The Gender Gap in Household Bargaining Power: A Portfolio-Choice Approach*

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July 19, 2021

Abstract

We quantify how bargaining power is distributed when spouses make financial decisions together. We build a model in which each spouse has their own risk preference and must bargain with each other to make asset allocation decisions for the household. By structurally estimating the model using data from Australian and German households, we find a significant gender gap in household bargaining power: in Australia, the husband's risk preference matters 44% more for the average household's asset allocation than the wife's; in Germany, the husband's risk preference is twice as important as the wife's. These gaps in bargaining power are partially explained by gender differences in income and employment status, but they are also due to gender effects. We provide further evidence that links the distribution of bargaining power to views on gender norms in the cross-section.

*We are grateful to Cynthia Balloch, Da Ke, and Francisco Gomes, as well as seminar participants at IFS WiP Seminar, 19th IZA/SOLE Transatlantic Meeting for Labor Economists, Cambridge, Essex, and LSE for helpful comments. We thank Xiaomeng Li for excellent research assistance. We thank the British Academy (Grant SRG1920\101488) and the Keynes Fund-Cambridge for financial support. Zhang gratefully acknowledges support from Cambridge Endowment for Research in Finance (CERF).

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1 Introduction

When studying the allocation of household assets, virtually all existing papers start with the household as the unit of analysis. In most models, a household is imagined as an individual who solves the optimal portfolio problem with a well-defined set of goals and constraints. In empirical analysis, it is common to treat a household as a simple average of all its members or to use the head of the household to represent the entire household, without further considering how each household member could play a different role within the household or could have a different say.

Heterogeneous preferences and beliefs, which are often observed within the same household, can possibly cause internal disagreement, and bargaining can act as a crucial step in reaching a decision between all household members. To date, we still know relatively little about the nature of household bargaining. What characteristics determine an individual's bargaining power within a household? Which characteristics are quantitatively more important? Between men and women, is there a gender gap in bargaining power? If so, what drives it?

A budding literature takes two approaches to tackle these questions.[1] The first approach links the variation in individual-level characteristics to household-level outcomes (e.g., Addoum 2017; Olafsson and Thornqvist 2018; Ke 2020).[2] Although this approach can establish the relevance of a plausible factor, the availability of plausible instruments restricts it, and, therefore, the approach does not allow for a quantitative comparison among multiple factors. A second approach finds an empirical proxy for bargaining power and studies its properties and determinants (e.g., Friedberg and Webb 2006; Yilmazer and Lich 2015; Zaccaria and Guiso 2020). A popular proxy is constructed based on so-called "final say," whereby each household is asked to report who has ultimate responsibility for making a decision in financial matters and acts as the "financial head" of the household. However, when separately surveyed, wives and husbands often give different answers to the same question, suggesting nontrivial noise and disagreement (Barsky et al., 1997;

[1] Gomes et al. (2020) review existing approaches and recent advancement in intrahousehold analysis. They also mention a third approach to intrahousehold problems that incorporates changes to the family structure, arising from divorce, the arrival of children, or the death of a spouse, into a life cycle model of portfolio choice (e.g., Love 2010). This approach, however, does not directly model the bargaining process among household members.

[2] For instance, when the wife's relative income increases (but the overall household income remains the same), it is expected that she has more bargaining power in the household's decisions. This increase in bargaining power then can be linked to subsequent changes in the household's asset allocations, in order to establish the role of the wife's relative income in the intrahousehold bargaining process.

Mazzocco, 2004). Furthermore, a common concern about survey responses directly used in this survey-based approach still lingers: is what people say consistent with what they do (Bertrand and Mullainathan, 2001)?

In this paper, we propose a novel structural approach by directly estimating bargaining power revealed through portfolio choice. This is motivated by a strand of literature that uses portfolio composition to back out the "implicit" risk preference (e.g., Cohn et al. 1975; Friend and Blume 1975; Siegel and Hoban 1982; Morin and Suarez 1983; Bucciol and Miniaci 2011; Calvet et al. 2019). Empirical work of this nature usually treats a household as a single decision-making unit. Our approach, instead, adopts a collective bargaining model (Chiappori et al. 1988; Chiappori 1992) and models the household risk preference as a weighted average of individual risk preferences. Therefore, household members with more bargaining power are more able to incorporate their own risk preferences into the household's overall portfolio decision. This departs from the survey-based approach by examining what people actually do rather than what they say. By explicitly modeling the portfolio-decision process and the determinants of bargaining power, we also depart from earlier approaches by studying multiple channels—such as income, employment status, education, and personality traits—at the same time and quantifying each channel's relative importance.

With this idea in mind, we build a tractable model of intrahousehold financial decisions and structurally estimate it using detailed longitudinal data. In our model, spouses differ in their risk preferences and other individual characteristics, and they make portfolio decisions for the entire household portfolio in two steps. We consider heterosexual couples throughout the paper; as we are interested in identifying the gender gap in bargaining power, this would not apply to households in which both partners are of the same gender. In the first step, they cooperatively decide on a household risk preference, which is the weighted average of their respective risk preferences. The weight represents each individual's bargaining power and is determined by spousal differences in individual characteristics and a gender effect.[3] The gender effect is positive if the husband has more bargaining power and is measured by the "residual" that cannot be explained by observable characteristics.[4] In the second step, the household makes portfolio decisions based on this

[3]While bargaining could also happen along other dimensions, we will primarily focus on bargaining over risk preference when spouses make financial decisions together; this is primarily due to data limitations.

[4]For same-sex couples, this would imply a residual close to zero.

household-level risk aversion as if it were a single individual, with additional considerations, such as wealth, participation cost, family size, literacy, and education, as suggested in the literature. The household then decides whether to particulate in the stock market (the extensive margin) and by how much (the intensive margin), in the spirit of the Merton model.

We use representative data from two countries: Australia and Germany. Our main analysis is based on the Household, Income, and Labour Dynamics in Australia (HILDA) Survey, a nationally representative survey conducted among Australian households. The HILDA Survey asks respondents to provide detailed information about household asset allocation, including holdings of financial and nonfinancial assets and cash positions. In addition, it includes individual characteristics, such as risk aversion, age, income, cognitive ability, and personality traits. Overall, the HILDA Survey has richer details on survey participants than other commonly used data sets, such as the Survey of Consumer Finances (SCF) and the Panel Study of Income Dynamics (PSID), allowing us to implement our estimation strategy. The model is then estimated using maximum likelihood, with stock market participation and risky asset holdings as the two outcome variables.

Our estimation results reveal substantial heterogeneity across households in their allocation of bargaining power. This heterogeneity, in turn, can be attributed to spousal differences in individual characteristics. Education, employment, and income are the most important characteristics in determining bargaining power: education attainment, employment status, and income all positively contribute to bargaining power. Other factors, such as age and cognitive ability, matter as well, but to a lesser extent. Interestingly, personality traits also matter in the bargaining process. For example, consistent with prior literature on personality and labor outcomes (Flinn et al., 2018), less agreeable and more extraverted individuals exhibit greater bargaining power.

For the average household, the weight placed on the husband's risk preference is about 0.59, while the weight placed on the wife's is 0.41. This suggests that the household's asset allocation reflects the husband's risk preference 0.18 (or 44%) more than the wife's. Part of this gender gap can be explained by spousal differences in individual characteristics. Overall, income, employment, and age tilt bargaining power toward the husband, as men on average earn more, are more likely to be employed, and are older. However, all observable characteristics combined can only account for above half of the gap, leaving the other half unexplained. This suggests a gender effect that contributes to husbands' disproportionally high bargaining power.

Our subsequent analysis tries to understand the sources of this gender effect. The HILDA Survey includes a question asking participants to identify who has the "final say" about financial decisions in the household. While some other papers have directly used it as a proxy for bargaining power, we view it as an indicator of patriarchal social norms (Ke 2020). We find that the above documented gender effect is primarily driven by husband-headed households. In an average husband-headed household, the husband obtains an additional bargaining weight of 0.27 to 0.29 beyond what is implied by his observable characteristics, and this effect has been persistent over time. In contrast, in wife-headed households, while wives obtain more bargaining power than their spouses, the magnitude of the additional weight is much smaller.

This analysis also allows us to directly compare our portfolio-choice approach to the survey-based approach. The latter approach makes the implicit assumption that the financial head is the *de facto* decision-maker of the household endowed with full or disproportionally high bargaining power. Qualitatively, our findings are consistent with this assumption. First, the husband's bargaining power monotonically increases from wife-headed to shared-responsibility households to husband-headed households. Second, the average bargaining weight of the husband in shared household is 0.53, which is fairly close to equal say. However, *quantitatively*, in both wife-headed and husband-headed households, financial heads incorporate the risk preferences of their spouses.

We link the gender effect to direct measures of gender norms. The HILDA Survey includes three specific questions about gender norms, and husbands and wives need to answer these questions separately. The questions elicit attitudes toward traditional gender roles and how housework and childcare studies should be shared. We find that households with progressive attitudes toward gender norms are more likely to elect the wife as the head of the household, thereby thereby empowering women with more say in financial decisions. In particular, we find that subjective perceptions of both the husband and the wife matter.

We conduct a similar analysis for the German population using the German Socio-Economic Panel (GSOEP) survey, a longitudinal survey similar to the HILDA survey in structure and question design. Among the German population, we find an even stronger gender gap: for the average household, the weight placed on the husband's risk preference is about 0.68, while the weight placed on the wife's is 0.32. More strikingly, observable gender differences such as wage and employment status can only explain around 25% of the gap, leaving the rest of the 75% likely explained by gender effects. Consistent with a greater gender gap among the German population, German households show a much more traditional attitude towards gender roles according to the the World Values Survey (Ke 2018)

This paper contributes to the analysis of intrahousehold financial decisions in several ways. First, we propose a new framework to understand the bargaining process within a household. This structural approach complements the existing reduced-form approaches that rely on exogenous variation in individual characteristics or on survey-based proxies of bargaining power. Rather than treating the household as a single decision unit (e.g., Bertaut 1998; Cocco et al. 2005; Gomes and Michaelides 2005; Wachter and Yogo 2010), we adopt the collective bargaining model developed by Chiappori et al. (1988); Chiappori (1992) and model the household's risk preference as a result of bargaining. While the collective bargaining model usually concerns consumption and labor supply (e.g., Chiappori et al. 1988; Browning et al. 1994), our model concerns asset allocation, the domain in which risk preferences are a key consideration and a natural starting point of our analysis. A division of labor may exist: perhaps spouses with less bargaining power in the household's financial decisions could be compensated by having greater bargaining power in other domains (e.g., consumption decisions and child-rearing). However, when we test the correlation between the financial decisions and other labor and consumption decisions, we do not find evidence supporting this labor division hypothesis.

Second, we contribute to the literature on gender differences in financial decisions. Earlier studies have revealed the existence of a gender gap in trading behavior and performance (Barber and Odean 2001), housing returns (Goldsmith-Pinkham and Shue 2020), and stock market participation and other financial decisions (Addoum 2017; Olafsson and Thornqvist 2018; Ke 2020; Zaccaria and Guiso 2020). We contribute to this literature by backing out the bargaining weights between husbands and wives in making financial decisions and show that a similar gender gap exists.

Third, our paper quantitatively evaluates the relative importance of different factors in determining the distribution of bargaining power between spouses. While existing papers mainly examine the potential factors associated with bargaining power in the domains of consumption and labor supply (e.g., Chiappori 1992; Bourguignon et al. 2009; Attanasio and Lechene 2014; Pollak 2011, 2005; Flinn et al. 2018), we are primarily concerned with financial decisions. We find that economic factors, such as income and employment status, are the most important determinants of bargaining power, whereas other factors, such as cognitive ability and personality traits, matter to a lesser extent. In this regard, the closest paper to ours is Bertocchi et al. (2014), who use the financial head of the household as the proxy for bargaining power and study its determinants.

Fourth, we find supportive evidence that traditional gender norms constrain women's power in intrahousehold decisions. The two papers closest to ours are Ke (2020) and Zaccaria and Guiso (2020). Ke (2020) studies how men and women of similar financial sophistication differently affect their household's stock market participation decisions. Zaccaria and Guiso (2020) use household headship to proxy for gender norms and find that egalitarian gender norms lead to higher stock market participation and better financial returns. Our paper is different in two fundamental aspects. First, as discussed above, our consideration of bargaining power primarily concerns risk aversion, and our approach is based on portfolio choice. Second, our measures of gender norms are directly based on survey responses, rather than on proxies based on household headship.

The paper proceeds as follows. Section 2 describes the data and stylized facts. Section 3 presents the model and estimation implementation. Sections 4 and 5 report the estimation results and counterfactual experiments. Section 6 conducts a similar analysis for German households. Section 7 concludes.

2 Data and Stylized Facts

2.1 HILDA Survey

Our main data set is the Household Income and Labour Dynamics in Australia (HILDA) Survey, which is nationally representative and has been conducted every year since 2001. Our choice of data is primarily driven by the rich set of variables available at both the individual and household levels. Below, in Section 2.3, we have a systematic review of similar household-level surveys conducted in other countries and argue that the HILDA Survey is most suitable for our analysis of intrahousehold decision-making.

For each household, all adult household members (15 years old and older) first attend a face-to-face interview and then complete a self-administered questionnaire in private. The interviews and questionnaires cover a wide range of topics, including participants' economic and subjective well-being, labor market dynamics, and family dynamics. Each wave includes a different questionnaire module and asks questions related to different aspects of the household. Because different sets of information are collected in different waves, we construct our main sample based on four waves: waves 6, 10, 14 and 18, all of which collect information about demographics, financial head, and asset allocation, but not for personality traits. Instead, we rely on the four preceding waves, which collect information on personality traits. Information on cognitive ability is only collected in waves 12 and 16, so we use the average value across all four waves; in doing so, we make the implicit assumption that cognitive ability is very persistent at the individual level. Table 1 shows how we merge information from different waves to arrive at a panel structure.

