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The Review of Financial Studies

The Gender Gap in Household Bargaining Power: A Revealed-Preference Approach

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When members of the same household have different risk preferences, whose preference matters more for investment decisions and why? We propose an intrahousehold model that aggregates individual preferences at the household level as a result of bargaining. We structurally estimate the model, analyze the determinants of bargaining power, and find a significant gender gap. Gender differences in individual characteristics, as well as gender effects, partially explain the gap. These patterns hold broadly across Australia, Germany, and the United States. We further link the distribution of bargaining power to households' perceived gender norms in a cross-sectional analysis. (*JEL* G11, G41, G50)

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Authors have furnished an Internet Appendix, which is available on the Oxford University Press Web site next to the link to the final published paper online.

When analyzing portfolio decisions, most studies start with the household as the primitive unit of analysis (Gomes, Haliassos, and Ramadorai 2021). In a typical model, a household is an imagined individual solving the optimal portfolio problem with a well-defined set of goals and constraints. In empirical analysis, it is common to treat a household by averaging across its members

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or by using the characteristics of the household's head to represent the entire household. Such treatments simplify the modeling of the decision-making process, but they also embed a fundamental disconnect between individuals and households: household decisions often involve multiple members, each of whom could be playing a different role or have a different say. This idea of intrahousehold bargaining has been studied previously in the domains of consumption and time-use decisions (e.g., Chiappori and Mazzocco 2017), but less has been uncovered in the domain of portfolio choice. For example, risk preference is a key determinant of portfolio choice, and it has been observed that members of the same household often have different risk preferences. When such disagreement occurs, what determines one's bargaining power? Within the household, is there a gender gap in bargaining power? If so, what drives it?

A budding body of literature is emerging to address these questions.[1] One approach links variation in individual characteristics to household decisions to establish the significance of these characteristics (e.g., Addoum 2017; Olafsson and Thornquist 2018; Ke 2021). This approach requires plausible instruments and usually does not allow for a quantitative comparison among multiple characteristics. A second approach directly relies on survey responses to measure bargaining power (e.g., Friedberg and Webb 2006; Yilmazer and Lich 2015; Guiso and Zaccaria 2023). A popular proxy is based on the so-called "final say" question, which asks who has the ultimate responsibility of making financial decisions for the household and acts as the "financial head." However, responsibility does not imply power, especially when coordination is effective and the decision-maker fully takes into account others' preferences. When separately surveyed, members of the same household frequently give different answers to the same final say question, suggesting nontrivial noise and disagreement about the allocation of responsibility (Barsky et al. 1997; Mazzocco 2004). Furthermore, a common concern about subjective survey responses still lingers: is what people say consistent with what they do (Bertrand and Mullainathan 2001)?

In this paper, we propose a revealed-preference approach for analyzing bargaining power in intrahousehold portfolio decisions. This approach rests on the premise that those with more bargaining power should be better able to incorporate their own risk preferences into the household's overall portfolio choice. Therefore, when individual risk preferences are observable, household-level portfolio choice reveals whose preference holds more weight in the household's decision-making. This departs from the aforementioned survey-based approach by examining what people actually *do* rather than what

[1] Gomes, Haliassos, and Ramadorai (2021) review existing approaches and recent advancements in intrahousehold analysis. They also mention an additional approach to intrahousehold problems incorporating a life cycle model of portfolio choice. This strategy addresses changes to the family structure arising from, for example, divorce, the arrival of children, or the death of a spouse (e.g., Love 2010). Bargaining between household members is not directly modeled, however, and, therefore, is not included in our discussion.

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they *say*. Moreover, by explicitly modeling the household's decision process and estimating the determinants of bargaining power, we can simultaneously study multiple channels and quantify each channel's relative contribution to bargaining power.

