Journal of Accounting Literature

115

Explaining the equity premium in Australia: a disaggregated consumption approach

Jennifer Z. Sun and Wei Cui
The University of Sydney, Sydney, Australia

Received 25 November 2025
Revised 18 January 2026
Accepted 21 January 2026

Abstract

Purpose – This study aims to examine whether the consumption capital asset pricing model (CCAPM) can explain the Australian equity market premium under incomplete markets with heterogeneous households. It provides the first household-level test for Australia and revisits prior work that relies mainly on aggregate consumption data, the complete market assumption and implied relative risk aversion (RRA) estimates that are implausibly high.

Design/methodology/approach – Using microdata from the Household, Income and Labour Dynamics in Australia longitudinal household survey (2006–2017), we construct four measures of household consumption and estimate the stochastic discount factor with unconditional and conditional CCAPM Euler equations under complete and incomplete market settings. We then extend the analysis from the market portfolio to size and value portfolios.

Findings – Household risk sharing in Australia does not fully smooth idiosyncratic consumption shocks. In the incomplete market setting, the CCAPM with disaggregated consumption matches the observed market risk premium with an RRA of about 2.16, whereas the complete market model requires an implausibly high RRA near 50. Total Consumption and Essentials explain the market premium, while Non-Durables and Services better capture premia associated with the equally weighted market, size portfolios and value portfolios. Conditioning on lagged market information modestly lowers effective risk aversion.

Originality/value – This study provides the first household-level CCAPM test for Australia under incomplete markets. It shows that cross-sectional dispersion in marginal utilities and careful measurement of household consumption restore sufficient pricing kernel volatility to reconcile the CCAPM with observed equity premia and clarify how consumption risk shapes asset prices.

Keywords Consumption-based asset pricing, Relative risk aversion, Incomplete markets, Equity premium, Household consumption, Stochastic discount factor

Paper type Research article

1. Introduction

In this study, we explore the equity premium puzzle (Mehra and Prescott, 1985) associated with the consumption capital asset pricing model (CCAPM) in Australia. Using an incomplete market framework and granular data on heterogeneous households, we show how this puzzle is resolved with disaggregated consumption data in the Australian context.

Compared with the classic portfolio-based CAPM, the CCAPM (Lucas, 1978) models the representative investor's behaviour through preferences over consumption rather than over wealth. It links asset prices directly to consumption risk through the idea that an asset's price equals the expected present value of its payoff, discounted by the investor's marginal utility of consumption (Cochrane, 2011). Despite this strong theoretical basis, empirical support for the CCAPM is weak. In particular, Mehra and Prescott (1985) document that U.S. equities earned approximately 6% per year more than short-term default-free bonds over 1889–1978. Under a representative-agent,

Fundings: This research did not receive external funding.

Disclosure statement: No potential conflict of interest is reported by the authors

Journal of Accounting Literature
Vol. 48 No. 5, 2026
pp. 115-132
Emerald Publishing Limited
e-ISSN: 2452-1469
p-ISSN: 0737-4607
DOI 10.1108/JAL-11-2025-0652

time-separable version of the CCAPM, matching this gap requires implausibly high risk aversion. This discrepancy is commonly known as the equity premium puzzle.

Much of the literature seeks to address this puzzle by relaxing model assumptions or modifying preferences. One key approach is to drop the assumption of complete markets. In complete markets, households can fully hedge idiosyncratic risk and equalise marginal rates of substitution (Mehra and Prescott, 1985), implying that risk premia depend only on aggregate consumption. However, aggregate consumption is too smooth to account for the observed premium with reasonable risk aversion (Chincarini *et al.*, 2020). In incomplete markets, households self-insure through borrowing and saving (Heaton and Lucas, 1997), which generates greater dispersion in the stochastic discount factor (SDF). This additional variability increases the compensation required to hold risky assets (Brav *et al.*, 2002), which can help resolve the equity premium puzzle. One significant challenge in testing the CCAPM under incomplete markets is obtaining suitable micro-level consumption data, because marginal utilities differ across agents in this framework. Several influential studies use U.S. household datasets (Brav *et al.*, 2002; Vissing-Jorgensen, 2002; Malloy *et al.*, 2009; Chincarini *et al.*, 2020), but these data sources face two key limitations. First, the commonly used household datasets, such as the Consumer Expenditure Survey (CEX) and the Panel Study of Income Dynamics (PSID), are limited in scope. The CEX follows the same households for at most two consecutive quarters within a calendar year (Chincarini *et al.*, 2020), which makes it difficult to construct reliable long-term consumption growth series and leads to noisy estimates of intertemporal substitution. The PSID, while longitudinal, records mainly food expenditure, which may not adequately capture overall household consumption risk. Second, most existing evidence comes from the U.S., leaving limited understanding of whether the incomplete markets mechanism holds in other economic and institutional contexts.

Our study addresses these limitations by exploiting a unique Australian data source. We use a panel constructed from the Household, Income and Labour Dynamics in Australia (HILDA) survey, administered by the Melbourne Institute. This survey tracks the same households from 2006 to 2017 and records detailed expenditure information. Its panel structure allows us to capture micro-level consumption shocks over a reasonably long horizon. Using this database, Sun (2025) shows that household consumption responds to idiosyncratic income shocks, which provides evidence against full insurance (i.e. complete markets) in Australia.

Following Brav *et al.* (2002), we examine the equity premium puzzle in Australia within an incomplete market framework with heterogeneous households. We first follow Sun (2025) and construct four disaggregated measures of household consumption: Total Consumption, Essentials, Non-Durables and Services. Based on these measures, we compute the SDF as the average of individual marginal rate of substitution (MRS). We then estimate the Euler equation across a range of risk aversion coefficients (that is, γ) in both complete and incomplete markets.

Our results show that the unexplained risk premium crosses zero at a plausible value of γ only in an incomplete market setting. Using a generalised method of moments (GMM), we find that an unconditional model with incomplete markets yields $\gamma \approx 2.16$, which provides a statistically valid match to the Australian equity premium. In contrast, a model with complete markets requires an implausibly high $\gamma \approx 52.71$. These findings confirm that allowing for household heterogeneity and partial insurance generates a more volatile and empirically consistent SDF, thereby reconciling the equity premium puzzle in Australia. We also show that measurement choices matter. Total Consumption and Essentials account for the market premium, while Non-Durables and Services better track premia tied to the equally-weighted market, size and value. Extending to a conditional setting with alternative instruments, we find that individuals are willing to shift more current utility to the future and accept slightly higher risk when informed by historical data. Finally, we apply the CCAPM to non-market portfolios and document that investors display greater risk aversion toward high-risk portfolios.

This study contributes to the existing literature in the following ways. First, it provides the first evidence from Australia using household-level panel data that allow direct estimation of the CCAPM under incomplete markets. Using a true longitudinal dataset with repeated observations on the same households, we overcome data limitations in prior U.S.-based studies (Brav *et al.*, 2002; Vissing-Jorgensen, 2002; Malloy *et al.*, 2009; Chincarini *et al.*, 2020). Our estimated relative risk aversion (RRA) coefficient achieves a stable and economically sensible fit to the observed equity premium. Our results directly reinforce the notion that disaggregated consumption measures help reconcile the CCAPM with observed asset returns within an incomplete markets setting (Chincarini *et al.*, 2020).