We focus on heterosexual married couples with a wife and a husband.[5] In the raw sample, we have 17,320 household-wave observations across the four waves. We then drop observations with missing information. We further exclude households in which financial decisions are made by someone not in the household and households in which both spouses claim to be the financial head of the household. This leaves us with a final sample of 8,708 household-wave observations, representing 3,951 unique households.[6]

2.2 Summary statistics

Table 2 shows the summary statistics for our main sample. We start with household characteristics. Stock participation is a dummy variable that indicates whether a household directly holds any equities.[7] The overall participation rate in the stock market is 48%, which is higher than those in many other developed countries (see Badarinza et al. 2016 for a recent international comparison). The median household income is AU\$105,000. The median total wealth and financial wealth are AU\$979,000 and AU\$243,000, respectively, suggesting good coverage of relatively affluent

[5] By construction, the gender gap exists only for households in which the spouses are of different gender. Same-sex marriage was legalized in Australia in 2017. While we do not sufficient data to analyze same-sex couples, we expect that gender dynamics would not apply in the same way in a non-heteronormative relationship.

[6] Appendix A.1 discusses the filters in detail. Table A.1 in the Online Appendix compares the raw sample and the baseline sample.

[7] We do not consider equities held in retirement accounts in this analysis for two reasons. First, investment decisions in retirement accounts are infrequent and more passive. Second, the HILDA Survey does not report how retirement accounts are invested.

families.[8] The average level of equity is AU$74,000, while the median level is zero. The distributions of income, total wealth, financial wealth, and equity, as expected, are positively-skewed. On average, a household has fewer than one child.

For individual characteristics, most of the demographic variables, such as age and education, covers a wide spectrum, consistent with the HILDA Survey's national coverage. A more interesting set of statistics concerns the comparison between husbands and wives. Overall, in an average household, compared with the wife, the husband is 2.4 years older, is 8% more likely to be employed, and makes AU$29,000 more every year; however, he has a similar level of education as the wife.

The HILDA Survey also collects information on each spouse's risk preference, cognitive ability, personality traits, and the identity of the household financial head. Below, we will explain how we code these individual noneconomic variables.

Risk preference. In the HILDA Survey, risk aversion is measured in the same way as in the Survey of Consumer Finances (SCF). Each household member answers the following question in the self-completion questionnaire: which of the following statements comes closest to describing the amount of financial risk that you are willing to take with your spare cash? That is, cash used for savings or investment. The answer options are (1) I take substantial financial risks expecting to earn substantial returns; (2) I take above-average financial risks expecting to earn above-average returns; (3) I take average financial risks expecting average returns; and (4) I am not willing to take any financial risks.[9] These four options are then numbered from one to four, with a higher number indicating a greater level of risk aversion. This self-assessment question is a widely used proxy for risk aversion, especially in the domain of financial decision-making. Although the measure does not capture the full spectrum of risk tolerance, it has good consistency over time and is correlated with other measures of risk aversion elicited using hypothetical gambles and from portfolio choices (Grable and Lytton, 2001; Hanna and Lindamood, 2004). As Table 2 shows, the average risk aversion is 3.18 for husbands and 3.42 for wives, suggesting that wives, on average, are more risk

[8] Financial wealth (the HILDA Survey variable HWFINI) includes equity, cash investments, trusts, bank accounts, insurance, and superannuation. We define total wealth as the sum of financial wealth and non-financial wealth (the HILDA Survey variable HWNFII).

[9] There is a fifth option: I never have any spare cash. We exclude individuals who choose this last option, because we are unclear about how to classify these individuals.

averse than husbands.

Cognitive ability. The survey conducts three tests to measure cognitive ability: (1) the "backward digits span" (BDS) test; (2) a 25-item version of the National Adult Reading Test (NART); and (3) the "symbol-digit modalities" (SDM) test. We construct a single measure by first standardizing the results of each test and then taking the mean. See Appendix A.2 for more details. In our sample, wives have a higher cognitive ability, scoring 0.11 higher than husbands.

Personality traits. The HILDA Survey collects information about the Big Five personality traits: openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability (for overviews of the Big Five, see Costa Jr and McCrae 1990; McCrae and John 1992; John and Srivastava 1999). Each trait is measured on a scale from 1 to 7. See Appendix A.3 for more details. Overall, husbands are less extraverted, less agreeable, less conscientious, and more open to experiences than are their wives.

Financial head of the household. The HILDA Survey also collects information on the financial head of the household. In the self-completion questionnaire, each spouse answers who makes the decisions about the savings, investment and borrowing in their household. Participants are given the following options: themselves, their spouses, shared equally between spouses, or other people. We exclude households whose financial decisions are made by other people and those in which both spouses claim to be the financial head of the household (full, not shared).

This question is similar to the question about "final say" used in other surveys (e.g., the Health and Retirement Study, HRS), which asks the following question: "When it comes to major family decisions, who has the final say, you or your husband (wife)?" The literature has used this variable for two purposes. First, it has been used as a proxy for bargaining power (e.g., Friedberg and Webb 2006; Yilmazer and Lich 2015; Zaccaria and Guiso 2020). Second, it has been used as a measure for gender norms, with husband-headed families being interpreted as having more patriarchal gender norms (Ke 2020). In this paper, we follow the second approach and use husband-headed families as a proxy for traditional gender norms.

Based on the answers to the "financial head" question, we first classify all households into three types: "husband-headed," in which both spouses report the husband makes financial decisions; "jointly headed," in which both husband and wife report that financial decisions are "shared equally" between the spouses; and "wife-headed," in which both spouses report the wife makes financial decisions. In some cases, the spouses give slightly different answers to the same question, and this gives rise to two other types: "husband-shared," in which one spouse reports "husband" and the other reports "shared equally," and "wife-shared," in which one spouse reports "wife" and the other reports "shared equally."

Figure 1 graphs the distribution of household types by year. Depending on the specific wave, 57% to 60% of households report that spouses equally share in the responsibility of making financial decisions. If responsibilities are not shared equally, it is more likely that the husband acts as the financial head: 26% to 29% of the households report the husband to be the financial head, while only 13 % to 17% report the wife. Across the four waves, the fraction of each household structure remains rather steady. There is a small trend toward wife-headed and wife-shared households, but the magnitude is relatively small.

2.3 Comparison with other data sets

The most comparable data set for U.S. households is the Panel Study of Income Dynamics (PSID). The PSID collects demographics, employment, income, wealth, and other information on a nationally representative panel of households and reports individual-level information. However, although the PSID collects individual-level risk aversion, it is only available for the household head, not for the other household members. This limitation makes it impossible to aggregate risk preferences from the individual level to the household level. A second candidate data set is the HRS, which provides comprehensive information on households' asset allocations and the risk preferences of all household members. However, the HRS restricts its sample by exclusively surveying people over the age of 50 only. While the focus on a particular demographic group is inherently interesting, the conclusions drawn from a restrictive sample will also face issues of generalizability. This concern is particularly keen to the study of bargaining power, as the prior literature has shown evidence of a power shift as couples transition into retirement (Addoum 2017). A third widely used data set is the U.S. Survey of Consumer Finances (SCF). However, the SCF does not survey each household member's characteristics in a given household, which again makes it unsuitable for our study.

Similar nationally representative data sets are available for other countries, but different data limitations make these data sets less ideal for our study. For example, in the Korean Labor and Income Panel Study (KLIPS), risk preference is measured using hypothetical lottery questions, but only 9.4% of individuals deviate from the safest choice, making the measure rather underpowered. The information in the German Socio-Economic Panel (GSOEP) is very detailed but does not extend to financial heads.[10] In the British Household Panel Survey (BHPS), households only report their asset holdings in dummy variables, which makes the main measure of asset holdings rather crude and potentially underpowered. China Household Finance Survey (CHFS) is similar to the PSID in that only the financial head's risk aversion is collected.

2.4 Stylized facts

2.4.1 Heterogeneous risk preferences within households

In our model, we will assume that spouses bargain by aggregating their risk preferences. A key premise for bargaining over risk aversion is that members of the same household have different levels of risk aversion. To confirm this, Table 3 shows the distribution of husband-wife-paired risk aversions. The diagonal terms represent the cases in which the husband and the wife have the same risk aversion. The off-diagonal terms represent cases in which the two spouses have different risk preferences and will need to reconcile with each other in making the household's financial decisions. Overall, two robust patterns emerge. First, consistent with prior literature (e.g., Dohmen et al. 2012), we find assortative mating on risk preferences between spouses: more than 50% of the couples have the same risk preference. It is unclear whether sorting happens prior to marriage or spouses become more alike post marriage. Second, in around 43% of the households, the two spouses have different levels of risk aversion. This pattern confirms our hypothesis that a significant proportion of spouses need to bargain over their risk preferences when making financial decisions.

[10] We conduct a more limited version of exercise using GSOEP without the financial head variable. See Section 6 for details.

2.4.2 Risk preference and stock market participation

To illustrate the quantitative importance of risk preference to the decision to participate in the stock market, we run a simple linear probability model by regressing the dummy of stock market participation on various household characteristics. Column 1 in Table 4 concerns the regression in which only measures of risk aversion are included as the explanatory variables. Indeed, both spouses' risk aversions show up negative and significant, suggesting that risk aversion is indeed a key determinant of stock market participation. Column 2 adds additional controls and shows that the relationship between risk aversion and risky shares remains robust after controlling for a variety of individual characteristics. That *R*-squared increases from 6.6% to 20.3% suggests that the overall explanatory power from risk preferences alone is rather substantial. Columns 3 and 4 repeat the analysis for single households and show a similar pattern.[11]

2.4.3 Financial head of the household

Table 5 reports household characteristics by sorting households into three different types: husband-headed, jointly headed, and wife-headed; we omit the two other household types for simplicity. As mentioned before, some existing papers use the identity of the financial head as a proxy for bargaining power. We view this approach as plausible; below, we will provide some supportive evidence of this approach. However, in this paper, we use this variable as a measure of household types and instead use portfolio choice to back out bargaining power.

We start by comparing average household characteristics. At the individual level, members of husband-headed households are slightly older, more educated, less likely to be employed (which is primarily driven by the wife), earn a higher income, and are less risk averse in general. At the household level, they are more likely to participate in the stock market, hold more equity, and are wealthier in their overall assets and financial assets.

A more interesting comparison concerns the difference between husbands and wives in their individual characteristics. We find that, generally, when a spouse is better off in education, employment, income, risk-taking capacity, and cognitive ability, then this person is more likely to become a financial head. Indeed, in an average husband-headed household, the husband is generally better

[11] Estimates from a logit regression model (not reported here) reveal a similar pattern to that obtained from the linear probability model.

off in these dimensions, and vice versa in an average wife-headed household.

3 Model

3.1 A baseline model

The economy has two assets: a risk-free asset with a constant interest return r_f and a risky asset (stock) with return $r_f + \widetilde{x}$. $\widetilde{x}$ represents the equity premium and follows a normal distribution, where $\widetilde{x} \sim N(r_x, \sigma_x^2)$. For simplicity, we assume that r_x is homogeneous across households and abstract away from heterogeneous expectations.[12] Household i has total wealth w. Consider a portfolio allocation between risky asset holding a and risk-free asset holding $w - a$. Participating in the stock market is costly, captured by a one-time lump-sum cost of C_i. Subscript i indicates that C_i is heterogeneous across households.[13]

The mean-variance utility function of the household i can be specified as

$$U_i(a) = \max_a \underbrace{w(1+r_f)}_{\text{Risk-free return}} + \left(\underbrace{ar_x - C_i}_{\text{Mean}} - \underbrace{\frac{1}{2}\gamma_i a^2 \sigma_x^2}_{\text{Variance}} \right) I(a > 0), \tag{1}$$

where $I(a > 0)$ is a dummy variable indicating whether the household invests in the risky asset and γ_i represents the household's risk aversion. The solution to the portfolio choice is given by

$$a = \begin{cases} 0 & \gamma_i > \frac{r_x^2}{2\sigma_x^2 C_i} \\ \frac{r_x}{\gamma_i \sigma_x^2} & \gamma_i \leq \frac{r_x^2}{2\sigma_x^2 C_i} \end{cases}. \tag{2}$$

Section B of the Online Appendix provides the details to this solution. Equation (2) implies that

[12] Since the HILDA Survey data do not provide information about stock market returns expectations, we cannot use household-level expectations data in our portfolio choice problem.

[13] A common tactic in the literature is to introduce trading costs, C_i, into the model to capture the limited stock market participation of households (e.g., Vissing-Jørgensen 2002; Gomes and Michaelides 2005; Alan 2006). While the prior literature has often interpreted this cost as the physical effort of opening a brokerage account and the mental effort of learning about financial markets, our interpretation is more flexible. We use the cost as an absorbing term that captures any factor other than risk aversion that also affects stock market participation.

household portfolio allocations have two sources of heterogeneity: household risk aversion γ_i and participation cost C_i. Both a higher risk aversion and a higher participation cost would lead to a lower participation rate and, conditional on participation, a lower fraction of wealth invested in the risky assets.

Next, we specify participation cost C_i. Because we view it as an absorbing term, we adopt a rather flexible specification as a linear combination of various household-level characteristics:

$$\begin{aligned} C_i = {} & c_0 + c_1 \log(\text{earning})_i + c_2 \log^2(\text{earning})_i + c_3 \log(\text{wealth})_i + c_4 \log^2(\text{wealth})_i + c_5 \text{age}_i \\ & + c_6 \text{age}_i^2 + c_7 \text{education}_i + c_8 \text{cognition}_i + c_9 \text{child}_i + c_{10} \text{year}_{2010} + c_{11} \text{year}_{2014} + c_{12} \text{year}_{2018}, \end{aligned} \tag{3}$$

where earning, wealth, and child represent household earning, household net wealth, and the number of children, respectively. Because we are primarily concerned with household-level characteristics at this point, we use the average value between the two spouses for age, education, and cognitive ability. We also include three-year dummies, with year 2006 as the reference group. It is important to allow household wealth to enter into the participation cost, as it breaks the wealth neutrality commonly implied by a mean-variation utility. Therefore, although household wealth does not directly show up in the portfolio solution, it still indirectly affects stock market participation through C_i.

