. The demographic effect of ageing has been especially significant, accounting for approximately 19% of the total change while income inequality contributed only 9%. Older households hold more wealth relative to income on average as wealth is accumulated throughout

their lifetime. Hence, movements in the age distribution towards an older population brings with them higher overall household wealth holdings.

A consistent finding across both shift-share decompositions is the substantial impact of within-group changes. In the case of saving, increases in saving rates within each age and income group accounted for 85% of the rise in aggregate savings-to-incomes. Similarly, the within-group effect for wealth-to-income ratios contributed 63% of the increase in aggregate household wealth relative to income. This finding suggests that inequality and age demographics may be less important than other factors in determining Australian household savings, wealth and, ultimately, the natural rate of interest.

There are several possible lines of future research from this study. First, the pronounced within-group changes evident in the shift-share suggest that uncovering what has driven the shift in household preferences towards greater savings and wealth relative to income in the Australian context is an important area of study. Additionally, further empirical evidence on the manner in which ageing and inequality affect investment and asset supply in Australia would complement this study's findings on savings and asset demand, to gain a more complete understanding of their impact on r* in the asset market equilibrium. Finally, more recent estimates suggest that r* is rising once again in Australia and other advanced economies. Studying the roles of ageing and inequality in this increase would be a valuable extension to this study, although only possible with more data than is currently available.

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Appendix

A Discussion: reconciling results from the flow and stock perspectives

The results from the saving and wealth shift-share decompositions indicate that population ageing has had a slight negative effect on the aggregate private saving ratio while increasing aggregate wealth-to-income. Therefore, when viewing the determinants of the natural rate of interest through the lens of flows, demographic change is placing upward pressure on r*. However, this change is contributing to the fall in r* when approached through the lens of stocks.

The following brief discussion is motivated and informed by the discussion on similar findings in Auclert et al. (2025), who find that this apparent contradiction is resolved when the effect of population ageing on investment is taken into account.[12]

In the baseline overlapping generations model used by Auclert et al. (2025), asset demand from households is equal to asset demand from firms and governments for a given r* which, when divided by GDP, can be written as

$$\frac{W}{Y} = \frac{K + B}{Y} \tag{5}$$

The authors note that standard neoclassical theory implies that $\frac{K}{Y}$ is unaffected by population ageing and they additionally assume that $\frac{B}{Y}$ is constant, although they acknowledge that is subject to debate. Under these assumptions, r* is determined solely by changes to asset demand (aggregate $\frac{W}{Y}$) from a stocks perspective. Therefore, the natural rate will decline with an increase in population ageing that increases aggregate wealth in the economy, as depicted in the right panel of Figure 14 (from Figure 10 in Auclert et al (2025)).

12. See Section 5 and Appendix F of Auclert et al. (2025) for full derivation.

Aggregate savings-to-income is defined as the change in aggregate wealth-to-income between periods:

$$\frac{S_t}{Y_t} = \frac{W_{t+1} - W_t}{Y_t} \tag{6}$$

Since wealth grows at a rate g (such that $W_{t+1} = (1+g)W_t$):