Furthermore, we demonstrate that the explanatory power of the CCAPM depends on how household consumption is defined. By constructing four micro-level consumption measures (i.e. Total Consumption, Essentials, Non-Durables and Services expenditures), we show that different dimensions of consumption risk capture distinct aspects of heterogeneity and partial risk sharing, providing a richer characterisation of how consumption dynamics shape asset prices.

The remainder of the paper is organised as follows. Section 2 reviews the related literature. Section 3 describes the methodology. Section 4 describes the data. Section 5 presents the empirical results. Section 6 concludes.

2. Literature review

In this section, we review empirical evidence concerning the equity premium puzzle and introduce the literature that attempts to address it by relaxing the complete markets assumption.

2.1 The equity premium puzzle

The equity premium puzzle, first documented by Mehra and Prescott (1985), highlights the striking gap between the high historical excess return on equities and the much lower premium implied by the standard CCAPM. Subsequent research confirms this discrepancy across periods and markets (e.g. Hansen and Singleton, 1982; Heaton, 1993; Mehra and Prescott, 2003; Campbell, 2003; Allen *et al.*, 2012).

As noted by Arnott and Asness (2003), the puzzle arises because the consumption-based pricing kernel implied by the representative-agent model is too smooth relative to asset returns. In the standard constant-relative-risk aversion (CRRA) framework, the expected excess return of an asset depends on how its payoff covaries with the marginal utility of consumption. Since aggregate consumption is very stable, the marginal utility varies little over time. Consequently, the model cannot generate a large equity premium without assuming an implausibly high degree of risk aversion (Hansen and Jagannathan, 1991; Heaton, 1993). This discrepancy has motivated a wide range of extensions that aim to produce a more volatile pricing kernel while preserving realistic preference parameters.

For instance, some studies challenge the complete market assumption (Hansen and Jagannathan, 1991; Heaton, 1993; Brav *et al.*, 2002). Others emphasise preference modifications, such as habit formation (Campbell and Cochrane, 1999) or generalised expected utility (Epstein and Zin, 1989; Bansal and Yaron, 2004), which increase the sensitivity of the SDF to consumption shocks without requiring extreme risk aversion. Alternative explanations focus on rare disaster risk (Rietz, 1988; Barro, 2006) and market frictions (Constantinides and Duffie, 1996; Fudenberg and Levine, 2007).

The empirical literature remains divided on which mechanism dominates, and our study emphasises incomplete markets as a promising path toward solving the puzzle. In the next section, we review this line of inquiry.

2.2 Market completeness

Mehra and Prescott (2003) highlighted the implications of market completeness for the empirical validity of the classic CCAPM. The model predicts only a small equity premium because individuals share identical preferences and can fully insure idiosyncratic consumption risk in complete markets. However, in reality, markets may be incomplete, so agents cannot fully smooth idiosyncratic income shocks. When these shocks are translated into additional consumption risk, investors demand higher compensation for holding risky assets. Furthermore, idiosyncratic risk matters only if it satisfies the following two conditions. First, the idiosyncratic shocks should be persistent so that households cannot borrow or draw down savings to smooth consumption (Telmer, 1993; Lucas, 1994; Heaton and Lucas, 1996; Constantinides and Duffie, 1996). Second, the conditional variance of the idiosyncratic income must be counter-cyclical (Constantinides, 2002). When idiosyncratic risk increases during recessions, marginal utility increases as market returns fall, allowing idiosyncratic risk to earn a premium.

Fudenberg and Levine (2007) extend earlier incomplete market models by introducing life-cycle heterogeneity and endogenous capital accumulation. Together, these mechanisms produce a more volatile and counter-cyclical pricing kernel, enabling the model to match the observed equity premium with plausible risk aversion parameters. Similarly, several other papers in this strand of literature extend the incomplete market models with limited participation (Brav *et al.*, 2002) or skewed household consumption risk (Constantinides and Ghosh, 2017) to address the equity premium puzzle.

A major challenge in empirically testing the CCAPM under incomplete markets is the measurement of consumption. As highlighted by Mankiw (1986), relying on aggregate consumption data can distort inferences about risk aversion and the equity premium when markets are incomplete. Early studies such as Constantinides and Duffie (1996) continued to use aggregate consumption growth when constructing the MRS. In contrast, Brav *et al.* (2002) replace aggregate consumption growth with household-level consumption growth. However, these studies are based on CEX or PSID survey data, both of which have limited coverage and do not provide a true panel of micro-level consumption over time (Sun, 2025). In our study, we follow the framework of Brav *et al.* (2002) and extend it by analysing micro-level consumption shocks using a true panel dataset.

3. Method

3.1 Euler equation

Consider a frictionless economy without taxes or short-sale constraints. There are $i = 1, \ldots, I$ investors and $j = 1, \ldots, J$ assets with gross returns R^j_{t+1} between dates t and $t+1$. Investors have time- and state-separable von Neumann–Morgenstern preferences with constant RRA $\gamma > 0$ and discount factor β. The Euler equation for investor i and asset j is

$$\mathbb{E}_t\left[\beta\left(\frac{C^i_{t+1}}{C^i_t}\right)^{-\gamma} R^j_{t+1}\right] = \mathbb{E}_t\left[\beta g^{-\gamma}_{i,t+1} R_{j,t+1}\right] = 1 \tag{1}$$

where C^i_t is consumption of investor i at date t and $g_{i,t+1} \equiv C^i_{t+1}/C^i_t$ is individual consumption growth.

In a complete market with full consumption insurance, the heterogeneous-consumer equilibrium is pricing-equivalent to that of a representative consumer (Constantinides, 2008). Therefore, $C_t \equiv I^{-1}\sum_{i=1}^{I} C^i_t$. In equilibrium, we obtain the set of $I \times J$ Euler equations of consumption between dates t and $t+1$ with a power utility function is:

$$\mathbb{E}_t\left[\beta\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma} R^j_{t+1}\right] = 1 \tag{2}$$

with SDF

$$m_{t+1} = \beta\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}, \tag{3}$$

so that

$$\mathbb{E}_t\left[m_{t+1}R^j_{t+1}\right] = 1, \quad j = 1, \ldots, J$$

In a *complete* market, where complete consumption insurance exists, individuals are able to insure against idiosyncratic risks and can equalise, state by state, their marginal rates of substitution [1]. Under a full-information economy, the equilibrium of a heterogeneous-consumer appears to be the same as the equilibrium of a representative-consumer, despite underlying heterogeneity (Constantinides and Duffie, 1996). In such a market an agent can insure against idiosyncratic income risk and $g_{i,t+1} = g_{t+1}$ for all i. The consumption growth rate is equal across individuals. Therefore, the MRS under a complete market is

$$m_{t+1} = \beta g_{t+1}^{-\gamma} = \beta\left(I^{-1}\sum_{i=1}^{I}\frac{C^i_{t+1}}{C^i_t}\right)^{-\gamma}. \tag{4}$$

In empirical studies, the per capita consumption growth in the Euler equation (2) is often substituted by aggregate consumption growth. In testing whether the individual MRS is a valid SDF, we use the equally weighted sum of individuals' MRS as the SDF, because individual consumption data are reported with substantial error and averaging across households helps mitigate these observation errors (Brav *et al.*, 2002).