Next, we specify how household risk aversion, γ_i, is aggregated from individual preferences; for simplicity, we now drop subscript i.[14] We focus our attention on traditional marriage in which a household consists of a husband (h) and a wife (w).[15] We assume the *reciprocal* of household risk aversion, $\frac{1}{\gamma}$, is a weighted average of the *reciprocals* of the two spouses' risk aversions, denoted by $\frac{1}{\gamma^h}$ and $\frac{1}{\gamma^w}$, respectively; that is,

$$\frac{1}{\gamma} = \frac{\beta^h(\cdot)}{\gamma^h} + \frac{\beta^w(\cdot)}{\gamma^w}, \tag{4}$$

where the weight parameters $\beta^h(\cdot)$ and $\beta^w(\cdot)$ can be interpreted as the bargaining power of the husband and of the wife, respectively, and $\beta^h + \beta^w = 1$. With this formulation, we are assuming that greater bargaining power means greater ability to incorporate one's own risk preference

[14] In theory, bargaining could happen along other dimensions as well. For instance, if one household member is more optimistic than the other about future market returns, they will need to aggregate each other's expectations in making household portfolio decisions. For simplicity, we will primarily focus on bargaining over risk preference.

[15] Our analysis makes the implicit assumption that couples are fully committed to staying in their marriage. We don't consider the case of divorce in our model.

into the household financial decision. Equation (4) also provides an equivalent expression as the classical collective bargaining model in which the household utility function is a weighted average of the individual's utility (Manser and Brown 1980; McElroy and Horney 1981; Chiappori 1988, 1992).[16] In other words, in our model, aggregating the two spouses' risk aversion coefficients is equivalent to aggregating their utility functions using the same bargaining weight. Therefore, this weight in equation (4) also can be interpreted as the Pareto weight in the collective model.[17]

Next, we specify the determinants of bargaining power. At period t, $\beta^h(\cdot)$ is determined by both the observed characteristics of the two spouses and a gender effect. Specifically, $\beta^h(\cdot)$ takes the following logistic form:

$$\beta^h(X_t^h, X_t^w, H_t) = \frac{\exp\left(\widetilde{\beta}\left(X_t^h, X_t^w, H_t\right)\right)}{\exp\left(\widetilde{\beta}\left(X_t^h, X_t^w, H_t\right)\right) + 1}, \tag{5}$$

where

$$\widetilde{\beta}\left(X_t^h, X_t^w, H_t\right) = \delta_x\left(X_t^h - X_t^w\right) + \sum_{j=1}^{5} \delta_{jt}^H I(H_t = j) + \mu + \varepsilon_t. \tag{6}$$

X_t^h and X_t^w are the observed characteristics of the husband and the wife at time t, receptively, and H_t denotes the household structure at time t; logistic transformation is commonly used to map the unrestricted $\widetilde{\beta}(\cdot)$ onto the unit interval, thereby bounding bargaining power between zero and one. The first term, $\delta_x\left(X_t^h - X_t^w\right)$, captures the contribution of the observed *differences* between the husband and the wife to bargaining power. Here, we assume the effects are gender neutral; that is, we do not assume the effects are different between the positive and negative regions. Instead, gender asymmetry is absorbed by the gender effect terms, $\sum_{j=1}^{5} \delta_{jt}^H I(H_t = j)$, where $I(H_t = j)$ indicates the five types of household structure based on the identity of the financial head. The inclusion of subscript t means that gender effects can be time-varying in our model. The next term, μ, captures household unobserved heterogeneity, which is assumed to be fixed for the same household over multiple periods; we discuss the distributional assumptions we make about μ in the next section. Lastly, ε_t captures a temporary preference shock and follows a normal distribution

[16] Appendix B provides a detailed description.

[17] We assume away the time allocation decision within a household, which is the main bargaining domain in traditional collective models (e.g., Manser and Brown 1980; McElroy and Horney 1981; Chiappori 1988, 1992). We test this assumption in Table 12 and find decisions about financial matters are not significantly correlated with decisions about labor supply, child-rearing, and time allocation.

with $N\left(0,\sigma_{\varepsilon}^{2}\right)$.

3.2 Econometric specification and maximum likelihood function

We now introduce some parametric assumptions in order to estimate the model. To simplify the exposition, we continue suppressing subscript i and will bring it back later when introducing the likelihood function. We use Ω_t to represent the observed characteristics at time t:

$$\Omega_t = \left(\overline{\gamma}_t^h, \overline{\gamma}_t^w, X_t^h, X_t^w, H_t\right),$$

where $\left\{\overline{\gamma}_t^h, \overline{\gamma}_t^w\right\}$ are the spousal risk aversion measures reported in the survey; $\left\{X_t^h, X_t^w\right\}$ represent the set of individual characteristics of the husband and the wife; and H_t denotes the household structure based on the identity of the financial head.

Our survey-based measures of risk aversion, $\{\overline{\gamma}_t^h, \overline{\gamma}_t^w\}$, are categorical variables that use a higher value to represent higher risk aversion. However, that these discrete variables may be noisy and measured with errors potentially leads to attenuation bias and inconsistent coefficient estimates (e.g., Beauchamp et al. 2017). Therefore, we introduce measurement errors, $\{\xi_t^h, \xi_t^w\}$, to map the survey-based risk aversion to the true risk aversion in the following way:

$$\begin{aligned} \log\gamma_t^h &= \zeta_0 + \zeta_1^h \log\overline{\gamma}_t^h + \xi_t^h \\ \log\gamma_t^w &= \zeta_0 + \zeta_1^w \log\overline{\gamma}_t^h + \xi_t^w \end{aligned}, \tag{7}$$

where coefficients $\{\zeta_1^h, \zeta_1^w\}$ are gender specific, which means same answers given to the survey question may reflect different risk preferences. The intercept, ζ_0, is assumed to be common, but making ζ_0 gender specific does not change our subsequent results. We assume $\xi_t = \{\xi_t^h, \xi_t^w\}$ follows a joint normal distribution, which is specified by

$$\xi_t = \begin{pmatrix} \xi_t^h \\ \xi_t^w \end{pmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho_\xi \\ \rho_\xi & 1 \end{bmatrix} \sigma_\xi^2\right),$$

where ρ_ξ represents the correlation between the two spouses' measurement errors. The lognormal functional form is a common choice in the literature and has several advantages. First, it ensures that the risk preference is nonnegative. Second, it is computationally simple.[18] Third, since the empirical distribution of risk aversion is highly skewed to the right, the lognormal assumption allows the model to better capture the distributions in the right tail (e.g., Kimball et al. 2008).

Next, we specify the outcome variables. We focus on both the extensive and intensive margins of stock market participation. d_t is a dummy for having a positive holding in equities, and $\overline{a}_t$ is the reported holdings in equities (in AU$). To account for measurement error, we assume $\overline{a}_t$ is also a noisy measure of the true asset value, a,

$$\log \overline{a}_t = \log a_t + \varepsilon_t^a, \tag{8}$$

where ε_t^a is a residual term and follows a normal distribution, $\varepsilon_t^a \sim N(0, \sigma_a^2)$. To simplify the notation, we write $O_t = \{d_t, \overline{a}_t\}$.

The last assumption we make is about the distribution of μ from equation (6). The term μ captures the persistent unobserved heterogeneity of each household, which is fixed over time conditional on the observed characteristics. Following Heckman and Singer (1984), we model μ as a random effect using the nonparametric mass points approach.[19] In particular, we assume μ draws from a discretized distribution of K mass points $\mu \in \{\mu_1, \mu_2, ..., \mu_K\}$ and use notation $p = \{p_1, p_2, ..., p_K\}$ as the associated probability weights.[20] In practice, we assume four types, that is, $K = 4$.

Next, we specify the individual likelihood function at time t, L_t, which links the outcome variables, denoted by O_t, to the observed characteristics, denoted by Ω_t, given the vector of parameter set Θ. In summary, the parameter set contains

$$\Theta = \left\{c, \delta, p, \mu, \zeta, \rho_\xi, \sigma\right\},$$

[18] For example, the mean and variance of γ can be calculated analytically using the moment-generating function of γ.

[19] A less common technique is to model μ as a fixed effect in a structural approach. We highlight two reasons to explain the approach's lack of popularity. First, the inclusion of fixed effects increases the parameters to estimate by thousands, substantially reducing the degrees of freedom in estimation. Second, the fixed effects method would produce inconsistent estimates when the model is nonlinear.

[20] Alternatively, we could impose a specific distribution for μ, for example, a mixture of several normal distributions. However, econometric evidence suggests that our current approach performs better. Using Monte Carlo simulation, Mroz (1999) shows the discrete type assumption performs as well as the normal assumption when the true distribution is normal. When the true distribution is not normal, however, the discrete type method performs better in terms of precision and bias.

where $c = \{c_i\}_{i=0}^{12}$ represents the coefficients in the participation cost function; $\delta = \left\{\delta_x, \left\{\delta_{jt}^H\right\}_{j=1}^5\right\}$ represents the coefficients in the bargaining equation; p and μ represent the two sets of parameters when modeling household time-invariant unobserved types; $\zeta = \left\{\zeta_0, \zeta_1^h, \zeta_1^w\right\}$ represents the coefficients in the measurement of risk aversion; ρ_ξ represents the correlation of the measurement errors in risk aversion between spouses; and $\sigma = \left\{\sigma_\xi, \sigma_\varepsilon, \sigma_a\right\}$ represents the standard deviations of the three shocks. Given the realization of the random preference shock (ε_t) and the joint measurement error (ξ_t), we define the household-level likelihood function as

$$\begin{aligned} L_t(O_t|\Omega_t, \varepsilon_t, \xi_t) &= \sum_{k=1}^{K} p_k L_t(O_t|\Omega_t, \varepsilon_t, \xi_t, \mu_k) \\ &= \sum_{k=1}^{K} p_k \left[P_d\left(d_t|\Omega_t, \varepsilon_t, \xi_t, \mu_k\right) P_a(\bar{a}_t|D_t = 1, \Omega_t, \varepsilon_t, \xi_t, \mu_k)^{d_t}\right], \end{aligned} \tag{9}$$

where P_d and P_a represent the probability of participating in the stock market and the amount of equity holding, respectively.[21] Therefore, for each household, we maximize the joint probability of matching both the extensive and intensive margins. The unobserved discrete type k affects outcomes through its impact on bargaining power and therefore must be integrated in order to construct the overall likelihood function.

Finally, we bring back subscript i to specify the overall likelihood function:

$$L = \prod_{it}\left(\int_{\xi_{it}}\int_{\varepsilon_{it}} L_{it}(O_{it}|\Omega_{it}, \varepsilon_{it}, \xi_{it})d\varepsilon_{it}d\xi_{it}\right) \tag{10}$$

where i indexes each household and t indexes each of four waves (2006, 2010, 2014, 2018). We estimate the set of parameters that maximizes the likelihood value, L. The standard errors are computed using the BHHH algorithm (Berndt et al. 1974).

3.3 Identification

Households in our model follow a two-step procedure when making portfolio decisions. Therefore, all individual characteristics enter the likelihood function only through two sources of het-

[21] Besides the two shocks $\{\varepsilon_t, \xi_t\}$, we have been already conditioning on the third shock, ε_t^a, which is included in the probability density function, P_a. In particular, $P_a(\bar{a}_t) = \phi\left(\frac{\varepsilon_t^a}{\sigma_a}\right) = \phi\left(\frac{\log\bar{a}_t - \log a_t}{\sigma_a}\right)$, in which ϕ represents the standard normal probability density function.

erogeneity, stock market participation cost C and household risk preference γ; for simplicity, we drop subscripts i and t in this section. Therefore, we can treat (C, γ) as a pair of parameters to be estimated without loss of generality. After we obtain these two estimates, the other parameters can be estimated from the equations that specify the determinants of C and γ. More specifically, we first identify (C, γ) for each group of households that shares exactly the same observed characteristics, $\Omega = \{\overline{\gamma}^h, \overline{\gamma}^w, X^h, X^w, H\}$. Second, we identify the coefficients associated with the risk preference measurement equation $\zeta = \{\zeta_0, \zeta_1^h, \zeta_1^w\}$ by comparing households with the same values of $\{X^h, X^w, H\}$ but different values of $\{\overline{\gamma}^h, \overline{\gamma}^w\}$. Third, we identify parameters, $c = \{c_i\}_{i=0}^{12}$, in the cost function and parameters, $\delta = \{\delta_x, \{\delta_{jt}^H\}_{j=1}^5\}$, in the bargaining equation by comparing households with heterogeneous values of $\{X^h, X^w, H\}$. The Online Appendix C provides more details about the identification.

4 Estimation Results

4.1 Model estimates

Table A.6 reports the estimation results for the bargaining equation. Column 1 reports the coefficients, and column 2 reports their standard errors. We also calculate the percentage change in bargaining weight in response to a one-standard-deviation change in a given characteristic and report these numbers in column 3. Employment and earnings stand out as the most important determinants of bargaining power: both coefficients are positive; a one-standard-deviation increase in employment and earnings increase the bargaining weight by 6.49% and 11.64%, receptively. Age, education, and cognitive ability also positively affect bargaining power, but with a smaller magnitude. Personality also matters: for the big-five personality traits, higher scores in stability and openness lead to more bargaining power, while higher scores in extraversion and agreeableness lead to less bargaining power.

Table 7 reports the estimates for the gender effects. Each coefficient represents one of the five household types—"husband-headed," "husband-shared," "jointly headed," "wife-shared," and "wife-headed"—in each of the four waves from 2006 to 2018. In any given year, the coefficients exhibit a monotonically increasing pattern from wife-headed to jointly headed to husband-headed households. Therefore, husbands have disproportionally more bargaining power in the households they head, whereas wives have disproportionally more bargaining power in the households they head. Without a proper simulation exercise, however, it is difficult to interpret the coefficients' contribution to bargaining power. We will perform this exercise later in Section 4.4.

Table A.7 reports the estimates for the rest of the model.[22] The left panel reports all the coefficients from equation (3), which specifies the stock market participation cost. The coefficients for the log of household earnings and the squared term are both negative, suggesting that higher earnings are associated with a lower participation cost. In comparison, the coefficients for the log of net wealth and the squared term are both positive. Meanwhile, the effects of age and cognitive ability on participation cost are both negative, indicating stock market participation decisions are easier for households with more experienced and intelligent household members. Having more children increases participation costs, possibly because of constraints in the allocation of time.