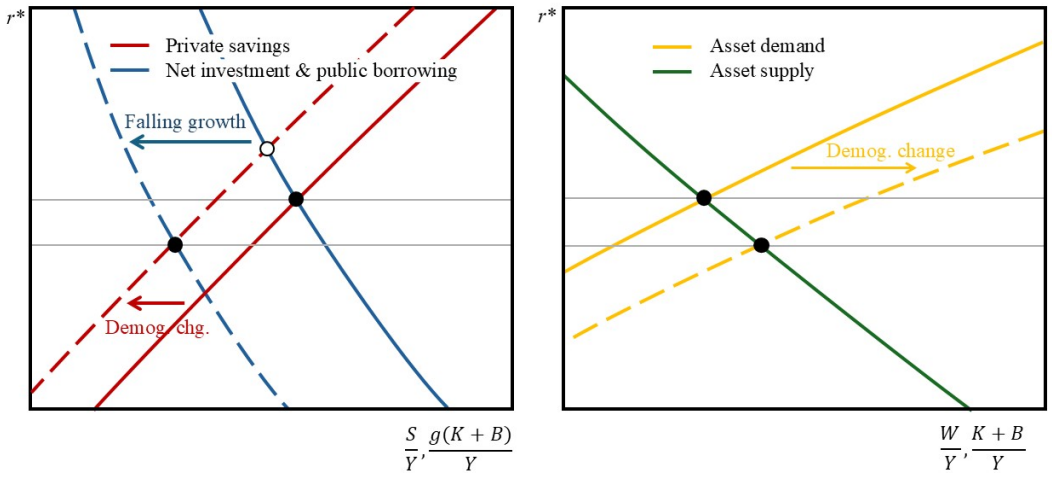
$$\frac{S}{Y} = g\frac{W}{Y} \tag{7}$$

By combining Equations (5) and (7) we see that, from the flow perspective, r* is determined by private savings and g in steady state:

$$\frac{S}{Y} = g\frac{K+B}{Y} \tag{8}$$

where $g\frac{K}{Y}$ and $g\frac{B}{Y}$ are net investment and net public borrowing, respectively. This relationship is illustrated in the left panel of Figure 14. Population ageing lowers savings relative to income, as the shift-share decomposition found, pushing r* up. However, population ageing is also expected to lower the population growth rate which contributes to g, thus also shifting the other curve left and lowering r*, given a significantly large effect of population ageing on g.

Figure 14: Asset market equilibrium

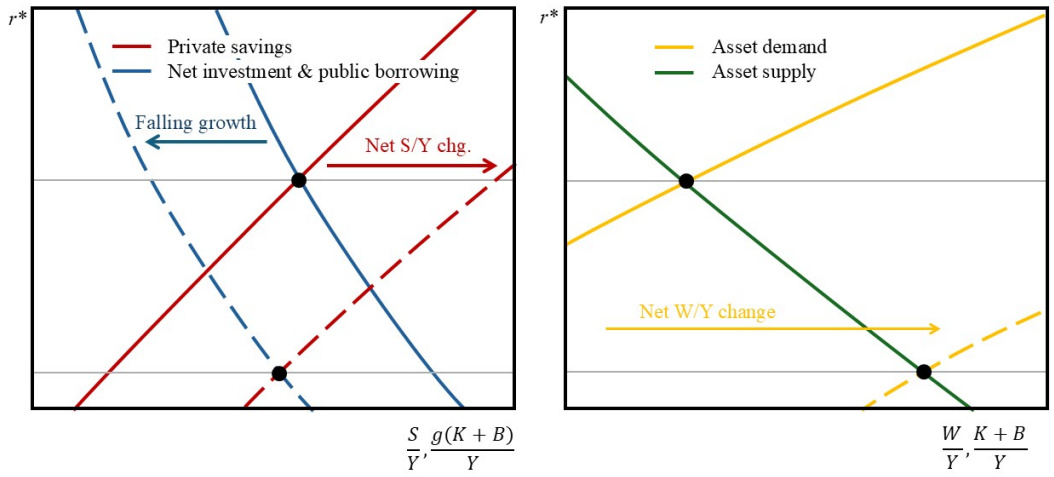


Note: The left panel represents asset market equilibrium in terms of flows, the right panel represents equilibrium in terms of stocks. The right panel is converted into the left by multiplying by the growth rate g.

The relationship in the right hand panel is identical, but with both curves multiplied by $\frac{1}{g}$. In this case, the entire decline in r* is explained by the increase in asset demand $\left(\frac{W}{Y}\right)$ brought about by the ageing of the population.

Auclert et al. (2025) suggest that this finding shows that while both the flow and stock views are equally valid, it is critical to account for the impact that factors which affect private savings and asset demand may have on net investment, public borrowing, and asset supply.

Figure 15: Asset market equilibrium



Note: The left panel represents asset market equilibrium in terms of flows, the right panel represents equilibrium in terms of stocks. The right panel is converted into the left by multiplying by the growth rate g.

Figure 15 illustrates the possible implication of results from the shift-share decomposition in this paper. In the left panel the net increase in aggregate private savings places downward pressure on r* which is exacerbated by the fall in g from population ageing (assuming income inequality and saving profiles do not affect g, although they may in reality).