In an *incomplete* market, where idiosyncratic income shocks are uninsurable, each consumer's MRS is associated with individual consumption growth and a valid SDF in this case is the equally weighted individual MRS,

$$m_{t+1} = \beta I^{-1}\sum_{i=1}^{I}\left(\frac{C^i_{t+1}}{C^i_t}\right)^{-\gamma} \tag{5}$$

To sum this across individuals, we can rewrite equation (2) as a non-representative agent Euler equation:

$$\mathbb{E}_t\left[\beta\left(I^{-1}\sum_{i=1}^{I}g_{i,t+1}^{-\gamma}\right)R^j_{t+1}\right] = 1 \tag{6}$$

3.2 Conditional vs. unconditional model

We estimate the subjective discount factor β and the RRA coefficient γ by GMM. Under the CCAPM, consumption fully prices the equity risk premium, so the population unexplained risk premium should be zero.

Following Hansen and Singleton (1982), the conditional moment equation for an incomplete markets setting is

$$\mathbb{E}[m_{t+1}R_{t+1}|\, I_t] - 1 = \mathbb{E}\left[\beta\left(I^{-1}\sum_{i=1}^{I}g_{i,t+1}^{-\gamma}\right)R_{t+1}|\, \overrightarrow{I_t}\right] - 1 = 0 \tag{7}$$

For convenience, let $\overrightarrow{x}_{t+1} = (R_{t+1}, g_{t+1})'$ and $\overrightarrow{\theta} = (\beta, \gamma)'$, where β and γ are time invariant. The information set I_t is approximated by the instrument vector

$$\overrightarrow{z}_t = (1, g_t, g_{t-1}, R_t, R_{t-1})'$$

which collects current and lagged consumption growth and returns.

In practice, many relevant state variables are unobserved. We therefore focus on unconditional moments as the main specification and view conditional moments as a robustness check. If the agents' information set is a subset of the full space $I_t \subset \Omega_t$, then by the law of iterated expectations

$$\mathbb{E}[\mathbb{E}_t[m_{t+1}R_{t+1}|I_t \in \Omega_t] - 1] = \mathbb{E}[m_{t+1}R_{t+1}] - 1 \tag{8}$$

so the conditional model collapses to the unconditional one. The unconditional moments therefore provide an unbiased estimate of γ even if the exact information set is not specified.

Following Brav *et al.* (2002), we can rewrite equation 8 in a format with a risk premium for an unconditional model as,

$$\mathbb{E}\left[m_{t+1}R^e_{t+1}\right] = 0 \tag{9}$$

where R^e_{t+1} is a vector of risk premiums under market, size or value premium. For example, $R^e_{t+1} = R^M_{t+1} - R^F_{t+1}$ is the market risk premium, with M denoting the market portfolio and F the risk free rate.

For robustness, we also estimate a conditional model by interacting returns with the instruments $\overrightarrow{z}_t$, which yields the Euler equation

$$\mathbb{E}\left[m_{t+1}R^j_{t+1} \otimes \left(1 \;\; \overrightarrow{z_t}'\right)\right] = 1 \tag{10}$$

where $\overrightarrow{z}_t$ is the information set at time t and $R^j_{t+1} \otimes (1 \;\; \overrightarrow{z_t}')$ are the returns on managed portfolios as in Cochrane (1996).

3.3 Empirical implication

To test the validity of an MRS, the null hypothesis is that the Euler equation holds and that the mean values of the unexplained premium statistics (μ) are individually zero,

$$H_0 : \mu = 0$$

where, for the unconditional model,

$$\mu = T^{-1} \sum_{t=0}^{T} m_t(R^e) \tag{11}$$

is the sample mean unexplained equity premium.

More specifically, we examine three related hypotheses:

(1) The aggregate MRS is an economically plausible SDF in a complete market.

(2) The equally weighted sum of individual MRS is an economically plausible SDF in an incomplete market.

(3) The equally weighted sum of individual MRS is an economically plausible SDF for managed portfolios in an incomplete market.

4. Data

4.1 Consumption data

The consumption data are drawn from the HILDA survey, a nationally representative longitudinal study conducted annually by the Melbourne Institute since 2001. This survey follows around 7,000 households (approximately 13,000 individuals, later expanding to 9,500 households and 17,000 individuals) and collects detailed information on household expenditures. Its key advantage lies in combining rich expenditure data with a true panel structure that tracks the same individuals over time, enabling the construction of individual-level consumption series and MRS.

We follow Sun (2025) to create four consumption measures from 18 detailed categories of household expenditures: Total Consumption, Essentials, Non-Durables and Services. We use these measures to calculate consumption growth as (C^i_{t+1}/C^i_t), where C^i_t is the consumption of individual i during year t, and to remove outliers and discontinuities in the consumption data. When multiple respondents belong to the same household, we retain only the household head. As a result, our individual consumption measures represent household-level consumption, and the implied individual MRS corresponds to the household MRS.

4.2 Return data

Market return data are obtained from the Bloomberg terminal as monthly total returns from July 2005 to June 2017. We use the S&P/ASX 200 (i.e. ASX(V)), the S&P/ASX 200 equally weighted index (i.e. ASX(E)), the S&P/ASX 50 and the S&P/ASX Small Ordinaries indices to represent the Australian equity market and different segments. Monthly returns are compounded to annualised gross returns for each sample year from July of year $t-1$ to June of year t, consistent with the Australian financial year and with the construction of the consumption measures.

Following Fama and French (1993), we construct size and value factors. SMB is the size premium, calculated as the return on the S&P/ASX Small Ordinaries index minus the return on the S&P/ASX 50 index. HML is the value premium, calculated as the return on the MSCI Australia value index minus the return on the MSCI Australia growth index. In our setting, the market, size and value premia are interpreted as risk premia on these managed portfolios.

The risk-free rate is measured using the AusBond Bank Bill index, which comprises the Reserve Bank of Australia (RBA) 24-hour cash rate and the 1-month and 3-month bank bill rates. Quarterly consumer price index (CPI) data are obtained from the Australian Bureau of Statistics to adjust for inflation. We construct an annual inflation factor using the CPI level at the end of June each year and express all returns and consumption variables in real terms with 2006 as the base year [2].

5. Results

5.1 Summary statistics

Table 1 shows the summary statistics of our key measures. In Panel A, the average annual market equity premium is 3.30% under the ASX200 value-weighted index and −2.87% under the ASX200 equally-weighted index. These values are considerably lower than those of Mehra and Prescott (1985), who found an equity premium of 6.18% p.a. in the U.S. from 1889–1978, and several Australian equity market studies (Officer, 1989; Brailsford *et al.*, 2008; Gregoriou and Pascalau, 2011), which document equity premia ranging from 6.3% p.a. to 12.52% over various long-term horizons. A likely explanation is that our macro return sample is relatively short (2006–2017) and includes the 2008–2009 global financial crisis (GFC), so extreme negative return years can mechanically depress the realised mean equity premium in this window [3]. Furthermore, the size premium has an average value of −3.48% (median −4.72%) and the value premium has an average of 1.78% (median 1.78%), consistent with previous studies (Faff, 2001, 2004).

Table 1, Panels B and C, presents summary statistics on the growth rates of gross consumption in a complete market and an incomplete market, respectively. Although the average growth rates across the two settings are similar, consumption growth is much less volatile in the complete market. This aligns with the notion of Hansen and Jagannathan (1991) that aggregate consumption is too smooth to match stock-market volatility with a reasonable RRA coefficient.

