

Actuaries Summit

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Housing and Retirement Financing: Optimal Time to Buy a Residential Home

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Consumption and Portfolio Choice

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Topic Coverage

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Research Motivation

Dual purpose of housing



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 - ▶ unlock home equity

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- ▶ Potential source of income
 - ▶ unlock home equity
- ▶ Prefer 'age in place'
(Productivity Commission, 2015)

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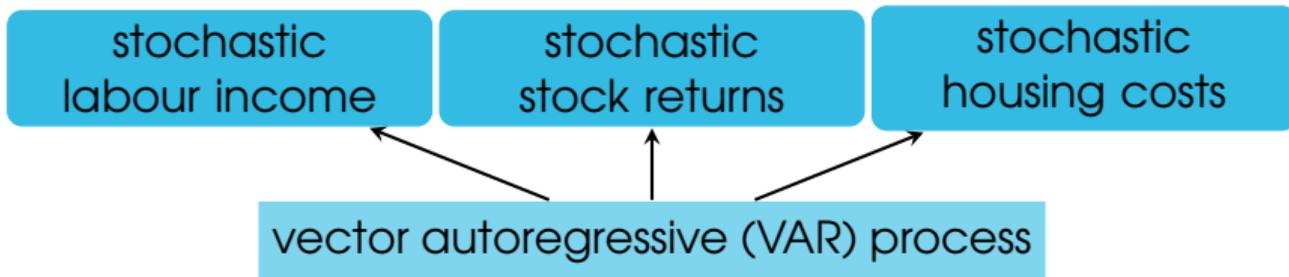
- ▶ Trade-off between rent risk and asset price risk
- ▶ Depend on labour earnings
- ▶ Impact on consumption and portfolio allocation
- ▶ Affect savings for retirement

Research Overview

A multi-period model of consumption and investment decisions with

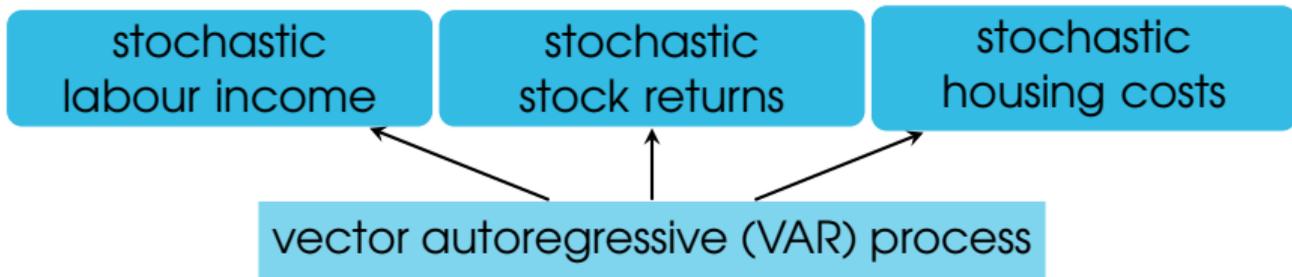
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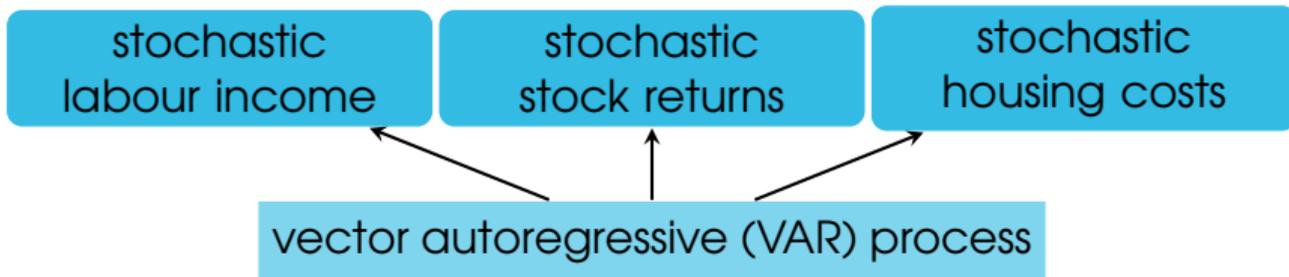
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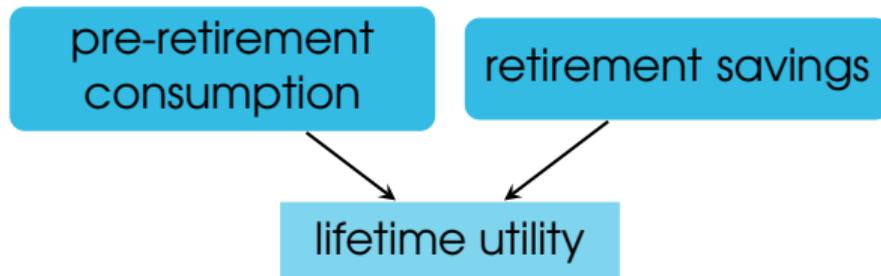
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- ▶ Assume utility derived from housing-service consumption is the same regardless of the tenure choice
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- ▶ Wealth consists of
 - ▶ liquid assets (cash and stocks)
 - ▶ employment-based pension (defined contribution type)
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- ▶ Wealth consists of
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- ▶ Intertemporal consumption and asset allocation decisions
 - ▶ parameterised using the HILDA survey data
 - ▶ HILDA (Household, Income and Labour Dynamics in Australia): household based panel study that began in 2001

