Ambiguity aversion and household portfolio choice puzzles: Empirical evidence☆

Stephen G. Dimmock [a], Roy Kouwenberg [b,c], Olivia S. Mitchell [d,*], Kim Peijnenburg [e]

[a] *Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798, Singapore*
[b] *Mahidol University, 69 Vipawadee Rangsit Rd., Bangkok 10400, Thailand*
[c] *Erasmus University Rotterdam, Burgemeester Oudlaan 50, 3062 PA Rotterdam, The Netherlands*
[d] *University of Pennsylvania, St 3000 SH-DH, 3620 Locust Walk, Philadelphia, PA 19104, United States, and NBER.*
[e] *Bocconi University, Via Roberto Sarfatti, 25, 20136 Milan, Italy*

A R T I C L E   I N F O

A B S T R A C T

We test the relation between ambiguity aversion and five household portfolio choice puzzles: nonparticipation in equities, low allocations to equity, home-bias, own-company stock ownership, and portfolio under-diversification. In a representative US household survey, we measure ambiguity preferences using custom-designed questions based on Ellsberg urns. As theory predicts, ambiguity aversion is negatively associated with stock market participation, the fraction of financial assets in stocks, and foreign stock ownership, but it is positively related to own-company stock ownership. Conditional on stock ownership, ambiguity aversion is related to portfolio under-diversification, and during the financial crisis, ambiguity-averse respondents were more likely to sell stocks.

1. Introduction

Households must consider both risk and ambiguity when making investment decisions. Risk refers to events for which the probabilities of the future outcomes are known. Ambiguity refers to events for which the probabilities of the future outcomes are unknown. Ellsberg (1961) argues that most people are ambiguity-averse, that is, they prefer a lottery with known probabilities to a similar lottery with unknown probabilities, and numerous theoretical studies explore the implications of ambiguity for economic behavior. A large body of theory suggests that ambiguity aversion can explain several household portfolio choice puzzles.[1] Empirical tests for some of these theoretical explanations, however, derive mainly from laboratory experiments instead of actual portfolio choices. In other cases, the proposed theoretical explanations have not been empirically tested.

In this paper, we provide non-laboratory empirical evidence that ambiguity aversion relates to five household portfolio choice puzzles: nonparticipation in equity markets, low portfolio fractions allocated to equity, home-bias, own-company stock ownership, and portfolio under-diversification. In a nationally representative sample of US households, we use real rewards to elicit measures of individuals' ambiguity aversion and then demonstrate that these measures can explain actual portfolio choices. As theory predicts, ambiguity aversion is negatively associated with stock market participation, the fraction of financial assets allocated to stocks, and foreign stock ownership, but ambiguity aversion is positively related to own-company stock ownership. Conditional on stock ownership, ambiguity aversion also helps to explain portfolio under-diversification.

We have developed a purpose-built internet survey module designed to elicit ambiguity aversion and fielded it on more than three thousand respondents in the American Life Panel (ALP). Following the classic Ellsberg urn problem, our module asks respondents to choose between a lottery with known probabilities (the drawing of a ball from a box with 100 colored balls in known proportions) versus a lottery with unknown probabilities. We vary the proportions of colored balls in the lottery with known probabilities, so as to measure individual respondents' ambiguity aversion. All respondents were eligible to win real monetary incentives (we paid a total of $23,850 to 1,590 of the 3,258 respondents), because previous studies show that rewards are crucial for eliciting meaningful responses to questions involving economic preferences.

Our results confirm prior laboratory studies finding large heterogeneity in ambiguity aversion; that is, a substantial fraction of our respondents is ambiguity-averse (52%); a small fraction ambiguity-neutral (10%); and the remainder ambiguity-seeking (38%). We find little to no correlation between our ambiguity measure and several

proxies for probability naiveté, thereby providing evidence that our measure reflects preferences, not mistakes. Having elicited ambiguity aversion, we then test whether it can help explain household portfolio choice puzzles.

A large proportion of the US population does not participate in the stock market, which is puzzling given that theoretical models using standard expected utility functions predict that all individuals will do so (Merton, 1969). For those who do participate, theory predicts they will allocate a counterfactually high fraction of assets to equity (Heaton and Lucas, 1997). Several theoretical papers suggest that ambiguity aversion can explain these puzzles, based on the assumption that investors view stock returns as ambiguous. Bossaerts, Ghirardato, Guarnaschelli, and Zame (2010), Cao, Wang, and Zhang (2005), Dow and Werlang (1992), Easley and O'Hara (2009), and Epstein and Schneider (2010), among others, show that ambiguity aversion can cause nonparticipation.[2] Garlappi, Uppal, and Wang (2007) and Peijnenburg (2014) show that ambiguity aversion can reduce the fraction of financial assets allocated to equity.

We test the predictions of these theoretical models and find that ambiguity aversion has a significant negative relation with both stock market participation and portfolio allocations to equity. Results indicate that a one standard deviation increase in ambiguity aversion implies a 2.0 percentage point decrease in the probability of stock market participation (8.6% relative to the baseline rate of 23%) and a 4.0 percentage point decrease in the fraction of financial assets allocated to equity (7.8% relative to the conditional average allocation of 51.4%). The results are robust to controlling for numerous variables that previous studies suggest could affect household portfolio choices, including wealth, income, age, education, risk aversion, trust, and financial literacy. The module also includes two check questions to assess whether a respondent's choices are consistent. We find stronger results for respondents whose choices are consistent.

In addition to explaining participation in and allocations to equities as a broad asset class, theory suggests that ambiguity aversion can help explain portfolio puzzles related to particular categories of equity: the home-bias and own-company stock puzzles. The home-bias puzzle refers to the fact that households heavily overweight domestic equity relative to mean-variance benchmarks (French and Poterba, 1991). The own-company stock puzzle refers to the fact that households voluntarily hold significant amounts of their employers' stock (Benartzi, 2001; Meulbrook, 2005; Mitchell and Utkus, 2003). Several theoretical papers argue that ambiguity aversion can explain these puzzles, because, relative to the domestic stock market, foreign stocks are relatively ambiguous and

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[1] For example, see Bossaerts, Ghirardato, Guarnaschelli, and Zame (2010), Cao, Wang, and Zhang (2005), Dow and Werlang (1992), Easley and O'Hara (2009), Epstein and Schneider (2010), Garlappi, Uppal, and Wang (2007), and Peijnenburg (2014), among others.

[2] These papers model ambiguity aversion using the multiple prior model of Gilboa (1987), Gilboa and Schmeidler (1989), and Schmeidler (1989). Bossaerts, Ghirardato, Guarnaschelli, and Zame (2010) use an extension of the multiple prior model, the α-MaxMin model of Ghirardato, Maccheroni, and Marinacci (2004), which distinguishes between preferences toward ambiguity and beliefs about the level of ambiguity. In this paper, we take no stand on the correct underlying model of ambiguity. Our measure of ambiguity aversion is valid under all commonly used models.