Table 1. Summary statistics

	Mean	Median	Std Dev	Observations
Panel A: Equity premium				
ASX200 (V)	3.30%	7.18%	0.1450	12
ASX200 (E)	−2.87%	3.25%	0.1634	12
SMB	−3.48%	−4.72%	0.1188	12
HML	1.78%	1.78%	0.1356	12

	Mean	Median	Std Dev	Observations	No of individuals
Panel B: Growth Rates Complete Market					
Total Consumption	1.0675	1.0778	0.0223	43,547	26,867
Essentials	1.0808	1.0786	0.0185	43,547	
Non-Durable Goods	1.0663	1.0796	0.0228	43,547	
Services	1.2504	1.2672	0.0381	43,547	
Panel C: Growth Rates Incomplete Market - Household Head					
Total Consumption	1.0679	0.9986	0.4264	33,265	6,711
Essentials	1.0810	0.9880	0.4806	33,008	
Non-Durable Goods	1.0667	0.9927	0.4537	33,253	
Services	1.2508	1.0223	1.0000	33,192	

Note(s): Table 1 presents summary statistics for the annual equity premium (Panel A) and consumption growth rates (Panels B and C) from July 2006 to June 2017. ASX200(V) and ASX200(E) are value and equal weighted ASX200 excess returns. SMB is the size premium and HML is the value premium. Growth rates are trimmed at the 1% right tail to remove extreme values, and all values are deflated to 2006 price levels
Source(s): Authors' own work

Table 2 shows the correlations between equity premia and consumption growth. Individual-level consumption growth rates are only weakly correlated with the market, size and value premia, whereas the aggregate measures (prefixed with (A)) show stronger correlations. The four consumption measures (Total Consumption, Essentials, Non-Durables and Services) are themselves highly correlated, indicating a common underlying component in household expenditure while still allowing us to distinguish between them.

5.2 Main results

This section presents the baseline CCAPM tests. We first estimate the model under the complete market assumption using aggregate consumption growth and examine whether plausible levels of risk aversion can price the Australian equity premia. We then relax the full-insurance assumption and re-estimate the CCAPM under incomplete markets using household-level MRS, comparing both the unexplained premium tests and the corresponding GMM estimates.

5.2.1 Estimating the CCAPM under complete markets. We first test the unexplained equity premium under a *complete* market following Equation (11). The MRS is calculated from aggregate consumption using Equation (4). The RRA coefficient γ is assigned values between 0 and 5. When $\gamma = 0$, the MRS equals 1 and the reported unexplained risk premium corresponds to the sample mean of the equity premium [4].

Table 3 reports the results using four alternative consumption measures. In Panel A, the unexplained equity premium measured by the ASX200 value-weighted index is 3.3026% when $\gamma = 0$. This value does not cross zero as γ increases from 0 to 5 in any of the panels [5]. The same result applies to the size and value premiums. This indicates that the CCAPM is not sufficient to fully explain equity premia with a reasonable risk aversion coefficient in.

Table 2. Correlations

	ASX200 (V)	ASX200 (E)	SMB	HML	Total consumption	Essentials	Non -Durables	Services	(A) Total consumption	(A) Essentials	(A) Non-Durables	(A) Services
ASX200(V)	1											
ASX200(E)	0.9054	1										
SMB	0.1582	0.5363	1									
HML	0.1251	−0.043	−0.5192	1								
Total Consumption	0.0043	0.01	0.0194	−0.0102	1							
Essentials	0.0053	0.0083	0.0159	−0.0205	0.6881	1						
Non-Durables	0.005	0.0094	0.0194	−0.021	0.8725	0.8218	1					
Services	0.0017	0.0015	0.001	0.0114	0.6087	0.1808	0.2694	1				
(A)Total Consumption	0.0903	0.1875	0.3424	−0.1725	0.0515	0.0286	0.0471	0.0303	1			
(A)Essentials	0.1457	0.2192	0.3949	−0.5199	0.0386	0.0382	0.0414	0.0165	0.7533	1		
(A)Non-Durables	0.1112	0.1887	0.3648	−0.4033	0.0488	0.0319	0.0496	0.0231	0.9491	0.8361	1	
(A)Services	0.0411	0.0294	−0.0024	0.3243	0.0417	0.0169	0.0306	0.0374	0.8144	0.4503	0.6215	1

Note(s): Table 2 shows the correlation between the equity premium and consumption growth rates. Consumption growth rates are measured at the individual level and in aggregate, indicated by the prefix (A)

Source(s): Authors' own work

Table 3. Unexplained equity premium with complete market assumption

RRA (γ)	ASX200 (V) μ	p-value	ASX200 (E) μ	p-value	SMB μ	p-value	HML μ	p-value
Panel: A - Total Consumption								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.3635	1.7801	0.7213
1	3.0485	0.4804	−2.7627	0.5605	−3.3471	0.3497	1.7209	0.7107
2	2.8153	0.4863	−2.6587	0.3609	−3.2152	0.3365	1.6630	0.7000
3	2.6009	0.4923	−2.5566	0.3532	−3.0863	0.3239	1.6065	0.6891
4	2.4040	0.4985	−2.4568	0.3545	−2.9606	0.3121	1.5515	0.6781
5	2.2229	0.5050	−2.3594	0.3534	−2.8382	0.3008	1.4979	0.6670
Panel: B - Essentials								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.3635	1.7801	0.7213
1	3.0125	0.4774	−2.7143	0.5605	−3.3004	0.3491	1.7595	0.7013
2	2.7503	0.4799	−2.5650	0.3609	−3.1253	0.3355	1.7310	0.6815
3	2.5132	0.4825	−2.4210	0.3532	−2.9566	0.3227	1.6962	0.6621
4	2.2986	0.4851	−2.2824	0.3545	−2.7944	0.3106	1.6563	0.6428
5	2.1043	0.4877	−2.1496	0.3534	−2.6389	0.2992	1.6122	0.6239
Panel: C - Non-Durables								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.3635	1.7801	0.7213
1	3.0453	0.4812	−2.7659	0.5605	−3.3577	0.3488	1.7872	0.6990
2	2.8073	0.4884	−2.6671	0.3609	−3.2360	0.3348	1.7861	0.6768
3	2.5869	0.4963	−2.5721	0.3532	−3.1167	0.3214	1.7781	0.6545
4	2.3830	0.5050	−2.4806	0.3545	−3.0002	0.3088	1.7640	0.6324
5	2.1941	0.5145	−2.3927	0.3534	−2.8866	0.2968	1.7448	0.6105
Panel: D - Services								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.3635	1.7801	0.7213
1	2.6107	0.4771	−2.3309	0.5605	−2.8002	0.3540	1.3293	0.7386
2	2.0660	0.4794	−1.8943	0.3609	−2.2528	0.3447	0.9897	0.7560
3	1.6369	0.4817	−1.5397	0.3532	−1.8129	0.3356	0.7345	0.7733
4	1.2984	0.4839	−1.2515	0.3545	−1.4592	0.3267	0.5429	0.7905
5	1.0313	0.4861	−1.0173	0.3534	−1.1748	0.3180	0.3995	0.8076

Note(s): Table 3 reports the unexplained equity premia from July 2006 to June 2017 under the CCAPM. AASX200(V) and ASX200(E) are value- and equally-weighted ASX200 excess returns. SMB is the size premium and HML is the value premium. μ is the average unexplained equity premium implied by the stochastic discount factor in Equation (4). The table reports tests of $\mu = 0$ and the corresponding p-values for γ coefficients from 0 to 5

Source(s): Authors' own work

5.2.2 Estimating the CCAPM under incomplete markets. Next, we replace the aggregate MRS with individual MRS and re-estimate the unexplained equity premium μ under an *incomplete* market following Equation (11). Table 4 reports the baseline test and Table 5 reports the corresponding system GMM estimates for the same specification.