B Appendix to Section 3.3

B.1 Alternative specifications for shift-share decomposition

To test the robustness of my results, I begin by assessing the sensitivity of my results to which waves from the HES are used in the pre- and post-period. In my baseline model I take the average of the 1988-89 and 1993-94 survey waves as my pre-period, 0, and the average of the 2009-2010 and 2015-16 waves as my post-period, τ.

My first alternative specification simply takes year 0 to be 1993-94 and year τ to be 2015-16, thus covering the period during which r* has declined and aggregate savings-to-income have increased. Results are reported in Table 7 and are largely similar to my baseline decomposition. Changes to saving profiles continue to be identified as the largest contributor to aggregate savings, followed by income inequality. Changes in the age distribution alone again contribute negatively. Overall, the approach of taking averages used in my baseline decomposition would be expected to be more robust by diminishing the effect on results of year-specific shocks.

Table 7: Shift-Share Results: 1993-94 to 2015-16

	Contribution (pp)	% of Total
Saving Profiles	2.17	42
Income Inequality	2.11	41
Demographics	-2.01	-39
Residual	2.85	56
Total	5.11	100

Note: This table presents the results of the shift-share methodology as outlined in equation (2). Period $t = 0$ is the 1993-94 HES survey wave and period $t = \tau$ is the 2015-16 wave. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.2. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate private saving-to-income ratio. Column 2 reports the

percentage of the total increase in the aggregate private saving-to-income ratio contributed by each component.

I change the pre-period to be the 2003-04 survey wave in Table 8, keeping the post-period as 2015-16. Changes to the methodology used to measure income in the HES changed in the early 2000s. The relative effect of three components of the decomposition remains the same despite variation in the magnitudes. This suggests that the significance of changes to within-group saving profiles and the positive impact of income inequality on private saving are trends which have continued through the period during which r* has been declining.

Table 8: Shift-Share Results: 2003-04 to 2015-16

	Contribution (pp)	% of Total
Saving Profiles	4.77	65
Income Inequality	1.73	23
Demographics	-2.81	-38
Residual	3.70	50
Total	7.39	100

Note: This table presents the results of the shift-share methodology as outlined in equation (2). Period $t = 0$ is the 2003-04 HES survey wave and period $t = \tau$ is the 2015-16 wave. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.2. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate private saving-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate private saving-to-income ratio contributed by each component.

In the following alternative specifications, I keep the survey years as in the baseline decomposition but vary the age and income groupings used.

Table 9 reports results for a specification with two age groups rather than five. Households fall into the first age bin if the age of the household head is between 20 to 44 years old. The second age bin is for households with a head who is 45 to 69

years old. Income groupings are the same as in the baseline specification - top 10%, middle 40% and bottom 50% of income earners for each age group.

Table 9: Saving Shift-Share Results: 2 Age Groups, 3 Income Groups

	Contribution (pp)	% of Total
Saving Profiles	4.68	74
Income Inequality	0.77	12
Demographics	0.23	4
Residual	0.62	10
Total	6.30	100

Note: This table presents the results of the shift-share methodology as outlined in equation (2). Period $t = 0$ is the average of 1988-89 and 1993-94 HES survey waves and period $t = \tau$ is the average of 2009-10 and 2015-16. I apply the shift-share method to 6 within-age income groups. Age bins are 20-44 years old and 45-69 years old. Income groups are top 10%, next 40% and bottom 50% of income earners within each age group. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate private saving-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate private saving-to-income ratio contributed by each component.

As a result of only having two age groups, the age demographics component now contributes positively to the rise in aggregate private saving-to-income. This specification fails to properly capture the heterogeneity in saving rates across the age distribution, particularly the dissaving of the elderly in the base year and so over-reports the effect that ageing alone has on household savings.

For the results in Table 10, I keep the five age groups as in the baseline and replace the three income groups with two - the top 10% of income earners and the bottom 90% of income earners for each age group.