Topic Coverage

Introduction

Consumption and Portfolio Choice

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Preference

The e.p.v. of the lifetime utility

$$U_1 = \mathbb{E}_1 \left[\sum_{t=1}^T \beta^{t-1} u(C_t) + \beta^T v(W_{T+1}) \right]$$

where

$$u(C_t) = \frac{C_t^{1-\gamma}}{1-\gamma}$$

utility from non-durable consumption

$$v(W_{T+1}) = b \frac{W_{T+1}^{1-\gamma}}{1-\gamma}$$

utility from retirement savings

$$T = 40$$

age 25 to age 65

Housing Decisions

Rent → Rent

Rent → Own

- ▶ Choose to purchase a house at ages 30, 40, 50, 60, or over 65
 - ▶ over 65: keep renting throughout working life
 - ▶ down payment ($\geq 20\%$ of property value)
 - ▶ 30-year fixed rate mortgage
 - ▶ keep renting if have insufficient fund

Own → Own

- ▶ Stay in the same property
 - ▶ low transition rates of 'own → rent' according to HILDA

Consumption Decisions

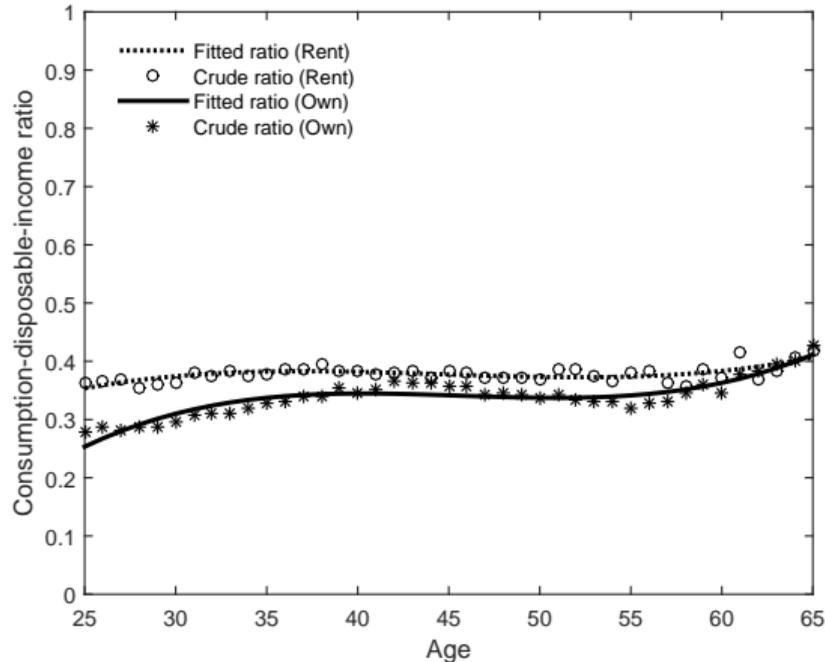


Figure 1: Crude and fitted median annual expenditure on non-durable goods as a proportion of disposable income.