Under the incomplete market setting in Table 4 Panel A, the unexplained risk premium crosses zero at an RRA coefficient between 2 and 3 for Total Consumption, indicating that a plausible value of γ can reconcile the CCAPM with the market premium. The system GMM results in Table 5 reinforce this finding. Under ASX200(V), the estimated γ is 2.160, which means that the CCAPM can explain the unexplained equity premium of ASX200(V) with a risk aversion coefficient of 2.160 in an incomplete market at the 1% significance level. We note that the period of analysis is characterised by a relatively low realised market risk premium, reflecting the short sample and the inclusion of the GFC. However, in this same return sample, a complete representative-agent market specification using aggregate Total Consumption still implies a much higher risk aversion coefficient of about 52.7019 under the GMM. This comparison indicates that the more plausible risk aversion estimate comes from modelling cross-sectional consumption dispersion rather than from a mechanically low equity premium in the period considered in this study.

Table 4. Unexplained equity premium with incomplete market assumption

RRA (γ)	ASX200 (V) μ	p-value	ASX200 (E) μ	p-value	SMB μ	p-value	HML μ	p-value
Panel: A - Total Consumption								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.4346	1.7801	0.7213
1	3.5744	0.4827	−3.3051	0.5560	−3.9815	0.4123	2.1275	0.6948
2	2.3427	0.8050	<−10	0.3241	<−10	0.2711	>10	0.4304
3	<−10	0.3637	<−10	0.3485	<−10	0.4094	>10	0.4200
4	<−10	0.3516	<−10	0.3505	<−10	0.4207	>10	0.4217
5	<−10	0.3508	<−10	0.3506	<−10	0.4218	>10	0.4219
Panel: B - Essentials								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.4346	1.7801	0.7213
1	3.6322	0.4804	−3.3607	0.5574	−4.0615	0.4107	2.1754	0.6957
2	6.0785	0.5160	−6.7967	0.5392	−8.0291	0.3549	7.5189	0.5070
3	26.0114	0.8733	<−10	0.5268	<−10	0.4231	>10	0.3573
4	<−10	0.7012	<−10	0.4602	<−10	0.4273	>10	0.3765
5	<−10	0.5416	<−10	0.4128	<−10	0.4170	>10	0.3914
Panel: C - Non-Durables								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.4346	1.7801	0.7213
1	3.7331	0.6885	−3.4760	0.5512	−4.0532	0.4212	2.2328	0.6911
2	>10	0.3721	>10	0.7029	>10	0.6263	5.3374	0.8140
3	>10	0.3571	>10	0.3874	>10	0.4406	<−10	0.5782
4	>10	0.3577	>10	0.3492	>10	0.4252	<−10	0.4524
5	>10	0.3513	>10	0.3505	>10	0.4226	<−10	0.4286
Panel: D - Services								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.4346	1.7801	0.7213
1	4.3161	0.4658	−3.6383	0.5816	−4.4463	0.4370	2.2443	0.7222
2	>10	0.3392	2.1240	0.9516	−5.0062	0.8797	5.7822	0.8093
3	>10	0.3131	>10	0.5001	>10	0.6263	<−10	0.7971
4	>10	0.3156	>10	0.4130	>10	0.5248	<−10	0.5631
5	>10	0.3207	>10	0.3863	>10	0.4887	<−10	0.4775
Panel: E − Non-Durables (excluding Essentials)								
0	3.3026	0.4748	−2.8685	0.5787	−3.4816	0.4346	1.7801	0.7213
1	4.4226	0.4619	−3.6053	0.5662	−4.7128	0.4026	2.6200	0.6638
2	>10	0.1804	−2.6733	0.8661	<−10	0.2667	>10	0.3907
3	>10	0.3571	>10	0.4638	<−10	0.2099	>10	0.3261

Note(s): Table 4 reports the unexplained equity premia under the CCAPM from July 2006 to June 2017. ASX200(V) and ASX200(E) are value and equal weighted ASX200 excess returns. SMB is the size premium and HML is the value premium. μ is the average unexplained equity premium implied by the stochastic discount factor in Equation (5). We test H_0: $\mu = 0$ and report p-values for γ coefficients from 0 to 5
Source(s): Authors' own work

This result does not extend to the ASX200(E), size or value premia. The discrepancy is expected. Total Consumption is smoothed through substitution across categories and therefore aligns more closely with aggregate market risk captured by the value-weighted index. In contrast, the equally-weighted, size and value factors tilt toward firm characteristics and exhibit greater cyclical sensitivity. For instance, Crouzet and Mehrotra (2020) show that small firms are more sensitive to business cycle fluctuations than large firms. Such cross-sectional variation in asset returns is more likely to reflect shocks to particular components of consumption rather than movements in aggregate consumption. In Panel B, the estimated RRA coefficient based on Essentials lies between 3 and 4, and the GMM result confirms a value of 3.172, indicating greater risk aversion to changes in Essentials than to changes in Total Consumption.

Table 5. Estimating RRA (γ) under GMM with incomplete market assumption

RRA(γ)	Coef	Robust Std. Err	z	*p*-value	[95% Conf.	Interval]
ASX200 (V)						
Total Consumption	2.160	0.318	6.79	0.000	1.537	2.784
Essentials	3.172	1.628	1.95	0.051	−0.190	6.362
ASX200 (E)						
Non-Durables	1.806	0.279	6.47	0.000	1.259	2.354
Non-Durables (Excl. Essentials)	2.091	0.266	7.85	0.000	1.569	2.613
Services	2.049	0.452	4.54	0.000	1.164	2.935
SMB						
Non-Durables	1.763	0.204	8.65	0.000	1.363	2.162
Services	2.368	0.597	3.96	0.000	1.197	3.540
HML						
Non-Durables	2.350	0.643	3.65	0.000	1.089	3.611
Services	2.880	0.990	2.92	0.004	0.947	4.829

Note(s): Table 5 reports the estimated risk aversion coefficient (γ) for each risk premium. We use a two step robust GMM procedure and choose the value of γ that sets the unexplained risk premium to zero in the test reported in Table 4. The discount factor β is set to 1

Source(s): Authors' own work

Panels C and D show that Non-Durables and Services do not generate a valid RRA coefficient for the ASX200(V). However, Non-Durables do explain the ASX200(E), size and value premia. Because Essentials form a major part of Non-Durables, we construct a nested Non-Durables measure excluding Essentials (Panel E). This measure no longer explains the size and value premia but continues to match the ASX200(E) with an RRA between 2 and 3.

Services exhibit a distinct pattern. They do not align with the market-level premium but relate more closely to the cross-sectional premia in ASX200(E), size and value. This likely reflects sensitivities to specific consumption risks, such as durables (Yogo, 2006) and energy use (Dittmar *et al.*, 2025), rather than aggregate consumption fluctuations. In our data, the Services category is dominated by spending on durables and energy (e.g. housing maintenance, vehicle repairs, insurance, electricity and gas), consistent with these prior findings.

5.3 Robustness checks and extensions

This section evaluates the robustness and broader applicability of the baseline findings. We first estimate a conditional CCAPM using managed-portfolio moments with lagged information as instruments. We then jointly estimate the subjective discount factor β and risk aversion γ using system GMM with an additional asset. Finally, we extend the CCAPM tests to non-market portfolios to assess whether the household-based pricing kernel can explain premia beyond the market portfolio.