Table 10: Saving Shift-Share Results: 5 Age Groups, 2 Income Groups

	Contribution (pp)	% of Total
Saving Profiles	5.31	82
Income Inequality	0.67	10
Demographics	-1.12	-17
Residual	1.65	25
Total	6.51	100

Note: This table presents the results of the shift-share methodology as outlined in equation (2). Period $t = 0$ is the average of 1988-89 and 1993-94 HES survey waves and period $t = \tau$ is the average of 2009-10 and 2015-16. I apply the shift-share method to 10 within-age income groups. Age bins are as specified in Section 2.2. Income groups are top 10% and bottom 90% of income earners within each age group. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate private saving-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate private saving-to-income ratio contributed by each component.

Reducing the number of income groupings from three to two almost doubles the estimated contribution from income inequality in the decomposition. This suggests that most of all the shift in income to the very top of the income distribution is driving the contributions from the income inequality component. This effect is also displayed in Table 11 where the decomposition included three income groups within each age group: the top 1% the next 9% and the bottom 50% of income earners.

Table 11: Saving Shift-Share Results: 5 Age Groups, 3 Income Groups

	Contribution (pp)	% of Total
Saving Profiles	5.27	81
Income Inequality	0.85	13
Demographics	-1.16	-18
Residual	1.52	23
Total	6.48	100

Note: This table presents the results of the shift-share methodology as outlined in equation (2). Period $t = 0$ is the average of 1988-89 and 1993-94 HES survey waves and period $t = \tau$ is the average of 2009-10 and 2015-16. I apply the shift-share method to 15 within-age income groups. Age bins are as specified in Section 2.2. Income groups are top 1%, the next 9% and bottom 90% of income earners within each age group. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate private saving-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate private saving-to-income ratio contributed by each component.

The relative contributions from changes to saving profiles and age demographics are largely unchanged. The change to within-group saving profiles remains the largest contributor to the overall change in saving rates.

Finally, I include only two age groups (20-44 years old and 45-69 years old) and two income groups (top 10% and bottom 90% of income earners within each age group). Results are reported in Table 12.

Table 12: Saving Shift-Share Results: 2 Age Groups, 2 Income Groups

	Contribution (pp)	% of Total
Saving Profiles	4.35	69
Income Inequality	1.21	19
Demographics	0.23	4
Residual	.51	8
Total	6.30	100

Note: This table presents the results of the shift-share methodology as outlined in equation (2). Period $t = 0$ is the average of 1988-89 and 1993-94 HES survey waves and period $t = \tau$ is the average of 2009-10 and 2015-16. I apply the shift-share method to 4 within-age income groups. Age bins are 20-44 years old and 45-69 years old. Income groups are top 10% and bottom 90% of income earners within each age group. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate private saving-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate private saving-to-income ratio contributed by each component.

Overall, the results from alternate specifications for the saving shift-share decomposition including different time periods and population partitions suggest

that the results from the baseline model are robust. While magnitudes and directions change, especially across different levels of heterogeneity in age and income grouping, the relative significance of the three components of the decomposition remain stable.

B.2 Income shift-share approach

For robustness, I evaluate the relative contributions of income inequality and population ageing on household saving-to-income ratios using the income shift-share approach of Mian, Straub and Sufi (2021), adapted from earlier studies by Summers and Carroll (1987) and Bosworth, Burtless and Sabelhaus (1991).

S_{it} and Y_{it} are the nominal saving and nominal income for any group i in year t, with S_t and Y_t being the aggregates over the groups. The change in the aggregate saving-to-income ratio for the groups from year 0 to year τ can be written as:

$$\frac{S_\tau}{Y_\tau} - \frac{S_0}{Y_0} = \sum_{i=1} \left(\frac{Y_{i,\tau}}{Y_\tau} . \frac{S_{i,\tau}}{Y_{i,\tau}} - \frac{Y_{i,0}}{Y_0} . \frac{S_{i,0}}{Y_{j,0}} \right) \tag{9}$$

That is, it can be broken down into the changes in saving rates for each group, taking into account that group's share of total income.