Figure 2 plots the distribution of participation costs, which display substantial heterogeneity across households. The average participation cost is around AU$300, which is consistent with estimates from the previous literature.[23]

The upper-right panel of Table A.7 reports the coefficients associated with the risk attitude measurement equation. To further understand the "true" risk preferences generated from the risk measure equation, we plot the distribution of risk aversion in Figure 3. The distribution of the husband's risk aversion has a lower median and is more positively skewed than the distribution of the wife's risk aversion. This finding is consistent with existing evidence in the literature. For example, Powell and Ansic (1997) provide experimental evidence of gender differences in risk behavior in financial decision-making, and Barsky et al. (1997) show survey-based evidence.[24]

[22]Table A.5 in the Online Appendix reports the estimates for unobserved types, μ, in the bargaining equation (6), which is used to capture the household heterogeneity that is not captured by observed characteristics. The estimates indicate that households are more likely to be Types I and II, not the other two types.

[23]For example, Vissing-Jorgensen (2003) finds that a per-period cost of AU$55 in 2003 prices is enough to explain 50% of nonparticipation using the Panel Study of Income Dynamics (PSID). However, our model differs from that of Vissing-Jorgensen (2003) in specifying participation cost as a one-time lump-sum cost. Moreover, the households surveyed by the PSID have less wealth on average: for example, around 21% of the households have no financial wealth at all.

[24]The lower-right panel of Table A.7 reports the other parameters. The residual term in the bargaining equation has a standard deviation of 0.633. The standard deviation of the measurement error term for the log asset is 1.084. We fix the mean and variance of the risk premium $r_p = 0.060$ and $\sigma_r = 0.135$ following the estimates in (Pojanavatee, 2013).

4.2 The model's goodness of fit

In this section, we compare the conditional moments from model simulation and those from the real data to examine whether the model does a good job fitting the data. In particular, we examine the two metrics the model is designed to match: a dummy for stock market participation and the level of risky asset holding. We calculate both variables for each household, average them by household head types and risk preferences, and then compare the average values across different groups. Table A.8 reports the results: the first two columns concern stock market participation, and the last two concern the level of risk asset holdings. Overall, the model fit is good: in the upper panel, moments from the model simulation and real data are close to each other, with a monotonic pattern across the five household types preserved; in the lower two panels, the simulated patterns are close to the patterns implied by the data. Figure 4 further plots the distribution implied by the model (in red line) against the empirical distribution (in blue histogram). Overall, the model does a good job of capturing the empirical distribution of risky asset holdings.

4.3 Gender asymmetry and its sources

Next, we quantify the distribution of bargaining power between husband and wife in intrahousehold financial decisions by conducting a series of simulation exercises. In each exercise, we shut down part of the model to focus on the mechanism we are interested in and then simulate both the distribution of bargaining power and the two key moments of financial decisions. The benchmark case is when spouses have equal say, with a 50/50 split in the distribution of bargaining power. This means setting $\beta = 0.5$ in our model, and the first line of Table 10 presents the results. In this benchmark case, stock market participation rate is 42.9%, which is substantially lower than the actual number. Similarly, the holdings of risky assets are also lower than the actual moment.

The next line presents the case in which we consider both gender effects and spousal differences in observable characteristics. We find a large gender gap: in an average household, the husband's bargaining power is 59%, whereas the wife's is 41%. This suggests an 18% gap in bargaining power; in relative terms, this suggests that husbands on average have 44% greater bargaining power than do wives. The fact that husbands have more bargaining power, combined with them having lower risk aversion on average, means that the stock market participation rate is now much higher than the one in our benchmark case. Indeed, the simulated stock participation rate has increased to 49.5%, which is fairly close to the actual number (48%).

The next two lines present the cases in which we consider only gender effects and only spousal differences in observable characteristics. Overall, both channels matter, with each channel alone generating 12% and 10% gaps in bargaining power, respectively. It is important to note that observable differences do not fully explain the gender gap: although the higher income and better employment status typical of husbands can partially justify their greater bargaining power, at least a 7% gap is left unexplained and can be traced to gender effects. Our subsequent analysis speaks to the sources of this gender effect.

The rest of Table 10 reports the explanatory power of each variable alone.[25] Income and employment appear to be the main contributors to the cross-sectional variations in the distribution of bargaining power. In our sample, wives are less likely to have a job and earn substantially less than their husbands, resulting in them having less say in financial matters. These differences could also be gendered: for example, a traditional family structure would involve the husband as the "breadwinner" and the wife as the "homemaker"; even when both work, the husband tends to earn more than the wife on average (Bertrand et al. 2015). We show that the gender inequality in labor market status can in turn lead to a gender gap in bargaining power, thereby constraining women's say in financial decisions.

On the other hand, wives have higher cognitive ability, and their personality traits, especially their higher level of extraversion, offer them a chance to bargain. However, the economic magnitude is generally small and dominated by the effects of employment and earnings. Overall, the net effect of observed characteristics leans toward husbands, resulting in more bargaining power for husbands in financial matters.

4.4 Bargaining power across household head types

Figure 5a plots, for each household type in any given wave, the average bargaining power a husband has. Because of the monotonic trend of average bargaining power across different household

[25]Because of the potential significant covariance between variables, the sum of all individual effect would not be equal to the total effect.

types, we omit husband-shared and wife-shared without losing too much information.[26] Consistent with the patterns revealed by the coefficients, a husband's bargaining power increases substantially from wife-headed to jointly headed to husband-headed households. The magnitude is large: in an average husband-headed household, the husband's bargaining power is around 89%; in an average wife-headed household, the husband's bargaining power ranges from 28% to 44%, depending on the year. Figures 5b and 5c further decompose bargaining power into two sources: gender effects and observable differences between spouses. While both can explain some heterogeneity in bargaining power across household types, gender effects seem to play the major role.

The patterns plotted in Figure 5 have two main implications. First, they directly compare our portfolio-choice approach to a survey-based approach. The latter approach makes the implicit assumption that the financial head is the *de facto* decision-maker of the household endowed with full or disproportionally high bargaining power (e.g., Friedberg and Webb 2006; Johnston et al. 2016). Qualitatively, our findings are consistent with this treatment: a husband's average bargaining power monotonically increases from wife-headed households to jointly headed households to husband-headed households. In addition, bargaining power in jointly headed households is close to an even distribution among the two spouses. Quantitatively, however, in both wife-headed and husband-headed households, financial heads incorporate—at least partially—the risk preferences of their spouses. Second, the decomposition further suggests that both observable differences and gender effects are important determinants of bargaining power in households. For a husband-headed household, the husband's greater bargaining power may arise because of his better economic status, but it could also arise because of the household having more traditional gender norms. Without separately quantifying each channel, differentiating between these two effects would be difficult to achieve.

[26] In particular, the average bargaining weight for the husband-shared group is between the husband-headed group and the jointly headed group, while the average bargaining weight for the wife-shared group is between the wife-headed group and the jointly headed group.

5 Discussion

5.1 Sources of the gender effect

We investigate the possible mechanism underlying the gender effect. The literature has documented the tight connection between household financial decision-making and gender norms (Ke 2020; Zaccaria and Guiso 2020). Therefore, we analyze participant responses to the questions about gender norms in the HILDA Survey and study the connection between the gender effect and views on gender norms. As detailed in Appendix A.5, the HILDA Survey includes three specific questions about attitudes toward gender norms that were separately posed to both husbands and wives. The three questions are intended to elicit participants' attitudes about the division of labor, the share of housework in the family, and the mother's role. Answers to each question are measured on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree).[27] We recode all variables so that a higher value represents a more traditional view of gender norms. We perform a simple OLS regression by regressing simulated bargaining weights of husbands (β_t^h) on these three questions about gender norms for both husbands and wives. Table 11 reports the results. In general, both husbands' and wives' attitudes toward gender norms matter and work toward the same direction. We find that households with progressive views of gender norms are more likely to select the wife as the household head, empowering women with more say in financial decisions. Among three gender norm questions, husbands' and wives' attitudes toward "division of labor" are similarly important. In contrast, the "share housework" question from the husband is the single most informative question when predicting bargaining weights, while the same question from the wife has quite limited impact.

The study most closely related to ours is that of Zaccaria and Guiso (2020). Our exercise advances their approach along two aspects. First, rather than using female headship to proxy for gender norms, we employ survey questions to directly elicit gender norms. Second, while Zaccaria and Guiso (2020) conduct their analysis based on the variation across regions and cohorts, our identification builds on the variation across households. As a result, we control for other potential confounding variables (e.g., individual economic characteristics) when studying the connection

[27] These three questions are widely used in surveys to elicit participants' attitudes on gender norms and stereotypes, for example, in the World Values Survey.

between gender effect and gender norms.

5.2 Division of labor

We have shown that, when making financial decisions, husbands have disproportionally high bargaining power compared with their wives. The results of our previous exercise showed that this gender asymmetry could be linked to traditional gender norms, a finding consistent with previous findings that financial matters are typically perceived as being within men's domain (Barber and Odean 2001). However, it also could be the division of tasks between genders, in line with Becker's theory. (See Pollak 2011; Chiappori and Lewbel 2015 for recent reviews.) In particular, perhaps men specialize in tasks perceived to be more "masculine" (such as decisions on financial matters), whereas women specialize in tasks perceived to be "feminine" (such as daily shopping decisions). In other words, wives' less bargaining power in financial matters may be compensated by them having more bargaining power elsewhere.

To test this hypothesis, we utilize another feature of the HILDA Survey. Besides questions about the financial head of the household, the survey also asks about household decision-making across six other domains: (1) managing day-to-day spending and paying bills; (2) making large household purchases (e.g., cars and major appliances); (3) the number of hours spent in paid work; (4) the number of hours partner/spouse spent in paid work; (5) the way children are raised; and (6) social life and leisure activities. Table 12 shows the correlation between the responses to the "savings, investment and borrowing" domain and the responses to all other domains. The "savings, investment and borrowing" domain is strongly positively correlated with the former two domains of "spending and bills" and "large household purchases," indicating no division of labor between these financial-related domains. On the contrary, the correlation between the "savings, investment and borrowing" domain and the latter four domains is rather weak, indicating the household investment decisions are orthogonal to other household decisions on labor supply, child-rearing, and time allocation. Therefore, we find evidence against the hypothesis that a division of labor exists and justifies wives having less say in financial matters.

6 Evidence from Germany

6.1 GSOEP Survey

In this section, we conduct a similar exercise using the German Socio-Economic Panel (GSOEP) survey. It is a longitudinal survey that has been conducted annually since 1984. The sample conforms to the distribution of the main socioeconomic characteristics in the German population, making the sample nationally representative. To make the two exercises comparable to each other, we select households from years 2002, 2007 and 2012, all of which collect information about demographics and asset allocation.[28] We then merge the measure of risk aversion from years 2004, 2009 and 2014.We use the average values across waves for both personality traits and cognitive ability by implicitly assuming both measures are persistent at the individual level. We did a sample filter process closely following the description in Appendix A.1. The final sample has 6,342 household-wave observations, representing 3,812 unique households.

Although GSOEP is similar to HILDA, there are a few significant limitations worth noting. First of all, the question on stock market participation only provides a dummy response, and the GSOPE survey does not provide the amount of equity investment. Therefore, we do not have any information about the fraction of risk assets in household portfolio and have to rely on the extensive margin for estimation.[29] Second, the question designed to measure risk preference has a different metric. In the GSOPE survey, individuals reports their willingness to take risks in financial matters using an eleven-point scale, with zero indicating complete unwillingness to take risks and ten indicating complete willingness to take risks.[30] Third, GEOSP does not ask the question who is the final decision maker within household, and we degenerate the gender effect to be an intecept term for each wave in our model.

[28]While demographic information is collected every year, asset information is collected every five years. Following Gröbel and Ihle (2018), the total household wealth has eight components: owner-occupied property, other properties (both including debts), financial assets, building loan contracts, private insurances, business assets, tangible assets, and consumer debts. Stock market participation is constructed as a dummy variable based on the following question: "Did you or another member of the household own any of the other securities (e.g., stocks, funds, bonds) last year?"

[29]The likelihood function in this case does not have the component of P_a because the exact amount of asset holding is not reported in GSOEP.

[30]There are also similar risk altitude questions in other contexts including car driving, financial matters, leisure and sports, career, and health. For the purpose of our analysis we only use the question regarding financial matters.

6.2 Results

We perform a maximum likelihood estimation using a likelihood function similar to equation (9). We report our estimated parameters and goodness of model fit in the Appendix E. We then use the estimated model to quantify the distribution of bargaining power between husband and wife by conducting a simulation exercise similar to the exercise performed in subsection 4.3.

Table 13 reports the results and highlights several findings. First, we find a greater gender gap in bargaining power in Germany than that in Australia. For an average household, the husband's bargaining weight is 0.59 in Australia but 0.68 in Germany. Our decomposition exercise further shows that the greater gender gap in Germany is due to more pronounced gender effects, rather than observable gender differences, among German households. Indeed, between the two countries, gender differences in observable characteristics such as wage and employment status can generate a gender gap of around 0.1. The more pronounced gender effects in Germany is also consistent with Germany's attitude towards traditional gender roles. According to the gender-role questions from World Values Survey, reported in Table 14, German households hold a more traditional attitude towards gender roles than Australian households.

7 Conclusion

In this paper, we develop a household portfolio choice model allowing for a dissection of the intrahousehold bargaining process. The model recognizes the fact that each spouse in a couple may have a different amount of influence over the household's financial decisions and aims to uncover how this process works. We structurally estimate the model using the HILDA Survey and the GSOEP Survey with a new approach, which deviates from existing approaches that primarily rely on survey-based proxies of bargaining power.

We find that the average Australia household incorporates 59% of the husband's preference but only 41% of the wife's, implying an 18% gap in bargaining power. Part of this gender gap is driven by observable characteristics, such as income and employment, but most of it can be traced back to a gender effect. Cross-sectionally, the gender effect is stronger in husband-headed households and weaker in households with more progressive views of gender norms. In Germany, we find a greater gender gap in bargaining power than that in Australia, which is consistent with the attitude towards gender roles of these two countries.