5.3.1 Conditional CCAPM estimation. We next estimate the RRA coefficient under a conditional GMM framework and report the results in Table 6. The top section of Table 6 Panel A shows the valid instruments that pass the Hansen J test for over-identification. It shows that the one-period lagged annualised market return is a valid instrument for predicting the current period market risk premium, with a reasonable RRA coefficient of 2.175. If the market risk premium for the past year is used as an instrument, it produces a smaller γ estimate of 2.003 compared to 2.160 in the unconditional model. This indicates that individuals may be less risk averse when informed about the prior year's market risk premium, and therefore more willing to accept uncertainty and to transfer purchasing power to the future.

Table 6. Estimating RRA (γ) with conditional models

RRA(γ)	Coef	Robust Std. Err	z	p-value	χ^2 (p-value)
Panel A: ASX200(V) Risk Premiums					
Valid Instruments					
R_t^M	2.175	0.314	6.93	0.000	0.153
$R_t^M - R_t^F$	2.003	0.312	6.43	0.000	0.634
$R_t^M - R_t^F(E)$	0.214	1.115	0.19	0.848	0.548
$R_t^S - R_t^B$	0.630	1.935	0.03	0.974	0.185
Invalid Instruments					
$R_t^H - R_t^L$	−0.192	0.712	−0.27	0.788	0.042
$R_{t-1}^M - R_{t-1}^F$	−0.094	1.970	−0.05	0.962	0.000
$g_{i,t}$	−0.230	0.203	−1.13	0.257	0.000
Panel B: Other Risk Premiums					
$R_t^M - R_t^F(E)$	−0.272	1.068	−0.25	0.799	0.000
$R_t^S - R_t^B$	−0.211	9.772	−0.02	0.983	0.000
$R_t^H - R_t^L$	−0.051	0.666	−0.08	0.939	0.000

Note(s): Table 6 reports estimates of the risk aversion coefficient (γ) for the conditional model using Total Consumption. Two step robust GMM is used to estimate γ with $\beta = 1$. Hansen's J test p-values are reported under χ^2 as an over identification test, and the table separates valid and invalid instruments

Source(s): Authors' own work

5.3.2 Joint estimation of β and γ. As a crucial part of the SDF, β is the subjective discount factor, which measures how patiently an individual values future (and uncertain) benefits relative to current consumption. In the previous tests, we set $\beta = 1$ when estimating γ, following the standard CCAPM literature (Cochrane, 1991; Brav *et al.*, 2002). However, whether this assumption is appropriate for Australian data is ultimately an empirical question. To examine this, we jointly estimate β and γ using GMM.

Joint estimation requires at least two independent moment conditions, because two unknown parameters must be identified. The first condition comes from pricing the market portfolio. A second moment condition is then obtained by pairing the market with an additional asset: either the risk-free rate or one of the non-market portfolios (Small, Large, Growth or Value). The resulting estimates are reported in Table 7, Panels A–E, based on alternative choices for the second asset.

In Table 7, the first set of tests in each panel estimates γ and β with a constant instrument, so the instrumental variable column is left blank. The estimated γ is consistent with 2.160 across all tests, which matches the unconditional estimate for the value-weighted market risk premium. The estimates of β are reasonably stable across different measures, ranging from 0.360 to 0.383. These values of β are smaller than those found in U.S. studies, suggesting that individuals in Australia are more impatient and prefer to receive benefits and returns sooner rather than later. At the same time, these relatively low discount factor estimates are best viewed as specific to our short sample, which includes the GFC, and may partly reflect short-horizon or crisis-period behaviour rather than long-run time preferences. Moreover, the results show that higher-risk portfolios lead to higher estimates of β, which is consistent with the idea that higher-risk portfolios are associated with greater uncertainty and require investors to be more patient in receiving benefits in the future [6].

Using the one-period lagged market risk premium as the instrumental variable increases the estimated β across all portfolios (ranging from 0.389 to 0.430) and slightly lowers the estimate of γ. This suggests that when individuals base their investment decisions on the past year's market risk premium, they are more willing to accept risk in their portfolio choice and appear less risk averse.

Table 7. Two parameter estimation on β and γ

2nd moments	β	p-value	γ	p-value	Instruments	χ^2 (p-value)
Panel A: AusBond bank bill index						
R^F_{t+1}	0.362 (0.175)	0.038	2.160 (0.318)	0.000		
	0.411 (0.158)	0.009	2.087 (0.287)	0.000	$R^M_t - R^F_t$	0.747
	1.135 (0.0004)	0.000	−0.008 (0.003)	0.004	g^i_t	0.000
	1.113 (0.080)	0.000	−1.061 (0.535)	0.048	g_t	0.0005

	β	p-value	γ	p-value	Instruments	χ^2 (p-value)
Panel B: ASX Small Ordinaries index						
R^S_{t+1}	0.383 (0.185)	0.038	2.160 (0.318)	0.000		
	0.430 (0.173)	0.013	2.106 (0.289)	0.000	$R^M_t - R^F_t$	0.608
	1.196 (0.0007)	0.000	0.008 (0.005)	0.088	g^i_t	0.000
Panel C: ASX 50 index						
R^L_{t+1}	0.360 (0.181)	0.039	2.160 (0.318)	0.000		
	0.407 (0.156)	0.009	2.086 (0.287)	0.000	$R^M_t - R^F_t$	0.764
	1.128 (0.0005)	0.000	−0.010 (0.003)	0.004	g^i_t	0.000
Panel D: MSCI Growth index						
R^G_{t+1}	0.379 (0.181)	0.036	2.160 (0.318)	0.000		
	0.428 (0.167)	0.010	2.100 (0.288)	0.000	$R^M_t - R^F_t$	0.626
	1.138 (0.0006)	0.000	−0.022 (0.004)	0.004	g^i_t	0.000
Panel E: MSCI Value index						
R^V_{t+1}	0.346 (0.169)	0.040	2.160 (0.318)	0.000		
	0.389 (0.148)	0.008	2.082 (0.286)	0.000	$R^M_t - R^F_t$	0.833
	1.119 (0.0007)	0.000	0.002 (0.005)	0.727	g^i_t	0.000

Note(s): Table 7 reports the joint estimation of the subjective discount factor (β) and the risk aversion coefficient (γ). The first column lists the second moment condition for each specification. Robust standard errors are reported in parentheses, and Hansen's J test p-values are reported under χ^2 as an over identification test
Source(s): Authors' own work

Across all panels, using the one-period lagged consumption growth as an instrumental variable does not yield a sensible estimate of the γ coefficient, indicating that the lagged consumption growth rate provides little additional information to enhance the CCAPM test.

5.3.3 Application of the CCAPM to non-market portfolios. In this section, we extend the CCAPM to non-market portfolios. Rather than focusing only on the market equity premium, we examine whether the household-based pricing kernel can also price portfolios sorted on size and style, such as the Small, Large, Growth and Value portfolios. In this setting, the first-moment condition is that the discounted payoff of each asset equals its current value, so a valid combination of β and γ should match the realised returns on these non-market portfolios.

Table 8 shows the results of the CCAPM tests for non-market portfolios in an incomplete market setting. In each panel, we first estimate only γ for the non-market portfolio, then jointly estimate both β and γ using the risk-free portfolio as the second asset.

Under the unconditional specification with $\beta = 1$, the Small portfolio produces a higher γ (1.122) than the Large portfolio (0.917), and the Growth portfolio yields a higher γ than the Value portfolio. This pattern is consistent with higher RRA estimates for higher-risk portfolios.