Now let $\alpha_{i,t}$ be the income share of group i at time t and $s_{i,t}$ be the average saving rate for that group out of its own income at time t. The change in aggregate saving-to-income ratio can now be decomposed as follows:

$$s_\tau - s_0 = \underbrace{\sum_{j=1}^{J} (\alpha_{i\tau} - \alpha_{i0}) s_{i0}}_{\text{shift-share}} + \underbrace{\sum_{i=1}^{J} (s_{i\tau} - s_{i0}) \alpha_{i\tau}}_{\text{residual}} \tag{10}$$

where the "shift-share" term which moves with changes in income shares going to each group, and a "residual" term which reflects changes in saving rates for each group. The shift-share term captures the compositional effects while the residual term captures the within-group effects on aggregate savings

The shift-share term is the focus of this approach, representing the impact on total saving rates were there to be a shift in income towards particular income or age groups over time, ceteris paribus. When a group with a relatively high saving rate experiences a sufficiently large increase in its share of overall income, the

aggregate saving ratio will increase by more than if the shift in income were to go to a group with a lower saving rate. Changes in the distribution of income across groups are the sole determinant of variations in the aggregate saving-to-income ratio if saving rates remain constant over time.

The residual term captures how changes in saving preferences of different groups have altered overall savings in the Australian economy.

This income shift-share approach could be used to study the dynamics of aggregate savings driven by changes in any grouping of the overall population. Mian, Straub and Sufi (2021) use it to study the income shifts amongst age groups and within-age income groups in the US. I compare the saving rate differences and shifts in income shares across the same types of groups in Australia. If a particular partition (by age or income) shows significant variation in saving rates and undergoes substantial changes in income shares across its groups, then this partition is likely to have been more influential in driving recent movements in r*.

The results from the alternative saving shift-share approach suggest that the rise in income inequality has been a stronger driver of the change in saving over time, supporting the evidence found in section 3.3.2. Table 13 shows shift-share results for the three within-age income groups, reporting each component from equation (10). The pre-period is once again the averages from the 1988-89 and 1993-94 HES survey years and the post-period is the averages from the 2009-10 and 2015-16 survey years.

Table 13: Shift-share results: within-age income groups

Income group	Saving rate s_0	Income shift $\alpha_\tau - \alpha_0$	Shift-share $s_0 \cdot (\alpha_\tau - \alpha_0)$	Δ Saving rate $s_\tau - s_0$	Post income share α_τ	Residual $(s_\tau - s_0) \cdot \alpha_\tau$	Total
Top 10%	0.271	0.047	0.013	0.061	0.281	0.017	0.030
Next 40%	0.061	−0.037	−0.002	0.009	0.447	0.004	0.002
Bottom 50%	−0.234	−0.011	0.002	0.107	0.272	0.029	0.032

Note: This table presents the results of the income shift-share methodology as outlined in equation (3) across the income distribution. Period $t = 0$ is the average of 1988-89 and 1993-94 HES survey waves and period $t = \tau$ is the average of 2009-10 and 2015-16.

The first column shows the saving rate of each group in the base period (s_0). It shows that there were large differences in saving rates across income groups, as already seen in Figure 8. The second column shows the change in average within-age income share between the two periods ($\alpha_\tau - \alpha_0$). The shares for the middle 40% and bottom 50% both declined across the sample period while the share held by the top 10% increased by 4.7 percentage points. The shift-share component is reported in column 3, calculated by multiplying together the estimates from columns 1 and 2. The shift-share component represents the expected change in savings as a result of the change in income shares for each income group. Given the higher saving rate and the positive income shift, it is unsurprising that the shift-share component for the top 10% is large and positive. Lower savings rates and smaller shifts in income dictate more modest shift-share estimates for the middle 40% and bottom 50% of income earners within each age group.

Summing together the shift-share components for each group, the decomposition predicts that aggregate saving would have increased by approximately 1.3 percentage points if saving rates for each group had remained stable across the sample period. However, actual aggregate and group saving rates diverge from the shift-share component alone due to changes in within-group saving behaviours between the pre- and post-period.

Column 4 reports the change in saving rate for each group ($s_\tau - s_0$). Each group experienced an increase in savings across the sample period. Column 5 shows each group's final income share (α_τ). Multiplying the values in these two columns produces the residual saving from the shift-share approach used by Mian, Straub and Sufi.

The total increase in the saving-to-income ratio is calculated by adding the shift-share component with the residual. The increase in savings is much higher for each group than what was predicted by the shift-share component alone. This is particularly the case for the top 10% and the bottom 50% who exhibited the large changes in average saving rates.