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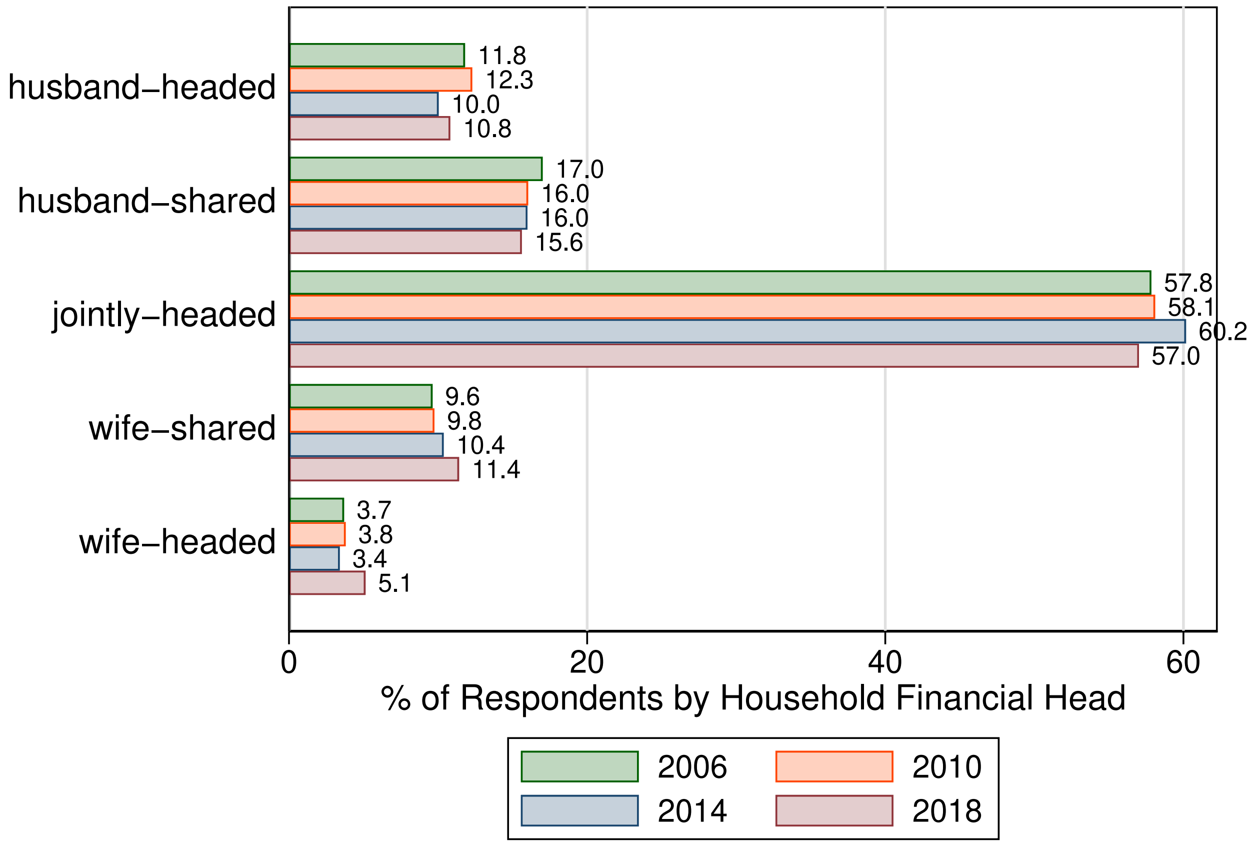
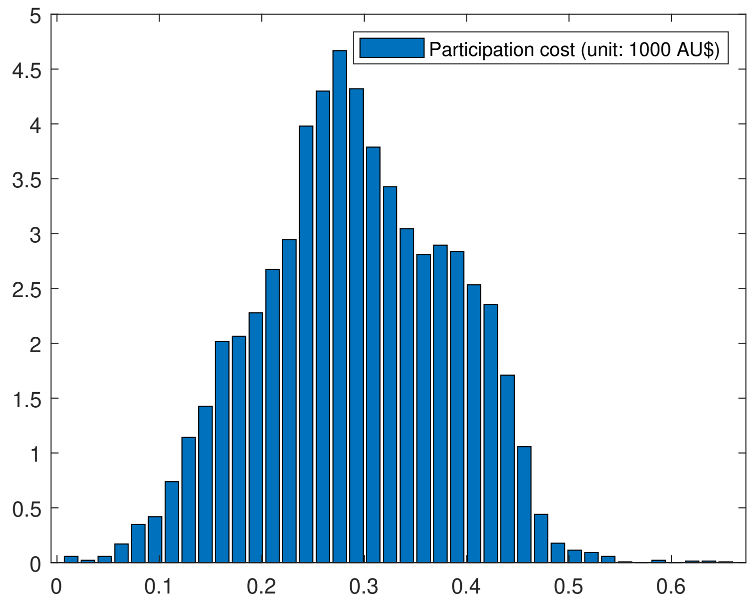
Figure 1: Distribution of the financial head of the household by years



Note: This figure shows the distribution of five household types by four different years (2006, 2010, 2014, 2018). The five types of households are "husband-headed," in which both spouses report the husband makes financial decisions; "jointly headed," in which both husband and wife report that financial decisions are shared equally between the spouses; "wife-headed," in which both spouses report the wife makes financial decisions; "husband-shared," in which one spouse reports "husband" and the other reports "shared equally"; and "wife-shared," in which one spouse reports "wife" and the other reports "shared equally."

Figure 2: Distribution of participation cost (unit: 1000 AU$)

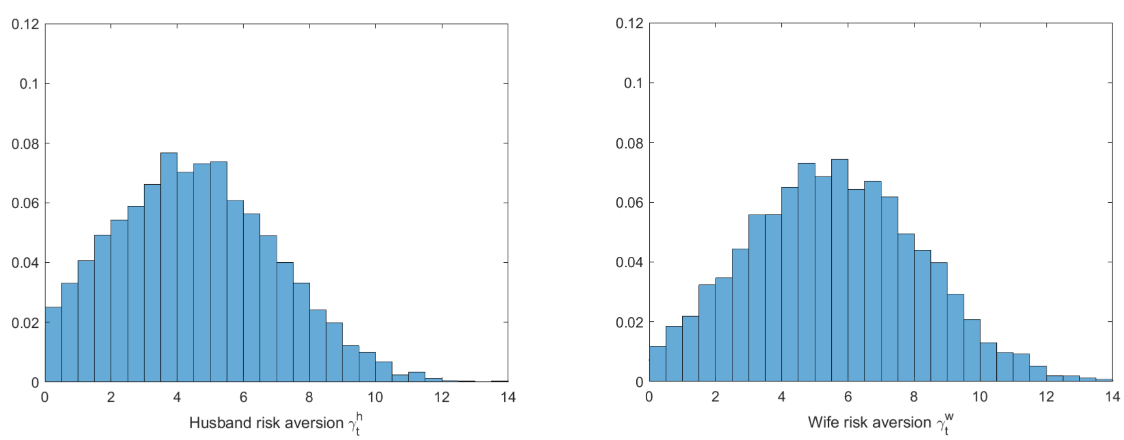


Note: The figure shows the histogram of participation costs for each household. The x-axis represents the participation costs (unit: AU$1000). The y-axis represents density. The participation costs are defined in equation (3).

Figure 3: Distribution of risk aversion

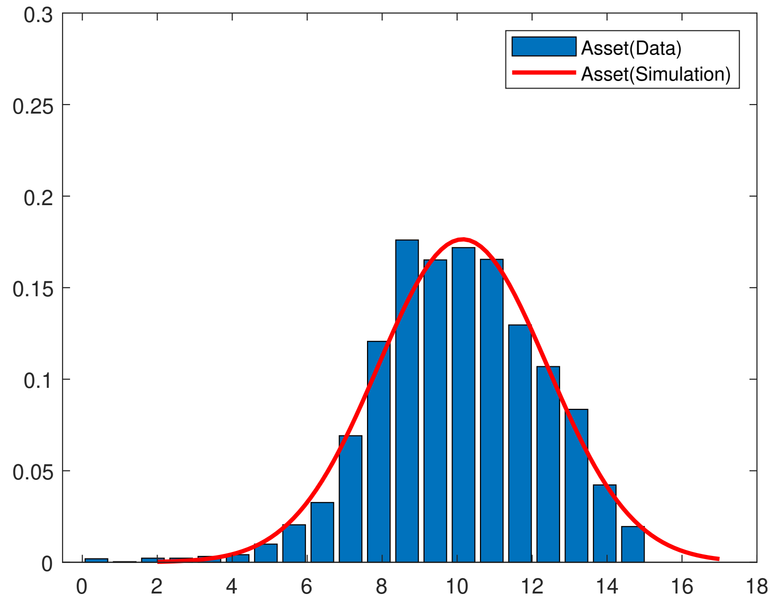
(a) Husband risk aversion, γ_t^h

(b) Wife risk aversion, γ_t^w



Note: This figure plots the distribution of the estimated risk aversion for both husbands (left panel) and wives (right panel) as a histogram. The x-axis represents the value of risk aversion. It is nonnegative. A larger value means the individual is more risk averse. The y-axis represents density.

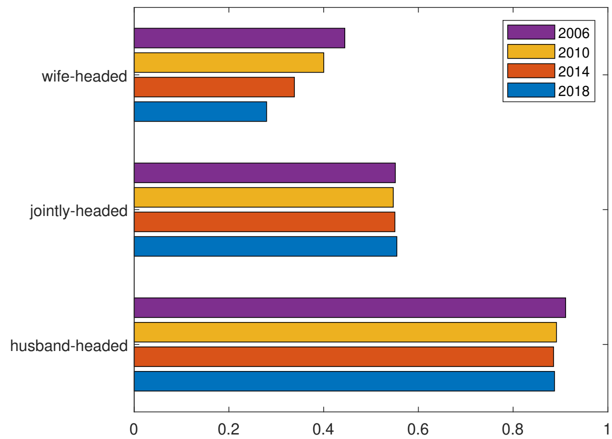
Figure 4: Distribution of the risky asset, $\log(a)$



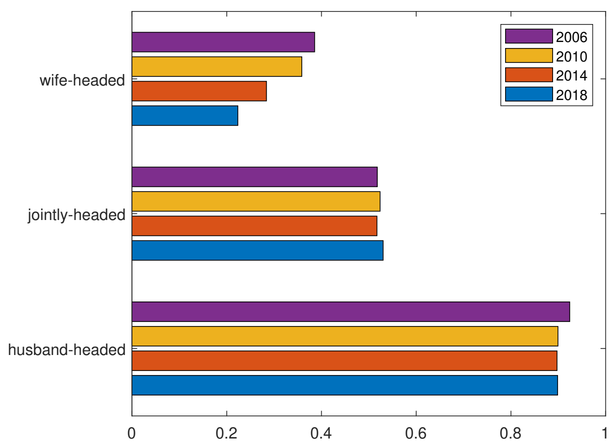
Note: This figure plots the distribution implied by the model (in red line) against the empirical distribution (in blue histogram). The x-axis represents the log value of the risky asset. The y-axis represents density. The asset value is top-coded in the HILDA Survey data by substituting the average value for all cases equal to or exceeding a given threshold. This approach explains the abnormally high value at the right end of the histogram distribution.

Figure 5: Husband's bargaining power, by financial head structure

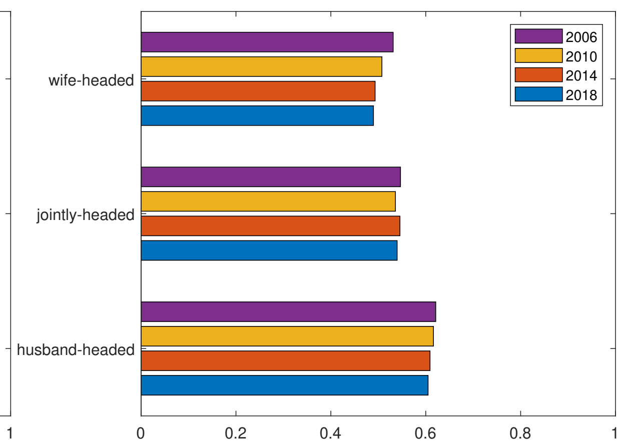
(a) Both gender effects and observed characteristics



(b) Gender effects only



(c) Observed characteristics only



Note: The figure plots the average bargaining power a husband has across household head types. "Husband-headed" represents the group in which both spouses report the husband makes financial decisions; "jointly headed" represents the group in which both husband and wife report that financial decisions are "shared equally" between spouses; and "wife-headed" represents the group in which both spouses report the wife makes financial decisions. Figure 5a plots, for each household type in any given wave, the average bargaining power a husband has in the baseline model. Figure 5b reports the simulated average husband bargaining weight when we retain gender effects and Figure 5c reports the simulated average husband bargaining weight when we retain the heterogeneity from the observed characteristics.

Table 1: Variable availability in each wave of the HILDA Survey

Variables	Wave number			
Asset allocation information	6	10	14	18
Demographics	6	10	14	18
Financial head of the household	6	10	14	18
Personality traits	5	9	13	17
Risk aversion	6	10	14	18
Cognitive ability	12, 16	12, 16	12, 16	12, 16

Note: This table reports the wave numbers for each set of variables we use in the empirical analysis. Our main sample is constructed based on four waves: 6, 10, 14, and 18. Each row reports the waves that the particular variable is collected from. For cognitive ability, we use the average value from waves 12 and 16.