To allow for heterogeneity in investor objectives, we extend the analysis by jointly estimating β and γ using the risk-free rate as the second asset. For the Small portfolio, $\beta = 1.075$ and $\gamma = 0.737$, although this estimate is not statistically significant. Values of $\beta < 1$ are consistent with standard intertemporal preferences, whereas $\beta > 1$ implies greater weight placed on future consumption. The estimates also show that investors who select Large portfolios ($\beta = 0.303$) place more weight on current utility than those who choose Growth portfolios ($\beta = 0.620$). More impatient investors tend to hold lower-risk portfolios and exhibit higher risk aversion. Finally, the CCAPM does not converge for the Value portfolio.

Table 8. CCAPM with the non-market portfolios

Moments	β	p-value	γ	p-value	Instruments	χ^2 (p-value)
Panel A: ASX small ordinary shares index						
R^S_{t+1}			1.122 (0.028)	0.000		
R^S_{t+1} & R^F_{t+1}	1.075 (0.756)	0.000	0.737 (0.517)	0.154		
R^S_{t+1} & R^F_{t+1}	0.949 (0.091)	0.000	1.366 (0.264)	0.000	R^M_t	0.000
Panel B: ASX 50 index						
R^L_{t+1}			0.917 (0.021)	0.000		
R^L_{t+1} & R^F_{t+1}	0.303 (0.175)	0.083	2.229 (0.336)	0.000		
R^S_{t+1} & R^F_{t+1}	0.240 (0.163)	0.141	2.399 (0.315)	0.000	R^M_t	0.016
Panel C: MSCI growth index						
R^G_{t+1}			0.985 (0.022)	0.000		
R^G_{t+1} & R^F_{t+1}	0.620 (0.135)	0.000	1.872 (0.260)	0.000		
R^S_{t+1} & R^F_{t+1}	0.664 (0.115)	0.000	1.763 (0.253)	0.000	R^M_t	0.000
Panel D: MSCI value index						
R^V_{t+1}			0.846 (0.019)	0.000		
R^V_{t+1} & R^F_{t+1}	DN.C.					

Note(s): Table 8 reports estimates of the subjective discount factor (β) and risk aversion coefficient (γ). When β is not reported, we set $\beta = 1$ and estimate only γ. Robust standard errors are reported in parentheses, and Hansen's J test p-values are reported under χ^2 as an over identification test

Source(s): Authors' own work

In sum, while the CCAPM offers useful insights for non-market portfolios, the results are highly sensitive to portfolio choice.

6. Conclusion

The equity premium puzzle remains a central and enduring challenge in asset pricing research. We follow Brav *et al.* (2002) to revisit this question within an incomplete market framework. Specifically, we exploit a unique panel of household consumption data constructed from the HILDA survey in Australia, which, to our knowledge, offers a true longitudinal structure of household-level consumption that has rarely been utilised in existing studies of consumption-based asset pricing.

We adopt four different consumption measures constructed from the HILDA data to test the CCAPM. Under the unconditional Euler equation, we estimate a rational and economically plausible RRA coefficient of 2.160 for Total Consumption under an incomplete market assumption. This is a significant improvement compared to the RRA coefficient of 52.7091 obtained using the aggregate MRS under a complete market assumption.

Measurement choices matter. Total Consumption and Essentials account for the market premium, while Non-Durables and Services better track premia tied to the equally-weighted market, size and value. Conditional tests with simple lagged instruments preserve these conclusions and imply slightly lower effective risk aversion, with γ reducing to around 2.00 when conditioning on the prior year's market premium. This reduction in γ suggests that individuals appear less risk averse when they understand the previous year's market performance and incorporate such information into their investment decisions.

Joint estimation using a second asset identifies the discount factor. Baseline estimates place β in the 0.36 to 0.43 range, suggesting higher effective impatience in Australian data over our sample. Applications to non-market portfolios indicate sensitivity to portfolio definition, with small and growth tilts requiring higher compensation or implying greater patience.

Our study contributes to the existing literature by adding positive evidence that the CCAPM can explain the unexplained risk premium in an incomplete market setting. While our estimates are based on a relatively short sample that includes the GFC and are best viewed as sample specific rather than long-run benchmarks, they directly support the notion that cross-sectional dispersion in marginal utilities restores sufficient pricing kernel volatility to match observed premia.

AI disclaimer

During the preparation of this work, the authors used ChatGPT to polish the language. After using this tool and/or service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Notes

1. Complete insurance exists if state contingent claims span all states, that is, if it is possible to construct a portfolio that pays off only in one particular state (Ingersoll, 1987).
2. Inflation for year t is based on CPI from the 3rd quarter of year $t-1$ to the 2nd quarter of year t. The average annual inflation rate is calculated as $[(\overline{Inf_t}/\overline{Inf_{t-1}})-1]$.
3. The large negative returns during the GFC in 2008 (−18.44%) and 2009 (−22.39%) are likely to contribute to the lower mean premium. Adding an additional non-recession year would increase the equity premium by 1.33%.
4. The discount factor is set to $\beta = 1$, unless stated otherwise.
5. A GMM test finds a γ value of 52.7019 for Total Consumption.
6. According to Fama and French (1993), small firms and growth firms are riskier than large firms and value firms.

References

Allen, L., Bali, T.G. and Tang, Y. (2012), "Does systemic risk in the financial sector predict future economic downturns?", *Review of Financial Studies*, Vol. 25 No. 10, pp. 3000-3036, doi: 10.1093/rfs/hhs094.

Arnott, R.D. and Asness, C.S. (2003), "Surprise! Higher dividends = higher earnings growth", *Financial Analysts Journal*, Vol. 59 No. 1, pp. 70-87, doi: 10.2469/faj.v59.n1.2504.

Bansal, R. and Yaron, A. (2004), "Risks for the long run: a potential resolution of asset pricing puzzles", *The Journal of Finance*, Vol. 59 No. 4, pp. 1481-1509, doi: 10.1111/j.1540-6261.2004.00670.x.

Barro, R.J. (2006), "Rare disasters and asset markets in the twentieth century", *Quarterly Journal of Economics*, Vol. 121 No. 3, pp. 823-866, doi: 10.1162/qjec.121.3.823.

Brailsford, T., Handley, J.C. and Maheswaran, K. (2008), "Re-Examination of the historical equity risk premium in Australia", *Accounting and Finance*, Vol. 48 No. 1, pp. 73-97, doi: 10.1111/j.1467-629X.2007.00231.x.

Brav, A., Constantinides, G.M. and Geczy, C.C. (2002), "Asset pricing with heterogeneous consumers and limited participation: empirical evidence", *Journal of Political Economy*, Vol. 110 No. 4, pp. 793-824, doi: 10.1086/340776.

Campbell, J.Y. (2003), "Consumption-based asset pricing",in *Handbook of the Economics of Finance*, Constantinides, G.M., Harris, M. and Stulz, R.M. Vol. 1. Elsevier, pp. 803-887, doi: 10.1016/S1574-0102(03)01022-7.

Campbell, J.Y. and Cochrane, J.H. (1999), "By force of habit: a consumption-based explanation of aggregate stock market behavior", *Journal of Political Economy*, Vol. 107 No. 2, pp. 205-251, doi: 10.1086/250059.