Asset Allocation Decisions

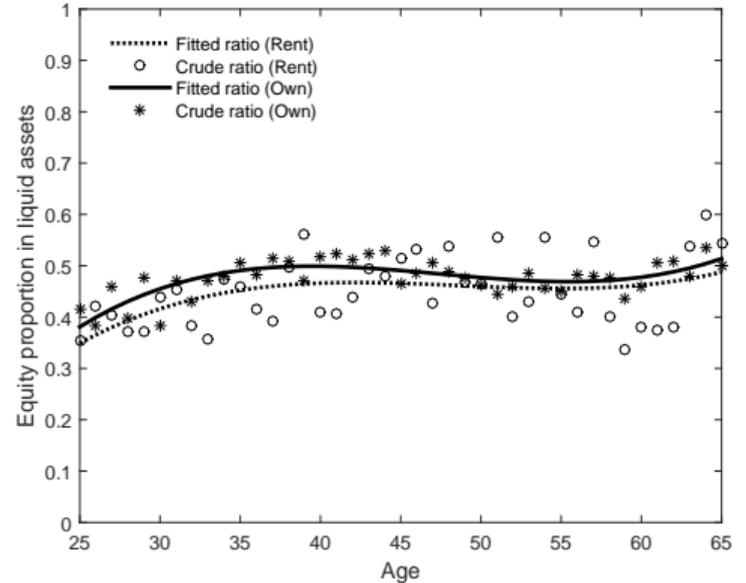
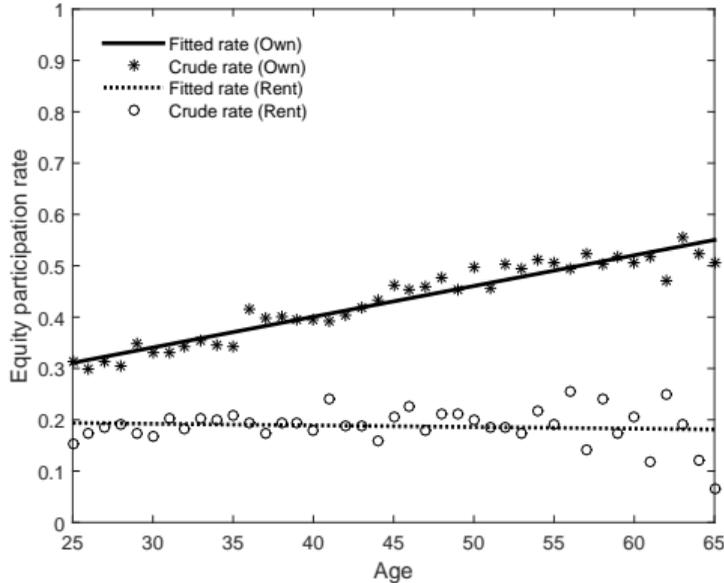


Figure 2: Crude and fitted equity participation rates (Left Panel), and average equity proportions in liquid assets (Right Panel).