Table 2: Summary statistics

	Mean	SD	P25	P50	P75	Husband	Wife	Diff
Household characteristics								
Stock participation	0.48	0.50	0	0	1			
Household earnings (AU$1,000)	120	107	53	105	160			
Total wealth (AU$1,000)	1,423	1,562	565	979	1,704			
Financial asset (AU$1,000)	504	804	100	243	572			
Equity (AU$1,000)	74	299	0	0	20			
Number of children	0.84	1.10	0	0	2			
Individual characteristics								
Age	49.38	15.02	37	49	61	50.57	48.20	2.36***
Education	13.04	2.55	12	12	15	13.09	12.99	0.10**
Employment	0.64	0.48	0	1	1	0.69	0.60	0.08***
Earnings (AU$1,000)	48	59	0	37	74	62	33	29***
Risk aversion	3.30	0.67	3	3	4	3.18	3.42	-0.24***
Cognitive ability	0.10	0.67	-0.33	0.12	0.58	0.05	0.16	-0.11***
Extraversion	4.42	1.09	3.67	4.50	5.17	4.29	4.55	-0.26***
Agreeableness	5.43	0.86	5.00	5.50	6.00	5.19	5.66	-0.47***
Conscientiousness	5.27	0.97	4.67	5.33	6.00	5.17	5.36	-0.19***
Stability	5.28	1.03	4.50	5.33	6.00	5.27	5.28	-0.02
Openness	4.21	1.00	3.50	4.17	4.83	4.27	4.15	0.12***

Note: This table reports summary statistics of our main sample. Stock participation is a dummy variable that indicates whether a household directly holds any equities. Both age and education are measured in years. Employment is a dummy variable indicating whether or not an individual is currently employed. Risk aversion is measured using an integer from 1 to 4 with a higher number indicating more risk aversion. Cognitive ability is measured by the average of the standardized scores of three tests (see Section A.2 of the Online Appendix for more details). Extraversion, Agreeableness, Conscientiousness, Stability, and Openness are based on 36 personality questions, the values of which range from 1 to 7 (see Section A.3 of the Online Appendix for more details). US$1 $\approx$ AU$1.2. Levels of significance are denoted as follows: * if $p < 0.10$; ** if $p < 0.05$; *** if $p < 0.01$.

Table 3: Percentage of households by the risk preference of each spouse

		Wife				
		1	2	3	4	Total
Husband	1	0.1	0.4	0.8	0.7	2.0
	2	0.2	1.8	6.4	3.0	11.4
	3	0.3	2.1	30.6	20.5	53.5
	4	0.2	0.5	8.3	24.1	33.1
	Total	0.8	4.9	46.1	48.2	100.0

Note: This table shows the distribution of husband-wife-paired risk aversions. Risk aversion is measured using an integer from 1 to 4, where a higher number indicates a higher level of risk aversion. Each cell reports the fraction of households with a given pair of risk preferences. The off-diagonal terms represent the cases in which the husband and the wife have different risk preferences.

Table 4: OLS regression of the stock market participation rate on risk preferences

	Couples		Singles	
	(1)	(2)	(3)	(4)
Risk aversion	-0.109***	-0.078***	-0.132***	-0.102***
	(0.008)	(0.008)	(0.014)	(0.013)
Risk aversion (wife)	-0.129***	-0.092***		
	(0.009)	(0.009)		
Age/10		-0.078*		-0.029
		(0.045)		(0.024)
Age/10, squared		0.008**		0.007**
		(0.004)		(0.003)
Age/10 (wife)		0.024		
		(0.045)		
Age/10 (wife), squared		0.003		
		(0.004)		
Education		0.006***		0.014***
		(0.002)		(0.003)
Education (wife)		-0.000		
		(0.002)		
No. children in HH		-0.002		-0.012
		(0.005)		(0.008)
Log HH earning		0.043***		0.029***
		(0.007)		(0.009)
Log HH earning, squared		-0.001**		-0.002**
		(0.001)		(0.001)
Log net wealth		-0.077***		-0.126***
		(0.029)		(0.014)
Log net wealth, squared		0.007***		0.009***
		(0.001)		(0.001)
2010		-0.061***		-0.029
		(0.016)		(0.022)
2014		-0.156***		-0.060***
		(0.015)		(0.020)
2018		-0.196***		-0.079***
		(0.015)		(0.020)
Female			0.037	-0.124*
			(0.084)	(0.073)
Female_RiskAversion			-0.022	0.028
			(0.023)	(0.020)
Constant	1.269***	0.535***	0.726***	0.617***
	(0.033)	(0.190)	(0.050)	(0.093)
Observations	8601	8601	3213	3213
R^2	0.066	0.203	0.061	0.252

Note: This table analyzes the impact of risk aversion on stock market participation. This regression excludes households with zero net wealth, and, thus, the observations drops from 8,708 to 8,601. The dependent variable is a dummy equal to one if the household directly holds any equities. Risk aversion is measured using an integer from 1 to 4 with a higher number indicating more risk aversion. No. Children of HH is the number of children in the household. Column (1) and (2) concern the regressions on married couple households. Columns (3) and (4) repeat the analysis for single households. In these two columns, Female is a dummy equal to one if the individual is a female. Female_RiskAversion is an interaction term between Female and measures of risk aversion. Robust standard errors are in parentheses. Levels of significance are denoted as follows: * if $p < 0.10$; ** if $p < 0.05$; *** if $p < 0.01$.

Table 5: Household characteristics by financial head

	Husband-headed				Jointly headed				Wife-headed			
	All	Husband	Wife	Diff.	All	Husband	Wife	Diff.	All	Husband	Wife	Diff.
Individual characteristics												
Age	50.12	51.42	48.81	2.60***	49.94	51.10	48.79	2.31***	48.28	49.59	46.97	2.63*
Education	13.66	14.04	13.29	0.75***	12.89	12.92	12.86	0.06	12.75	12.30	13.21	-0.91***
Employment	0.58	0.68	0.49	0.19***	0.64	0.68	0.61	0.07***	0.63	0.65	0.61	0.03
Earnings (AU$1,000)	53	82	25	57***	45	58	33	25***	44	47	42	5
Risk aversion	3.09	2.84	3.35	-0.52***	3.34	3.25	3.44	-0.19***	3.35	3.37	3.32	0.05
Cognitive ability	0.20	0.26	0.14	0.12***	0.06	-0.01	0.13	-0.15***	0.13	-0.05	0.30	-0.35***
Extraversion	4.30	4.16	4.45	-0.29***	4.43	4.33	4.53	-0.20***	4.50	4.37	4.62	-0.25**
Agreeableness	5.36	5.04	5.69	-0.65***	5.46	5.24	5.68	-0.44***	5.35	5.12	5.57	-0.44***
Conscientious.	5.26	5.32	5.20	0.12**	5.30	5.19	5.41	-0.22***	5.10	4.77	5.42	-0.65***
Stability	5.18	5.25	5.11	0.14**	5.33	5.31	5.34	-0.03	5.18	5.10	5.27	-0.17*
Openness	4.28	4.39	4.18	0.21***	4.18	4.24	4.13	0.11***	4.27	4.24	4.30	-0.06
Household characteristics												
Stock participation	0.64				0.45				0.42			
HH earnings (AU$1,000)	145				110				110			
Total wealth (AU$1,000)	2,144				1,284				1,300			
Financial asset (AU$1,000)	883				442				426			
Equity (AU$1,000)	204				46				101			
No. children in HH	0.97				0.79				0.89			

Note: This table reports household characteristics by the three types of financial heads of the household. The financial head of the household is measured based on the answers to the question of who makes the decisions about the savings, investment and borrowing in the household. The three types of households shown here are "husband-headed," in which both spouses report the husband makes financial decisions; "jointly headed," in which both husband and wife report that financial decisions are shared equally between spouses; and "wife-headed," in which both spouses report the wife makes financial decisions. US$1 $\approx$ AU$1.2. Levels of significance are denoted as follows: * if $p < 0.10$; ** if $p < 0.05$; *** if $p < 0.01$.

Table 6: Model estimates for determinants of bargaining power in the bargaining equation

Characteristic	Value	SE	$\Delta\beta/\Delta char$
	(1)	(2)	(3)
$Age/10$	0.263	0.126	0.33%
Education	0.416	0.076	3.05%
Employment	0.452	0.073	6.49%
Earning	0.080	0.009	11.64%
Cognitive ability	0.160	0.020	6.06%
Extraversion	-0.155	0.016	-8.88%
Agreeableness	-0.120	0.015	-6.26%
Conscientiousness	0.053	0.010	2.80%
Stability	-0.049	0.010	-2.35%
Openness	0.046	0.010	2.22%

Note: This table reports the estimation results for the bargaining equation. Each characteristic is defined as the value difference between paired husbands and wives. Column 1 reports the coefficients; Column 2 reports the standard errors; and Column 3 displays the deviation from the baseline bargaining weights for a one-standard-deviation increase in each observed characteristic.

Table 7: Model estimates for gender effects in the bargaining equation

	Period t			
	2006	2010	2014	2018
husband-headed	2.500	2.189	2.167	2.181
	(0.057)	(0.009)	(0.033)	(0.060)
husband-shared	0.803	0.508	0.517	0.610
	(0.059)	(0.048)	(0.024)	(0.000)
jointly headed	0.071	0.095	0.069	0.121
	(0.026)	(0.552)	(2.646)	(3.540)
wife-shared	-0.035	-0.174	-0.665	-0.630
	(1.789)	(2.742)	(0.380)	(0.229)
wife-headed	-0.466	-0.582	-0.925	-1.246
	(0.202)	(0.617)	(0.841)	(0.869)

Note: This table reports the estimates for gender effects in the bargaining equation. Each coefficient represents one of the five household types based on the identity of the financial head in each of the four waves (2006, 2010, 2014, 2018) . The financial head of the household is measured based on the answers to the question regarding who makes the decisions about the savings, investment and borrowing in the household. The five types of households are "husband-headed," in which both spouses report the husband makes such decisions; "jointly headed," in which both husband and wife report that such decisions shared equally between spouses; "wife-headed," in which both spouses report the wife makes such decisions; "husband-shared," in which one spouse reports "husband" and the other reports "shared equally"; "wife-shared," in which one spouse reports "wife" and the other reports "shared equally."

Table 8: Model estimates for the rest of the parameters

Parameter	Value	SE	Parameter	Value	SE
Participation cost (AU$100)			*Risk measure equation*		
c_0(Intercept)	4.761	0.109	σ_ξ	2.623	0.057
c_1(log HH earning)	-0.020	0.003	ρ_ξ	-0.975	0.009
c_2(log HH earning, squared)	-1.069	0.055	ζ_0	0.735	0.033
c_3(log net wealth)	0.014	0.003	ζ_1^h	3.098	0.060
c_4(log net wealth, squared)	0.000	0.000	ζ_1^f	3.893	0.059
c_5(Age/10)	-0.017	0.002			
c_6(Age/10, squared)	0.000	0.000	*General parameters*		
c_7(Education)	0.023	0.004	σ_ε	0.641	0.048
c_8(Cognition)	-0.196	0.023	σ_a	2.111	0.024
c_9(No. children in HH)	0.153	0.020	r_p	0.060	-
c_{10}(2010)	0.387	0.062	σ_r	0.135	-
c_{11}(2014)	1.281	0.084			
c_{12}(2018)	14.953	0.869			

Note: This table reports estimates of the rest of the parameters. The left panel reports all the coefficients from the participation cost function. The upper-right panel reports the coefficients associated with the risk attitude measurement equation. The lower-right panel reports the other parameters: σ_ε is the standard deviation of the residual term in bargaining equation; σ_a is the standard deviation of the measurement error term for the log asset; and r_p and σ_r are the mean and variance of the risk premium. Values of r_p and σ_r are preset following Pojanavatee (2013).

Table 9: Marginal distributions of portfolio choices

	Stock market participation		Risky asset (log value)	
	Sim	Data	Sim	Data
By the financial head of the household				
Husband-headed	0.653	0.648	10.60	11.03
Husband-shared	0.533	0.540	10.19	10.24
Jointly headed	0.463	0.449	10.04	9.74
Wife-shared	0.431	0.424	10.02	9.53
Wife-headed	0.462	0.424	10.15	9.92
By husband's risk preference				
Risk-taking	0.569	0.560	10.28	10.24
Risk averse	0.336	0.325	9.71	9.17
By wife's risk preference				
Risk-taking	0.605	0.591	10.35	10.31
Risk averse	0.370	0.365	9.81	9.48

Note: This table compares the conditional moments from the model simulation with those from the real data. The first two columns concern stock market participation and the last two concern the level of the risk asset holdings. In the upper panel, we calculate metrics, including bargaining weights and financial decisions for each household, and we average them by the household head types. In the middle panel, we average the metrics by the husband's risk preference. "Risk-taking" includes the households in which husbands report their values of risk aversion to be between 1 to 3. "'Risk averse" includes the households in which husbands report their risk aversion to be 4. In the bottom panel, we average the metrics by the wife's risk preference. "Risk-taking" includes the households in which wives report their values of risk aversion to be between 1 to 3. "'Risk averse" includes the households in which wives report their risk aversion to be 4.

Table 10: Source of bargaining power heterogeneity

	Bargaining weight (β_t^H) Mean	SD	Stock participation	Risky asset (log values)
Equal weight ($\beta = 0.5$)	0.500	0.000	0.429	9.96
All heterogeneity	0.587	0.275	0.495	10.15
Gender effects (δ_{jt}^H)	0.561	0.147	0.448	10.02
All observed variables (δ_x)	0.552	0.174	0.455	10.00
Age	0.523	0.042	0.432	9.96
Education	0.515	0.358	0.526	10.43
Employment	0.541	0.256	0.491	10.64
Earning	0.550	0.218	0.469	10.09
Cognitive ability	0.481	0.130	0.440	9.98
Extraversion	0.467	0.193	0.445	10.01
Agreeableness	0.485	0.036	0.428	9.96
Conscientiousness	0.490	0.073	0.429	9.96
Stability	0.501	0.064	0.430	9.96
Openness	0.495	0.050	0.431	9.96

Note: This table quantifies the importance of various components of the model in explaining the distribution of bargaining power between husband and wife. Our method is as follows: we allow for one particular component each time in the bargaining equation and simulate the bargaining weight and financial decisions (stock market participation and the level of risk asset holdings) for each household. Columns 1 and 2 report the mean and standard deviation of the simulated bargaining weights. Columns 3 and 4 report the average stock market participation and average risky asset holdings. The first line presents the benchmark case, in which spouses have equal say about financial decisions with the bargaining power of $\beta = 0.5$ in our model. The next line presents the case in which we consider both gender effects and spousal differences in observable characteristics. The next two lines present the cases in which we consider only gender effects and only spousal differences in observable characteristics. The rest of the table reports the importance of each variable one by one.