Chincarini, L.B., Kim, D. and Moneta, F. (2020), "Beta and firm age", *Journal of Empirical Finance*, Vol. 58, pp. 50-74, doi: 10.1016/j.jempfin.2020.05.003.

Cochrane, J.H. (1991), "A simple test of consumption insurance", *Journal of Political Economy*, Vol. 99 No. 5, pp. 957-976, doi: 10.1086/261785.

Cochrane, J.H. (1996), "A cross-sectional test of an investment-based asset pricing model", *Journal of Political Economy*, Vol. 104 No. 3, pp. 572-621, doi: 10.1086/262034.

Cochrane, J.H. (2011), "Presidential address: discount rates", *The Journal of Finance*, Vol. 66 No. 4, pp. 1047-1108, doi: 10.1111/j.1540-6261.2011.01671.x.

Constantinides, G.M. (2002), "Rational asset prices", *The Journal of Finance*, Vol. 57 No. 4, pp. 1567-1591, doi: 10.1111/1540-6261.00471.

Constantinides, G.M. (2008), "Understanding the equity risk premium puzzle", *Handbook of the Equity Risk Premium*. Ed. by Mehra, R. Handbooks in Finance. Elsevier, pp. 331-359.

Constantinides, G.M. and Duffie, D. (1996), "Asset pricing with heterogeneous consumers", *Journal of Political Economy*, Vol. 104 No. 2, pp. 219-240, doi: 10.1086/262023.

Constantinides, G.M. and Ghosh, A. (2017), "Asset pricing with countercyclical household consumption risk", *The Journal of Finance*, Vol. 72 No. 1, pp. 415-460, doi: 10.1111/jofi.12471.

Crouzet, N. and Mehrotra, N.R. (2020), "Small and large firms over the business cycle", *The American Economic Review*, Vol. 110 No. 11, pp. 3549-3601, doi: 10.1257/aer.20181910.

Dittmar, R.F., Schlag, C. and Thimme, J. (2025), "Nonsubstitutable consumption growth risk", *Management Science*, Vol. 71 No. 6, pp. 4847-4876, doi: 10.1287/mnsc.2022.01269.

Epstein, L.G. and Zin, S.E. (1989), "Substitution, risk aversion, and the temporal behavior of consumption and asset returns: a theoretical framework", *Econometrica*, Vol. 57 No. 4, p. 937, doi: 10.2307/1913778.

Faff, R. (2001), "An examination of the Fama and French three-factor model using commercially available factors", *Australian Journal of Management*, Vol. 26 No. 1, pp. 1-17, doi: 10.1177/031289620102600101.

Faff, R. (2004), "A simple test of the Fama and French model using daily data: Australian evidence", *Applied Financial Economics*, Vol. 14 No. 2, pp. 83-92, doi: 10.1080/0960310042000176353.

Fama, E.F. and French, K.R. (1993), "Common risk factors in the returns on stocks and bonds", *Journal of Financial Economics*, Vol. 33 No. 1, pp. 3-56, doi: 10.1016/0304-405X(93)90023-5.

Fudenberg, D. and Levine, D.K. (2007), "Continuous time limits of repeated games with imperfect public monitoring", *Review of Economic Dynamics*, Vol. 10 No. 2, pp. 173-192, doi: 10.1016/j.red.2007.02.002.

Gregoriou, G. and Pascalau, R. (2010), *Financial Econometrics Modeling: Derivatives Pricing, Hedge Funds and Term Structure Models*, Palgrave Macmillan UK, London.

Hansen, L.P. and Jagannathan, R. (1991), "Implications of security market data for models of dynamic economies", *Journal of Political Economy*, Vol. 99 No. 2, pp. 225-262, doi: 10.1086/261749.

Hansen, L.P. and Singleton, K.J. (1982), "Generalized instrumental variables estimation of nonlinear rational expectations models", *Econometrica*, Vol. 50 No. 5, p. 1269, doi: 10.2307/1911873.

Heaton, J. (1993), "The interaction between time-nonseparable preferences and time aggregation", *Econometrica*, Vol. 61 No. 2, p. 353, doi: 10.2307/2951555.

Heaton, J. and Lucas, D.J. (1996), "Evaluating the effects of incomplete markets on risk sharing and asset pricing", *Journal of Political Economy*, Vol. 104 No. 3, pp. 443-487, doi: 10.1086/262030.

Heaton, J. and Lucas, D. (1997), "Market frictions, savings behavior, and portfolio choice", *Macroeconomic Dynamics*, Vol. 1 No. 1, pp. 76-101, doi: 10.1017/S1365100597002034.

Ingersoll, J.E. (1987), *Theory of Financial Decision Making*, Vol. 3, Rowman & Littlefield.

Lucas, R.E. (1978), "Asset prices in an exchange economy", *Econometrica*, Vol. 46 No. 6, p. 1429, doi: 10.2307/1913837.

Lucas, D.J. (1994), "Asset pricing with undiversifiable income risk and short sales constraints", *Journal of Monetary Economics*, Vol. 34 No. 3, pp. 325-341, doi: 10.1016/0304-3932(94)90022-1.

Malloy, C.J., Moskowitz, T.J. and Vissing-Jørgensen, A. (2009), "Long-run stockholder consumption risk and asset returns", *The Journal of Finance*, Vol. 64 No. 6, pp. 2427-2479, doi: 10.1111/j.1540-6261.2009.01507.x.

Mankiw, N. (1986), "The equity premium and the concentration of aggregate shocks", *Journal of Financial Economics*, Vol. 17 No. 1, pp. 211-219, doi: 10.1016/0304-405X(86)90012-7.

Mehra, R. and Prescott, E.C. (1985), "The equity premium: a puzzle", *Journal of Monetary Economics*, Vol. 15 No. 2, pp. 145-161, doi: 10.1016/0304-3932(85)90061-3.

Mehra, R. and Prescott, E.C. (2003), "The equity premium in retrospect", *Handbook of the Economics of Finance*. Ed. by Constantinides, G.M., Harris, M. and Stulz, R.M. Vol. 1. Elsevier, pp. 889-938, doi: 10.1016/S1574-0102(03)01022-0.

Officer, R. (1989), "Rates of return to shares, bond yields and inflation rates: an historical perspective", *Share Markets and Portfolio Theory*, Vol. 2, pp. 207-211.

Rietz, T.A. (1988), "The equity risk premium a solution", *Journal of Monetary Economics*, Vol. 22 No. 1, pp. 117-131, doi: 10.1016/0304-3932(88)90172-9.

Sun, J.Z. (2025), "Consumption measurement and the limits of insurance: evidence from Australia", *Pacific-Basin Finance Journal*, Vol. 94, 102956, doi: 10.1016/j.pacfin.2025.102956.

Telmer, C.I. (1993), "Asset-pricing puzzles and incomplete markets", *The Journal of Finance*, Vol. 48 No. 5, pp. 1803-1832, doi: 10.2307/2329068.

Vissing-Jorgensen, A. (2002), "Towards an explanation of household portfolio choice heterogeneity: nonfinancial income and participation cost structures", *Tech. Rep. National Bureau of Economic Research*, available at: https://www.nber.org/system/files/working_papers/w8884/w8884.pdf

Yogo, M. (2006), "A consumption-based explanation of expected stock returns", *The Journal of Finance*, Vol. 61 No. 2, pp. 539-580, doi: 10.1111/j.1540-6261.2006.00848.x.

Corresponding author
Jennifer Z. Sun can be contacted at: jennifer.sun@sydney.edu.au