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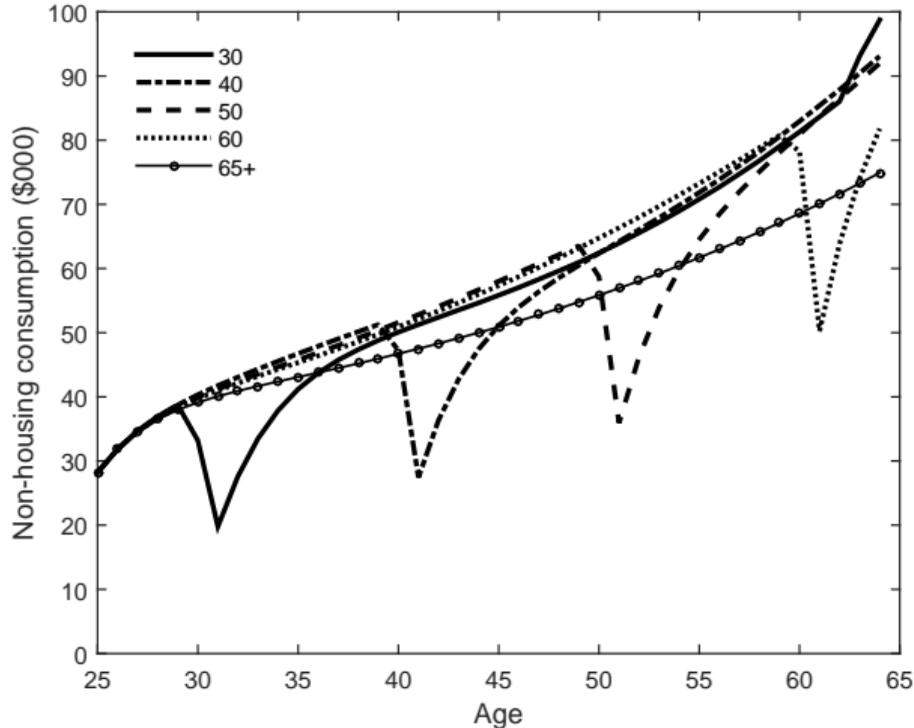
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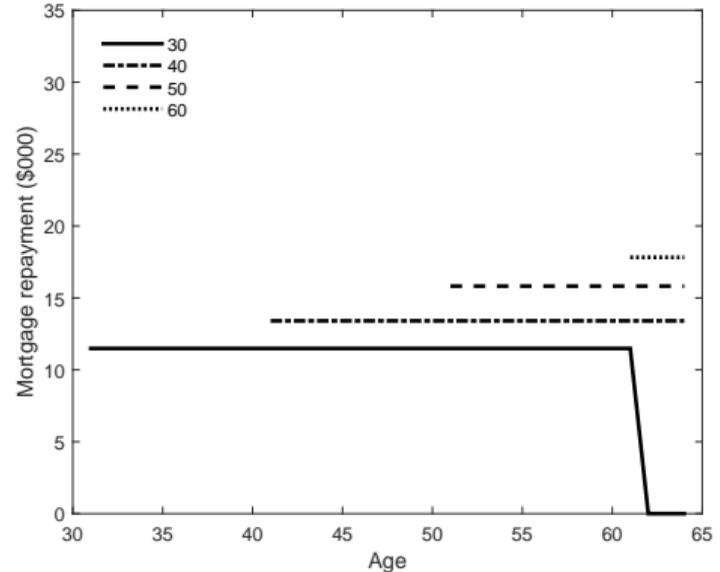
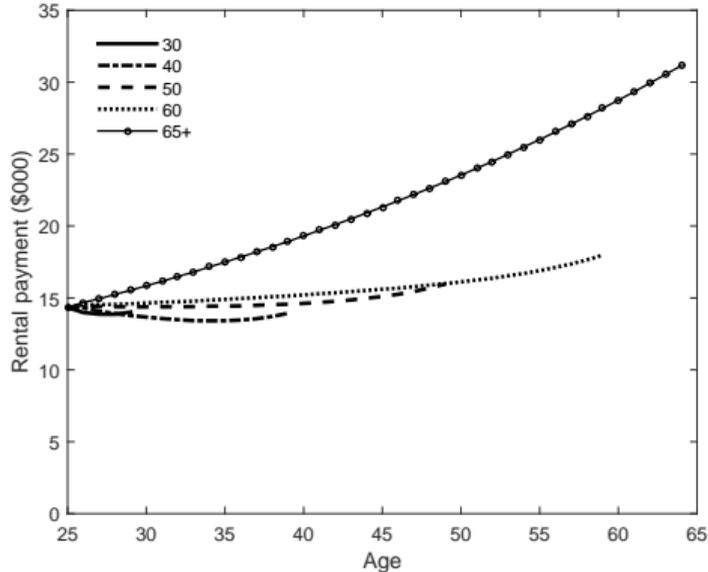
Conclusion

Average Non-Housing Consumption



- ▶ Home owners
 - ▶ dramatic drop after property purchase
 - ▶ followed by quick recovery
- ▶ 65+
 - ▶ before 30: almost the same as other groups
 - ▶ approaching retirement: spend the least

Housing Costs: Rent and Mortgage Repayment



- ▶ 65+: pay higher rental costs for a longer period
- ▶ Mortgage repayment
 - ▶ the earlier, the lower
 - ▶ generally lower than the rental cost

Wealth at Retirement

\$000	Wealth		Liquid assets		Home equity		Pension	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
30	2,077	440	148	23	719	260	1,210	333
40	1,897	413	126	21	527	194	1,244	342
50	1,722	390	122	21	354	145	1,245	342
60	1,515	365	104	21	174	79	1,237	343
65+	1,312	343	83	39	0	0	1,229	337

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- ▶ Dominated by pension, followed by home equity (if home owner)
- ▶ Purchase the property at a younger age
 - ↑ home equity
 - ↑ liquid assets
 - ⇒ average wealth at retirement ↑