Table 11: Gender norms and bargaining weights

	Bargaining weight of husbands with gender effect only	
	(1)	(2)
	Only gender norms	With other controls
Division of labor (husband)	0.001	0.004**
	(0.002)	(0.002)
Share housework (husband)	0.010***	0.006***
	(0.003)	(0.002)
Mother's role (husband)	-0.003	0.001
	(0.002)	(0.002)
Division of labor (wife)	0.010***	0.005***
	(0.002)	(0.002)
Share housework (wife)	-0.005*	-0.001
	(0.003)	(0.002)
Mother's role (wife)	0.006***	0.001
	(0.002)	(0.002)
Observations	7,741	7,741

Note: This table analyzes the impact of gender norms on bargaining weights. Attitudes about gender norms are measured by three questions that elicit participants' attitudes toward the division of labor, the share of housework in the family, and the mother's role. Answers to each question are measured on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). We recode all variables so that a higher value represents a more traditional view of gender norms (see Section A.5 of the Online Appendix for more details). The dependent variable is the simulated bargaining weight when we only allow the gender effect in the bargaining equation, which is the same as the one shown in Figure 5a. Column 1 is a simple OLS regression of this simulated bargaining weight of husbands on both husbands' and wives' gender norm questions. Column 2 has extra controls including age, income, employment, education, cognitive ability and personality traits. Robust standard errors are in parentheses. Levels of significance are denoted as follows: * if $p < 0.10$; ** if $p < 0.05$; *** if $p < 0.01$.

Table 12: Correlation between responses to household investment decisions and other household decisions

Domains	Correlation Savings, investment and borrowing
(1) Managing day-to-day spending and paying bills	0.53
(2) Making large household purchases	0.52
(3) The number of hours spent in paid work	0.23
(4) The number of hours partner/spouse spent in paid work	0.12
(5) The way children are raised	0.04
(6) Social life and leisure activities.	0.04

Note: This table investigates the correlation between household investment decisions and other household decisions. In addition to asking about household decision-making in "Savings, investment and borrowing," the HILDA Survey also asks about household decision-making along six other domains: (1) managing day-to-day spending and paying bills; (2) making large household purchases (e.g., cars and major appliances); (3) the number of hours spent in paid work; (4) the number of hours partner/spouse spent in paid work; (5) the way children are raised; (6) social life and leisure activities. Respondents are given the following options: themselves, their spouses, shared equally between spouses, or other people. In each domain, we classify all households into five types: "husband-headed," in which both spouses report the husband makes such decisions; "jointly headed," in which both husband and wife report that such decisions are "shared equally" between the spouses; "wife-headed," in which both spouses report the wife makes such decisions; "husband-shared," in which one spouse reports "husband" and the other reports "shared equally"; "wife-shared," in which one spouse reports "wife" and the other reports "shared equally."

Table 13: Comparison of bargaining power heterogeneity between Australia and Germany

	Australia		Germany	
	Bargaining weight (β_t^H)	Stock participation	Bargaining weight (β_t^H)	Stock participation
Equal weight ($\beta = 0.5$)	0.500	0.429	0.500	0.206
All heterogeneity	0.587	0.495	0.682	0.279
Gender effects (δ_{jt}^H)	0.561	0.448	0.731	0.216
All observed variables (δ_x)	0.552	0.455	0.549	0.238

Note: This table quantifies the distribution of bargaining power between husband and wife in both Australia and Germany. Our method is as follows: we allow for one particular component each time in the bargaining equation and simulate the bargaining weight and financial decisions (stock market participation and the level of risk asset holdings) for each household. Columns 1 and 2 report the average bargaining weights and stock market participation rate in Australia. Columns 3 and 4 report the average average bargaining weights and market participation rate in Germany. The first line presents the benchmark case, in which spouses have equal say about financial decisions with the bargaining power of $\beta = 0.5$ in our model. The next line presents the case in which we consider both gender effects and spousal differences in observable characteristics in our baseline full-fledged model. The next two lines present the cases in which we consider only gender effects and only spousal differences in observable characteristics.

Table 14: Comparison of gender role attitude between Australia and Germany

	Wave 6 (2010-2014)		wave 5 (2005-2009)	
	Australia	Germany	Australia	Germany
Men should have more right to a job than women				
Agree	6.9%	15.5%	13.7%	17.4%
Neither	19.0%	23.6%	21.2%	15.0%
Disagree	73.0%	60.2%	64.1%	65.1%
Problem if women have more income than husband				
Agree	9.1%	18.7%	-	-
Neither	22.4%	25.6%	-	-
Disagree	59.6%	54.0%	-	-
Obs	1,477	2,046	1421	2,064

Note: This table reports two survey questions in World Values Survey related to the gender role attitude. The Australia sample was collected in 2005 (wave 5) and 2012 (wave 6), while the Germany sample was collected in 2006 (wave 5) and 2013 (wave 6). While the question "Men should have more right to a job than women" was asked in both waves, the other question "problem if women have more income than husband" was only asked in wave 6. The total number does not add to 100 due to the occasional non-response cases.

A Additional details about the data

A.1 Sample construction

Across waves 6, 10, 14, and 18 in the raw sample of married couple households, we have 17,320 household-wave observations.[31] We follow the below steps and drop observations that do not meet certain criteria:

- We drop households with information missing on risk preference and education; doing so leaves us with a total of 15,277 observations.
- The HILDA Survey measures risk preference by asking individuals the amount of financial risk they are willing to take on with their spare cash. We exclude individuals who answer that they never have spare cash, because we are unclear about how to classify these individuals. This restriction leaves us with 12,406 observations.
- We keep households that make financial decisions between the couple; doing so reduces the number of observations to 11,401.
- We drop households in which both spouses claim to be the financial head of the household; doing so reduces the number of observations to 11,254.
- We restrict our sample to households for which we have information on the personality traits of both partners. This restriction leaves us with 10,071 observations.
- We further drop households with information on missing cognitive ability. Our final sample has 8,708 observations.

Table A.1 shows the summary statistics for the raw sample and for our baseline sample.

A.2 Cognitive ability

The survey conducted three tests to measure cognitive ability: (1) the “backward digits span” (BDS) test, (2) a 25-item version of the National Adult Reading Test (NART), and (3) the “symbol-

[31] At the beginning of the HILDA Survey, 7,682 households were surveyed in the first wave, and another 2,153 households were surveyed in 2011. Waves 6, 10, 14, and 18 have a total of 32,746 household-wave observations, of which 17,320 are married couples.

digit modalities” (SDM) test. The BDS test is a traditional subcomponent of intelligence tests and measures working memory span. The interviewer reads out a string of digits that the respondent has to repeat in reverse order. NART is a short version of the National Adult Reading Test that measures premorbid intelligence. Respondents have to read out loud and correctly pronounce 25 irregularly spelled words. The SDM test asks respondents to match symbols to numbers according to a printed key. The test was originally developed to detect cerebral dysfunction but is now a recognized test for divided attention, visual scanning, and motor speed. To derive a summary measure for cognitive ability, we first construct a one-dimensional measure for each of these three tests. Then we standardize these three one-dimensional measures. Finally, we take the mean to construct a single measure of cognitive ability.

A.3 Personality traits

Personality trait measures aim to capture “patterns of thought, feelings and behavior” that correspond to “individual differences in how people actually think, feel and act” (Borghans et al., 2008). The personality trait measurements in this paper are based on the Five-Factor (“Big Five”) Personality Inventory, which classifies personality traits along five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability. “Big Five” information in the HILDA Survey is constructed by using responses to 36 personality questions. Participants were asked how well each personality adjective describes them, and their answers are measured on a seven-point Likert scale. The lowest number, 1, denotes a totally opposite description, and the highest number, 7, denotes a perfect description. According to Losoncz (2009), only 28 of 36 items load well into their corresponding components when performing factor analysis. The other eight items are discarded because of either their low loading values or their ambiguity in defining several traits.[32] Our construction of the “Big Five” follows the procedure provided by Losoncz (2009).

[32] To check each item’s loading performance, one can calculate the loading value after doing an oblimin rotation. The loading values of eight abandoned items were either lower than 0.45 or did not load more than 1.25 times higher on the expected factor than any other factor.

A.4 Transition rates of financial heads of the household between waves

Table A.2 presents a transition matrix for the financial heads of the household between waves. Jointly headed households are the most stable households between waves. More than 80% of jointly headed households report the same choice in the following wave compared to about 70% for husband-headed households, about 50% for wife-headed households, and about 40% for husband-shared and wife-shared households.

A.5 Attitudes about gender norms

The survey measures attitudes about gender norms against the following three statements: (1) It is better for everyone involved if the man earns the money and the woman takes care of the home and children (division of labor). (2) If both partners in a couple work, they should share equally in the housework and care of children (share housework). (3) Whatever career a woman may have, her most important role in life is still that of being a mother (mother's role). Answers to each question are measured on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). We recode all variables so that a higher value represents a more traditional view of gender norms. Table A.3 shows changes in measures of gender norms between waves. Husbands have stronger attitudes about traditional gender roles in the division of labor and the share housework, while wives have stronger attitudes about the mother's role. In general, attitudes toward gender norms trend toward becoming less traditional across most of these measures.

We run a simple linear probability model of the financial heads of the household on these three gender norms measures. Table A.4 reports the estimates. We find that both husbands' and wives' attitudes about gender norms matter for financial heads of the household. Households with more traditional attitudes toward gender norms are more likely to select the husband as the financial head, while households with more progressive attitudes about gender norms are more likely to be select the wife as the financial head. Among three gender norms measures, the "division of labor" question from the wife and the "share housework" question from the husband are the most informative questions when predicting husband-headed households, while the "share housework" question from the wife is the single most informative question when predicting wife-headed households.

B CARA and mean-variance utility

Assuming a household has constant absolute risk aversion (CARA) utility with the risk aversion parameter, γ_i, the portfolio choice is

$$V_i = \max_a EU_i(a) = \max_a E\left\{-\exp\left\{-\gamma_i\left[w\left(1+r_f\right)+(a\tilde{x}-C_i)I(a>0)\right]\right\}\right\},$$

where a is the amount of asset the household chooses to invest into the stock market, and $I(a>0)$ is dummy variable indicating whether the household invests in the risky asset. Assume the risky return follows a normal distribution, $\tilde{x} \sim N(r_x, \sigma_x^2)$, then the utility is lognormally distributed when the stock asset $a>0$. Therefore, the portfolio choice problem is equivalent to

$$\begin{aligned}
&\min_a \log E\left\{\exp\left\{-\gamma_i\left[w\left(1+r_f\right)+(a\tilde{x}-C_i)I(a>0)\right]\right\}\right\} \\
&= \min_a\left\{-\gamma_i\left[w\left(1+r_f\right)+\left(ar_x-C_i-\tfrac{1}{2}\gamma_i a^2\sigma_x^2\right)I(a>0)\right]\right\}.
\end{aligned}$$

Then, we can rewrite the portfolio allocation problem using mean-variance utility as

$$U_i(a) = \max_a w(1+r_f)+\left(ar_f-C_i-\frac{1}{2}\gamma_i a^2\sigma_x^2\right)I(a>0).$$

Next, we want to prove that the utility function has a collective bargaining expression:

$$V_i = \beta^h V^h + \beta^w V^w, \beta^h + \beta^w = 1.$$

If the utility function of each spouse, $j \in \{h, w\}$, is also mean-variance,

$$U^j(a_j) = \max_{a_j} w_j(1+r_f)+\left(a_j r_f - C_j - \frac{1}{2}\gamma^j a_j^2\sigma_x^2\right)I(a_j>0), j \in \{h, w\},$$

where

$$\begin{aligned}
&C_h\gamma^h = C_w\gamma^w \\
&\tfrac{1}{\gamma_i} = \tfrac{\beta^h}{\gamma^h}+\tfrac{\beta^w}{\gamma^w}.
\end{aligned} \tag{11}$$

We solve the optimization problem for each household member j and get the indirect utility function V^j as

$$V^j = \begin{cases} w_j\left(1+r_f\right) & \gamma^j > \frac{r_x^2}{2\sigma_x^2 C_j} \\ w_j\left(1+r_f\right) + \frac{r_x^2}{2\gamma^j\sigma_x^2} - c_j & \gamma^j \leq \frac{r_x^2}{2\sigma_x^2 C_j}. \end{cases}$$

Given condition $C_h\gamma^h = C_w\gamma^w$, the individual investment decisions of both spouses are the same. If we further assume the household's participation cost is the weighted average of the household members' participation cost,

$$C_i = \beta^h C_h + \beta^w C_w,$$

then the cutoff value of the household's investment decision would be the same as the cutoff values of both individuals' investment decisions,

$$\gamma_i C_i = \gamma^h C_h = \gamma^w C_w,$$

and the indirect utility of the household also can be expressed as the weighted average of the indirect utility of both individuals,

$$V_i = \beta^h V^h + \beta^w V^w.$$

C More details about identification

Let us begin by considering the identification of (C,γ) from the group of households who are homogeneous in their characteristics Ω. It is worthwhile to point out that even the household with exactly the same characteristic may have different portfolio decisions due to the random components in γ. Therefore, the value of γ we identify in this step is the average value within the particular group of household. Following the decision rule specified in equation 2, γ is identified from the average risky asset holding, while C is identified from the fraction of households choosing to participate into the stock market. To ensure that parameters (C,γ) are point estimates, we need to impose one additional common support assumption: the fraction of households with positive stock market participation should be bounded away from zero and one.[33]

$$0 < \Pr(a > 0|\Omega) < 1$$

While this condition seems strong, we only need this assumption to be valid for two groups of households in order to identify the parameters in the bargaining equation and the participation cost equation.