Overall, these results support the evidence in Section 3.3 despite using an alternative shift-share design. Income inequality has contributed to the increase in savings in Australia, primarily through the increased income share held by the top 10% of income earners who are also, on average, the most inclined to save in the economy. Further, the increase in within-group savings continue to suggest that households are choosing to save more due to factors other than changes to the income distribution.

In Table 14, I present the results from the same shift-share analysis applied to age groups, rather than within-age income groups. Similar to the results found in Section 3.3, changes in the age distribution alone have made a small, negative contribution towards aggregate saving-to-income ratios.

Table 14: Shift-share results: age groups

Age	Saving rate s_0	Income shift $\alpha_\tau - \alpha_0$	Shift-share $s_0 \cdot (\alpha_\tau - \alpha_0)$	Δ Saving rate $s_\tau - s_0$	Post income share α_τ	Residual $(s_\tau - s_0) \cdot \alpha_\tau$	Total
20–34	0.022	−0.022	0.000	0.058	0.185	0.011	0.010
35–44	0.036	−0.039	−0.001	0.033	0.189	0.006	0.005
45–54	0.051	−0.020	−0.001	0.087	0.237	0.021	0.020
55–64	0.020	0.037	0.001	0.085	0.220	0.019	0.019
65–69	−0.112	0.044	−0.005	0.180	0.169	0.030	0.025

Note: This table presents the results of the income shift-share methodology as outlined in equation (3) across the age distribution. Period $t = 0$ is the average of 1988-89 and 1993-94 HES survey waves and period $t = \tau$ is the average of 2009-10 and 2015-16.

Saving rates reported in column 1 do not differ greatly across age groups, unlike across income groups. The shift in income shares towards the two oldest groups seen in column 2 is evidence of the two main factors affecting the Australian age distribution - population ageing and the movement of the Baby Boom generation through the life cycle. The shift-share component shows that age demographics alone, when saving rates are left fixed, have contributed little, and in fact it seems negatively, to changes in aggregate savings.

These findings confirm the difficulty in using the ageing of the Baby Boom generation to explain the increase in aggregate savings and the decrease in r*. Since differences in saving rates across age groups are not large, a change in the age distribution would not be expected to have a large effect on overall private savings. Additionally, the movement of the Baby Boom generation through the life cycle does not create a monotonic shift in income toward high-saving age groups. In fact, the two oldest age groups have some of the lowest saving rates out of all groups. These results challenge the extent to which the Baby Boom hypothesis can be used to explain the decline in r*.

All age groups increased their saving-to-income ratios between the pre- and post-periods, with the largest increase seen in the 65-69 age group. The increase in saving rates across age groups has already been discussed in Section 3.2.2. Multiplying these changes in saving rates with the post-period income share yields the residuals from the decomposition. As was the case in the decomposition by income groups, the residual components in this decomposition are far larger than the shift-share components. Once again, this suggests that it is changes within groups rather than between groups that have been more significant in driving changes to Australia's private savings.

C Appendix to Section 3.4

C.1 Alternative specifications for shift-share decomposition

In this section I present a series of robustness checks which test the sensitivity of the results from the wealth-to-income shift-share to variation in time and age-income groupings.

I begin by altering the pre- and post-periods in my first set of alternatively specified shift-share decompositions. In Table 15, I present the results for the decomposition when year 0 remains as 2002 and year τ is 2018 rather than 2022. Table 16 presents results for the decomposition when 2006 is year 0 and 2022 is year τ.

Table 15: Wealth Shift-Share Results: 2002 to 2018

	Contribution (pp)	% of Total
W-Y Profiles	20.2	20
Income Inequality	30.0	29
Demographics	39.8	38
Residual	13.2	13
Total	103.3	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2002 and period $t = \tau$ is 2018 from HILDA. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.3. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

Table 16: Wealth Shift-Share Results: 2006 to 2022

	Contribution (pp)	% of Total
W-Y Profiles	11.2	19
Income Inequality	5.2	9
Demographics	46.8	82
Residual	-5.8	-10
Total	57.5	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2006 and period $t = \tau$ is 2022 from HILDA. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.3. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

It appears that the exclusion of 2002 and 2022 have a significant effect on results and, in particular, the estimated contribution to aggregate wealth-to-income growth from changes to within-group wealth-to-income profiles. Table 17 shows the decomposition results for the years 2002 to 2006, and Table 18 shows the results for 2014-2022. Comparing these results to those in the two previous tables, it is clear that the majority of the increase in within-group wealth-to-income profiles took place during these periods, rather than the period between 2006 and 2014. A potential explanation for this phenomenon could be a decrease in asset prices during the GFC lowering the value of household wealth, and so decreasing wealth-to-income ratios.