Certainty Equivalent Consumption

30	40	50	60	65+
\$34,577	\$39,772	\$40,946	\$41,015	\$38,921



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- ▶ Purchase the property **earlier** during the working life
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 - enjoy the benefits of being a home owner at a lower cost
- ▶ Rent **throughout working life**
 - constrains spending
 - slows down wealth accumulation

Utility

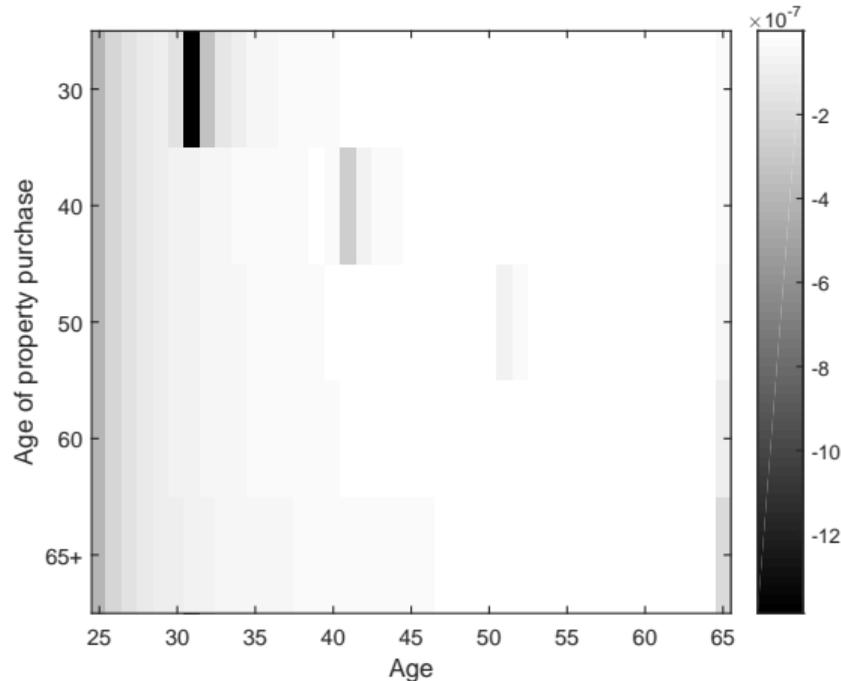


Figure 3: Average utility level in each period for a 25-year-old investor who chooses to purchase the property at ages 30, 40, 50, 60, and over 65.

Comparison with Empirical Data

Most Australians purchased their first home before age 45 (Australian Bureau of Statistics, 2013b)

- ▶ Emphasise more on retirement savings when making the first-home-purchase decision
- ▶ Our model abstracts from several real world complications

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- ▶ Purchase the property earlier during the working life
 - likely a higher level of wealth at retirement
 - ▶ higher home equity value
 - ▶ more liquid assets
- ▶ Defer residential property purchase to later ages
 - more attractive based on lifetime utility
 - ▶ utility loss due to consumption cut is deferred
- ▶ Keep renting during the working life
 - unattractive both in terms of retirement wealth and utility level
 - ▶ rental cost constrains spending and slows down wealth accumulation

References

- Australian Bureau of Statistics (2013a). Household wealth and wealth distribution, Australia, 2011-12. Cat. No. 6554.0, Australian Bureau of Statistics, Canberra.
- Australian Bureau of Statistics (2013b). Housing occupancy and costs, Australia, 2011-12. Cat. No. 4130.0, Australian Bureau of Statistics, Canberra.
- Cocco, J. F. (2004). Portfolio choice in the presence of housing. *Review of Financial Studies*, 18(2):535–567.
- Ortalo-Magné, F. and Rady, S. (2002). Tenure choice and the riskiness of non-housing consumption. *Journal of Housing Economics*, 11(3):266–279.
- Productivity Commission (2015). Housing decisions of older Australians. Commission Research Paper, Canberra.
- Yao, R. and Zhang, H. H. (2004). Optimal consumption and portfolio choices with risky housing and borrowing constraints. *Review of Financial Studies*, 18(1):197–239.
- Yates, J. and Bradbury, B. (2010). Home ownership as a (crumbling) fourth pillar of social insurance in Australia. *Journal of Housing and the Built Environment*, 25(2):193–211.