We now consider the identification for coefficients in risk preference measurement equation $\zeta = \{\zeta_0, \zeta_1^h, \zeta_1^w\}$ by comparing households with different risk preference values $\{\bar{\gamma}^h, \bar{\gamma}^w\}$ but same values for other observed characteristics $\{X^h, X^w, H\}$. In particular, taking the first order derivative of $1/\gamma$ with respect to the measured risk preference $1/\bar{\gamma}^h$, we have

$$\frac{d\,(1/\gamma)}{d\left(1/\bar{\gamma}^h\right)} = \beta^h \exp\left(-\left(\zeta_0 + \zeta_1^h \log \bar{\gamma}^h + \xi^h\right)\right) \zeta_1^h \bar{\gamma}^h \tag{12}$$

$$\frac{d\,(1/\gamma)}{d\,(1/\bar{\gamma}^w)} = \beta^w \exp\left(-\left(\zeta_0 + \zeta_1^w \log \bar{\gamma}^w + \xi^w\right)\right) \zeta_1^w \bar{\gamma}^w \tag{13}$$

when we consider two groups of households i and j with same $\{X^h, X^w, H\}$ but different $\{\bar{\gamma}^h, \bar{\gamma}^w\}$, we have

$$\frac{d(1/\gamma_i)}{d\left(1/\bar{\gamma}_i^h\right)} = \beta_i^h \exp\left(-\left(\zeta_0 + \zeta_1^h \log \bar{\gamma}_i^h + \xi_i^h\right)\right) \zeta_1^h \bar{\gamma}_i^h$$
$$\frac{d\left(1/\gamma_j\right)}{d\left(1/\bar{\gamma}_j^h\right)} = \beta_j^h \exp\left(-\left(\zeta_0 + \zeta_1^h \log \bar{\gamma}_j^h + \xi_j^h\right)\right) \zeta_1^h \bar{\gamma}_j^h$$

in which $\beta_i^h = \beta_j^h$ as they are determined by the same set of $\{X^h, X^w, H\}$. Therefore, we can identify ζ_1^h by comparing the difference in $\log \frac{d(1/\gamma_i)}{d\left(1/\bar{\gamma}_i^h\right)}$ and $\log \frac{d\left(1/\gamma_j\right)}{d\left(1/\bar{\gamma}_j^h\right)}$

$$\log \frac{d\,(1/\gamma_i)}{d\left(1/\bar{\gamma}_i^h\right)} - \log \frac{d\left(1/\gamma_j\right)}{d\left(1/\bar{\gamma}_j^h\right)} = \left(1 - \zeta_1^h\right) \log\left(\frac{\bar{\gamma}_i^h}{\bar{\gamma}_j^h}\right) - \left(\xi_i^h - \xi_j^h\right)$$

Similarly, we could identify ζ_1^w by comparing the difference in $\log \frac{d(1/\gamma_i)}{d\left(1/\bar{\gamma}_i^w\right)}$ and $\log \frac{d\left(1/\gamma_j\right)}{d\left(1/\bar{\gamma}_j^w\right)}$. Lastly, the identification of ζ_0 is based on the constraint $\beta^h + \beta^w = 1$. When we plug equations (12) and

[33] When the common support assumption is violated, we would only get boundary identification of (C, γ). For example, if all households have positive stock market participation $\Pr(a > 0|\Omega) = 1$, we would only identify the upper bound of the participation cost $C \le \bar{C}$ given the value of γ.

(13) into this constraint, we identify ζ_0 from the following equation

$$\underbrace{\frac{d\left(1/\gamma\right)}{d\left(1/\bar{\gamma}^h\right)}\frac{\exp(\zeta_0+\zeta_1^h\log\bar{\gamma}^h+\xi^h)}{\zeta_1^h\bar{\gamma}^h}}_{\beta^h}+\underbrace{\frac{d\left(1/\gamma\right)}{d\left(1/\bar{\gamma}^w\right)}\frac{\exp(\zeta_0+\zeta_1^w\log\bar{\gamma}^w+\xi^w)}{\zeta_1^w\bar{\gamma}^w}}_{\beta^w}=1$$

Once we identify $\zeta=\{\zeta_0,\zeta_1^h,\zeta_1^w\}$, we could calculate bargaining weights $\{\beta^h,\beta^w\}$ by groups from equation (12) and (13), respectively.

Lastly, we introduce the household heterogeneity and argue that the parameters in the cost function $c=\{c_i\}_{i=0}^{12}$ and parameters in the bargaining equation $\delta=\{\delta_x,\{\delta_{jt}^H\}_{j=1}^5\}$ are identified by comparing differences in $\{\beta^h,\beta^w,C\}$ between households with different observables $\{X^h,X^w,H\}$. In particular, we have

$$\begin{aligned}\frac{dC}{dX_i}&=c_x,\forall c_x\in c\\ \frac{d\beta^h}{dX^h}&=(1-\beta^h)\beta^h\delta_x\\ \frac{d\beta^h}{dH}&=(1-\beta^h)\beta^h\delta_j^H\end{aligned}$$

Therefore, parameters c and δ are identified non-parametrically from the variation of $\{\beta^h,\beta^w,C\}$ across households.

D Additional tables and figures

Table A.1: Summary statistics between the raw sample and the baseline sample

	Raw sample			Baseline sample		
	Mean	SD	P50	Mean	SD	P50
Household characteristics						
Stock participation	0.39	0.49	0	0.48	0.50	0
Household earnings (AU$1,000)	105	101	90	120	107	105
Total wealth (AU$1,000)	1,147	1,474	739	1,423	1,562	979
Financial asset (AU$1,000)	383	708	153	504	804	243
Equity (AU$1,000)	53	257	0	74	299	0
Number of children	0.86	1.15	0	0.84	1.10	0
Individual characteristics						
Age	47.60	16.19	46	49.38	15.02	49
Education	12.60	2.61	12	13.04	2.55	12
Employment	0.62	0.49	1	0.64	0.48	1
Earnings (AU$1,000)	42	53	30	48	59	37
Risk aversion	3.34	0.69	3	3.30	0.67	3
Cognitive ability	0.01	0.70	0.04	0.10	0.67	0.12
Extraversion	4.44	1.07	4.50	4.42	1.09	4.50
Agreeableness	5.41	0.90	5.50	5.43	0.86	5.50
Conscientiousness	5.18	0.99	5.33	5.27	0.97	5.33
Stability	5.22	1.06	5.33	5.28	1.03	5.33
Openness	4.17	1.03	4.17	4.21	1.00	4.17

Note: This table reports summary statistics for the raw sample and the baseline sample. Stock participation is a dummy variable that indicates whether a household directly holds any equities. Both age and education are measured in years. Employment is a dummy variable indicating whether or not an individual is currently employed. Risk aversion is measured using an integer from 1 to 4, where a higher number indicates a higher level of risk aversion. Cognitive ability is measured by the average of the standardized scores of three tests. Extraversion, agreeableness, conscientiousness, stability, and openness are based on 36 personality questions, the values of which range from 1 to 7. US$1 $\approx$ AU$1.2.

Table A.2: Transition rates of financial heads of the household between waves

	To					
From	husband-headed	husband-shared	jointly-headed	wife-shared	wife-headed	Total
husband-headed	61.9	27.5	10.4	0.19	0	100
husband-shared	19.6	43.0	36.2	1.16	0	100
jointly-headed	2.44	9.72	79.4	7.01	1.46	100
wife-shared	0	2.15	41.1	42.8	13.9	100
wife-headed	0	1.27	17.7	34.2	46.8	100

Note: This table presents a transition matrix for the financial heads of the household between waves.

Table A.3: Changes in the measures of gender norms between waves

	2006	2010	2014	2018	All
Division of labor (husband)	3.615	3.584	3.440	3.169	3.419
	(1.827)	(1.781)	(1.776)	(1.811)	(1.807)
Division of labor (wife)	3.173	3.173	3.072	2.727	3.005
	(1.882)	(1.845)	(1.862)	(1.789)	(1.850)
Share housework (husband)	2.265	2.326	2.236	2.182	2.243
	(1.232)	(1.252)	(1.249)	(1.262)	(1.251)
Share housework (wife)	1.792	1.830	1.869	1.767	1.814
	(1.069)	(1.048)	(1.167)	(1.103)	(1.106)
Mother role (husband)	5.172	5.174	5.150	5.152	5.160
	(1.632)	(1.598)	(1.641)	(1.679)	(1.642)
Mother role (wife)	5.539	5.493	5.505	5.451	5.492
	(1.664)	(1.628)	(1.639)	(1.727)	(1.669)
Observations	1488	1573	2277	2403	7741

Note: This table shows changes in the measures of gender norms between waves. Attitudes toward gender norms are measured by three questions that elicit participants' attitudes toward the division of labor, the share of housework in the family, and the mother's role. Answers to each question are measured on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree. We recode all variables so that a higher value represents a more traditional view of gender norms.

Table A.4: OLS regression of financial heads of the household on attitudes toward gender norms

	Husband-headed	Wife-headed
Division of labor (husband)	0.006***	0.003*
	(0.002)	(0.001)
Division of labor (wife)	0.009***	-0.000
	(0.002)	(0.001)
Share housework (husband)	0.010***	-0.001
	(0.003)	(0.002)
Share housework (wife)	-0.001	-0.004**
	(0.003)	(0.002)
Mother role (husband)	0.002	-0.001
	(0.002)	(0.001)
Mother role (wife)	0.007***	-0.003**
	(0.002)	(0.002)
Age/10 (husband)	-0.003	-0.008
	(0.034)	(0.024)
Age/10 (husband), squared	0.001	0.001
	(0.003)	(0.002)
Age/10 (wife)	-0.049	0.021
	(0.034)	(0.022)
Age/10 (wife), squared	0.003	-0.003
	(0.003)	(0.002)
Education (husband)	0.016***	-0.007***
	(0.002)	(0.001)
Education (wife)	-0.004*	0.005***
	(0.002)	(0.001)
No. children in HH	0.012***	0.002
	(0.004)	(0.003)
Log HH earning	-0.000	0.002
	(0.005)	(0.003)
Log HH earning, squared	-0.000	-0.000
	(0.000)	(0.000)
Log net wealth	-0.145***	0.000
	(0.043)	(0.015)
Log net wealth, squared	0.007***	-0.000
	(0.002)	(0.001)
2010	-0.000	-0.001
	(0.011)	(0.007)
2014	-0.022**	-0.003
	(0.010)	(0.006)
2018	-0.020*	0.015**
	(0.011)	(0.007)
Constant	0.599**	0.073
	(0.274)	(0.102)
Observations	7741	7741

Note: This table analyzes the impact of attitudes toward gender norms on financial heads of the household. Robust standard errors are in parentheses. Levels of significance are denoted as follows: * if $p < 0.10$; ** if $p < 0.05$; *** if $p < 0.01$.

Table A.5: Model estimates for unobserved types, μ, in the bargaining equation

	Value (μ_k)		Proportion (p_k)	
	Mean	SE	Mean	SE
Type I	0.788	0.068	0.409	0.002
Type II	-0.935	0.063	0.469	0.002
Type III	2.154	0.951	0.017	0.008
Type IV	0.081	–	0.106	–

Note: The value and proportion are uniquely pinned down by the three other types given the constraints $E[\mu] = 0$ and $\sum_{k=1}^{4} p_k = 1$.

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Table A.6: Model estimates for determinants of bargaining power in the bargaining equation

Characteristic	Value	SE
	(1)	(2)
$Age/10$	0.048	0.175
Education	0.055	0.067
Employment	0.036	0.085
Earning	0.345	0.074
Cognitive ability	0.796	0.207
Extraversion	0.410	0.106
Agreeableness	-0.120	0.060
Conscientiousness	-0.195	0.082
Stability	-0.022	0.019
Openness	-0.601	0.142
Intercept (2002)	1.504	0.483
Intercept (2007)	1.808	0.463
Intercept (2012)	1.606	0.401

Note: This table reports the estimation results for the bargaining equation. Each characteristic is defined as the value difference between paired husbands and wives. Column 1 reports the coefficients; Column 2 reports the standard errors.

Table A.7: Model estimates for the rest of the parameters

Parameter	Value	SE	Parameter	Value	SE
Participation cost (€100)			*Risk measure equation*		
c_0(Intercept)	1.756	0.006	σ_ξ	2.025	0.095
c_1(log HH earning)	-0.382	0.001	ρ_ξ	-0.038	0.021
c_2(log HH earning, squared)	0.009	0.000	ζ_0	0.105	0.031
c_3(log net wealth)	0.598	0.002	ζ_1^h	1.445	0.047
c_4(log net wealth, squared)	-0.032	0.000	ζ_1^f	1.312	0.064
c_5(Age/10)	0.632	0.079			
c_6(Age/10, squared)	-0.229	0.040	*General parameters*		
c_7(Education)	-0.240	0.041	σ_ε	1.617	0.286
c_8(Cognition)	-0.140	0.013	r_p	0.070	-
c_9(No. children in HH)	0.040	0.022	σ_r	0.100	-
c_{10}(2007)	0.148	0.060			
c_{12}(2012)	0.353	0.079			

Note: This table reports estimates of the rest of the parameters. The left panel reports all the coefficients from the participation cost function. The upper-right panel reports the coefficients associated with the risk attitude measurement equation. The lower-right panel reports the other parameters: σ_ε is the standard deviation of the residual term in bargaining equation; and r_p and σ_r are the mean and variance of the risk premium. Values of r_p and σ_r are preset following Breunig et al. (2021).

Table A.8: The average stock market participation rate across different risk preferences

	Men		Women	
Risk-taking level	Sim	Data	Sim	Data
Low	0.212	0.151	0.240	0.201
Middle	0.298	0.293	0.311	0.310
High	0.417	0.450	0.402	0.364

Note: This table compares average stock market participation rate for households with different levels of risk preference from the model simulation with those from the real data. In the first two columns, we group the households based on husbands' risk preference. "Low" includes the households in which husbands report their values of risk aversion to be 0 or 1. "Middle" includes the households in which husbands report their values of risk aversion to be 2 to 5. "High' includes the households in which husbands report their risk preference values between 6 to 10. The last two columns report average stock market participation rate based on wives' risk preference. The grouping rule is the same.