Table 17: Wealth Shift-Share Results: 2002 to 2006

	Contribution (pp)	% of Total
W-Y Profiles	99.3	71
Income Inequality	20.0	14
Demographics	14.2	10
Residual	7.3	5
Total	140.8	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2002 and period $t = \tau$ is 2006 from HILDA. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.3. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

Table 18: Wealth Shift-Share Results: 2014 to 2022

	Contribution (pp)	% of Total
W-Y Profiles	226.3	103
Income Inequality	-11.2	-5
Demographics	12.3	6
Residual	-8.5	-4
Total	218.9	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2014 and period $t = \tau$ is 2022 from HILDA. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.3. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

Next, I compare the baseline results with those from wealth shift-share decompositions with altered income and age partitions. Table 19 presents results for only two age groups, 20-44 and 45-69, with the baseline three income groups. Table 20 contains results from the baseline five age groups with three income groups - the top 1%, the next 9% and bottom 90% of income earners within each age group. Lastly, table 21 reports results for two age groups and two income groups. The relative importance of W-Y profiles and population ageing on aggregate wealth-to-income is consistent across each specification.

Table 19: Wealth Shift-Share Results: 2 age groups, 3 income groups

	Contribution (pp)	% of Total
W-Y Profiles	178.1	79
Income Inequality	2.3	1
Demographics	35.2	16
Residual	9.8	4
Total	225.4	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2002 and period $t = \tau$ is 2022 from HILDA. I apply the shift-share method to 6 within-age income groups. Age bins are 20-44 years old and 45-69 years old. Income groups are top 10%, next 40% and bottom 50% of income earners within each age group. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

Table 20: Wealth Shift-Share Results: 5 age groups, 3 income groups

	Contribution (pp)	% of Total
W-Y Profiles	148.2	66
Income Inequality	19.3	8
Demographics	42.8	19
Residual	15.2	7
Total	225.4	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2002 and period $t = \tau$ is 2022 from HILDA. I apply the shift-share method to 15 within-age income groups. Age bins are as specified in Section 2.3. Income groups are top 1%, the next 9% and bottom 90% of income earners within each age group. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

Table 21: Wealth Shift-Share Results: 2 age groups, 2 income groups

	Contribution (pp)	% of Total
W-Y Profiles	177.7	79
Income Inequality	2.6	1
Demographics	35.1	16
Residual	10.0	4
Total	225.4	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2002 and period $t = \tau$ is 2022 from HILDA. I apply the shift-share method to 4 within-age income groups. Age bins are 20-44 years old and 45-69 years old. Income groups are top 10% and bottom 90% of income earners within each age group. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

Finally, I apply the wealth shift-share decomposition from section 2.3 to data from the Survey of Income and Housing collected by the ABS between 2005-06 and 2019-20. Results are reported in table 21. The negative contribution from W-Y profiles can likely be explained by the decline in asset prices described above. Both income inequality and ageing contributed to the rise in wealth-to-income ratios.

Table 22: Wealth Shift-Share Results (Survey of Income and Housing)

	Contribution (pp)	% of Total
W-Y Profiles	-6.8	-8
Income Inequality	28.3	33
Demographics	28.8	34
Residual	35.0	41
Total	85.4	100

Note: This table presents the results of the shift-share methodology as outlined in equation (4). Period $t = 0$ is 2005-06 and period $t = \tau$ is 2019-20 from the Survey of Income and Housing. I apply the shift-share method to 15 within-age income groups as detailed in Section 2.3. Column 1 provides the sum of each component across all groups as that component's percentage point contribution towards the increase in the aggregate household wealth-to-income ratio. Column 2 reports the percentage of the total increase in the aggregate household wealth-to-income ratio contributed by each component.

D HILDA data disclaimer

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