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Generational asset pricing, equity puzzles, and cyclicality ☆

Alan Guoming Huang [a,*], Eric N. Hughson [b], J. Chris Leach [c]

[a] School of Accounting and Finance, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L 3G1, Canada
[b] Claremont McKenna College, Claremont, CA 91711, United States
[c] Leeds School of Business, University of Colorado, Boulder, CO 80309, United States

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ABSTRACT

To examine the potential role cohort preferences play in asset pricing cycles and puzzles, we consider a model with stochastic generational variation in preferences. In our structure, the pricing kernel reflects an investing generation's consumption growth from mid-life to retirement rather than aggregate consumption's growth over the same time period. Generational domination of the pricing kernel provides insight into rationalizing three widely-recognized asset pricing puzzles and suggests one potential contributor to boom-bust patterns in stock market returns.

1. Introduction

Long-term cycles in financial markets suggest that investor risk aversion is time-varying. We consider a model of generational swings in risk aversion, and examine how volatile interactions of age-related consumption-investment tendencies and generation cohort contribute to boom-bust cycles and three well-known asset pricing puzzles: equity premium, riskfree rate, and equity volatility.

We first employ a simplified deterministic four-generation single-security example to demonstrate the potential for time-varying generational preferences to create: (i) rational cyclicality in equity prices; and (ii) an implied risk aversion coefficient for a representative agent that is much different from the security buyers' actual risk aversion. Building on this insight, we next employ a richer setup to produce consumption growth and equity premium consistent with those found in the literature in a model where the population risk-aversion parameters are low. Our overlapping-generations (OLG) model incorporates riskless and risky investing, periodic cash flows and stochastic risk aversion. Because the model incorporates risk and risk aversion uncertainty, we can address how heterogeneity in investment and risk aversion across generations can help resolve three counterfactual predictions of standard asset pricing models: (i) the implausibly high CRRA coefficient implied by high equity premium and low covariance between aggregate consumption growth and equity returns (the "equity premium puzzle"); (ii) the implausibly low rate of time preference implied by historically smooth aggregate con-

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* Corresponding author. Fax: +1 519 888 7562.
E-mail addresses: aghuang@uwaterloo.ca (A.G. Huang), eric.hughson@ClaremontMcKenna.edu (E.N. Hughson), chris.leach@colorado.edu (J.C. Leach).

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sumption growth (the "risk-free rate puzzle" for highly intertemporal-substitution-averse agents); and (iii) the implausibly low volatility of equity premiums implied by low volatility in aggregate consumption growth (the "stock market volatility puzzle").[1]

Our approach relies on time-varying endowments and cohort risk aversion joined with security markets made incomplete by a participation constraint. Following Constantinides et al. (2002), we caricature structural differences between life stages by assuming extreme versions of underlying tendencies: (i) young adults consume and cannot buy or sell securities; (ii) the middle-aged trade riskless and risky securities to maximize the utility of consumption in their remaining lives; and (iii) the old liquidate their securities holdings, consume everything possible, and die.

Such a structure of limited participation entertains an important departure from traditional aggregate consumption-based asset pricing. We use the term "generational asset pricing" to emphasize the notion that, given any existing stock of risky securities, a cohort subset of the consuming population – the currently middle-aged – set security prices. When the middle-aged reach the end of their security accumulation phase, they relinquish their dominating influence on asset prices to their offspring, whose risk aversion is revealed only as a byproduct of their parents' liquidation process. In this context, one can demonstrate that a large risk-tolerant generation (e.g., "risk-loving baby boomers"), that reaches middle age relatively content to bear the risk inherited by assuming ownership of its parents' investments-in-place, faces the distinct possibility of having to discount the value of those same investments significantly when it comes time to sell them to their own children, who may be more risk averse than they are.[2]

In light of the puzzles arising from an infinitely-lived CRRA representative agent approach involving *aggregate* consumption, Cochrane (2001) comments:

> *Thus, we need either time-varying consumption risk or time-varying curvature, loosely speaking, a time-varying risk aversion. The data do not show much evidence of conditional heteroskedasticity in consumption growth, leading one to favor a time-varying curvature.*[3]

Our analysis incorporates stochastic curvature, but adds the wrinkle that the relevant time-varying curvature is not in *aggregate* consumption; rather, it is in the *middle-aged's* consumption in equilibrium. An important aspect of our approach is that we embed time-varying curvature in an economy with exogenous entrance and exit for subsets of the population. Unlike the usual setup, our consumer–investors are short-lived, with distinct entry to the securities market during the *middle* of their consuming lives and exit when retired.

When saddled with life-stage variations in expected wage income, our rational optimizing investors, when they can, use the securities markets to smooth consumption. How much they are willing to pay for securities depends on both their savings need and their risk aversion. Time-variation and uncertainty in endowments and risk aversion introduce the potential for significant variation in the relevant (the middle-aged's) consumption growth and consequently, the pricing kernel. Together they increase both the level and volatility of the equity premium for plausible CRRA coefficients (for the investing sub-population).

Our calibrations provide consistency with a battery of empirical regularities. When an average CRRA coefficient of 4 derives from two equally likely next generations with CRRA coefficients of 2 and 6, the equity premium is 1.3% with a volatility of 9.2%. These rise to 2.0% and 11.1%, respectively, when the next generation is equally likely to have CRRA coefficients of 2 or 10 (corresponding to an unconditional mean of 6). These values are accompanied by single-digit returns for a long-lived consol bond. Our generational asset pricing model's ability to generate this level of equity premium with reasonable levels of unconditional mean CRRA coefficient compares favorably with: (1) the existing representative-agent literature, where even producing a mild equity premium requires a rather high CRRA coefficient, and (2) an otherwise similar OLG model not having time-varying risk aversion, where the volatility of the equity premium is substantially lower (e.g., Constantinides et al., 2002). Our model also produces a rich set of historical experience-consistent results, such as high market Sharpe ratio, reasonable price–earnings ratio, negative long-term price–excess return correlation (return predictability), low and smooth consumption growth, and high stochastic discount factor volatility, both over the model-period (20-year) and per annum.

Our generational asset pricing model also suggests a potential reason for substantial long-term price swings in equity markets. With a single generation's dominating security pricing, intergenerational changes in risk aversion can induce large changes in asset prices. If the "baby boomers" are much more risk-tolerant than their offspring, then our model suggests that there should be a sizeable decline in asset prices as those baby boomers net-sell to the next generation. The size of the "correction" depends on the realized wealth of the next generation and is increasing in that generation's risk aversion. We bring this prediction to demographic waves of post-WWII generations. When we feed the model with wage endowments and risk aversion estimated for Baby boomers (those born in 1946–1965) and Baby busters (those born in 1926–1945 and

[1] For the equity premium puzzle see, e.g., Mehra and Prescott (1985); for the risk free rate puzzle see, e.g., Weil (1989); and for the stock market volatility puzzle see, e.g., Campbell (1999).

[2] We do not address the moral hazard question of whether one generation can or should affect the risk aversion of the next.

[3] Time-varying risk aversion has also been suggested in the literature. See, for example, Campbell and Cochrane's (1999) habit-formation model, the state-dependent risk aversion model of Melino and Yang (2003) and Gordon and St-Amour (2004), Brandt and Wang's (2003) unexpected-inflation model, Routledge and Zin's (2010) generalized disappointment aversion model, and Gârleanu and Panageas's (2015) continuous-time overlapping generations model. On the empirical side, Malmendier and Nagel (2011) find that baby boomers are more risk tolerant than their predecessors.