We start with a tractable intrahousehold model of portfolio choice. In our model, spouses—a husband and a wife—differ in risk preferences and other individual characteristics and make portfolio decisions for the entire household in two steps.[2] In the first step, they cooperatively decide on a household risk preference, modeled as a 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. In the second step, the household makes portfolio decisions based on this household-level risk aversion as if it were a single individual, taking into account additional considerations suggested in the literature, such as participation cost.[3] The household then decides whether to participate in the stock market (the extensive margin) and by how much (the intensive margin), in the spirit of the Merton model (Merton 1969, 1971). While we are only concerned with bargaining over risk preference in this paper, the model can be extended to accommodate bargaining over beliefs or other types of preferences.[4]

We structurally estimate the model using data from Australia, Germany, and the United States. Our main analysis is based on the Household, Income, and Labour Dynamics in Australia (HILDA) Survey, a nationally representative survey of Australia. The HILDA Survey asks respondents to provide detailed information about household asset allocation. More importantly, it includes a comprehensive set of individual characteristics, including risk aversion, making it an ideal data set to implement our method. The model is then estimated using maximum likelihood, with stock market participation and risky asset holdings being the two outcome variables.

Our estimation results show substantial heterogeneity in the intrahousehold allocation of bargaining power across households. This heterogeneity, in turn, can be attributed to spousal differences in individual characteristics. Employment, earning, and cognitive ability are important determinants of bargaining power. Other factors, such as age and education, matter as well, but to a lesser extent. Interestingly, noncognitive attributes such as personality traits also matter in the bargaining process. For example, consistent with prior

[2] Since we are interested in identifying the gender gap in bargaining power, we are only concerned with heterosexual couples throughout the paper.

[3] Although we model bargaining through risk aversion, fundamentally, household members are bargaining over investment decisions: those with a higher risk aversion would like to invest less in equities, while those with a lower risk aversion would like to invest more. Therefore, household members are ultimately bargaining over the level of risky assets they want the household to invest in.

[4] For instance, when one member is optimistic about future market returns, but the other is pessimistic, some form of bargaining may be needed to resolve such belief disagreement. This can be done, for example, by collecting detailed expectations data on stock market returns at the individual level.

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literature on personality and labor outcomes (Flinn, Todd, and Zhang 2018), less agreeable and less extraverted individuals have more bargaining power.

Analyzing the allocation of bargaining power between husband and wife, we find that in an average household, the weight placed on the husband's risk preference is about 0.6, while the weight placed on the wife's is 0.4. Therefore, household asset allocation reflects the husband's risk preference 0.2—or 50% in relative terms—more than the wife's. We decompose this gender gap into two components, one driven by spousal differences in individual characteristics and the other by gender. Individual characteristics, such as employment and age, tilt bargaining power toward the husband, as the husband is typically older and more likely to have a job. However, observable characteristics combined can only account for about half the gap, leaving the other half attributed to gender. It has been widely documented that certain characteristics, such as employment and earnings, are also "gendered" in that they themselves embed gender stereotypes and discrimination against women (e.g., Bertrand, Kamenica, and Pan 2015). Because the gender gaps in these characteristics generally further tilt the bargaining power toward men, the estimates from our exercise can be perceived as a lower bound of the total gender effect in intrahousehold bargaining.

Our subsequent analysis examines the sources of the gender effect documented above. The HILDA Survey includes a question asking participants to identify who has the "final say" about financial decisions in the household. As discussed above, previous studies have directly used it as a proxy for bargaining power whereby the financial head has full bargaining power. We follow Ke (2021) and view it as an indicator of patriarchal social norms. We find that the above-documented gender effect is primarily driven by husband-headed households. In an average husband-headed household, the husband retains an additional bargaining weight (about 0.3) beyond what is implied by his observable characteristics, an effect that has been persistent over time. In contrast, in wife-headed households, while wives retain more bargaining power than their spouses, the magnitude of the additional weight is much smaller. This analysis also allows us to compare our revealed-preference approach to the survey-based approach. Qualitatively, the two approaches are consistent in two aspects. First, the husband's bargaining power monotonically increases from wife-headed to shared-responsibility households and then to husband-headed households. Second, the average bargaining weight of the husband in a shared-responsibility household is close to having an equal say. However, quantitatively, in both wife-headed and husband-headed households, financial heads incorporate the risk preferences of their spouses in a nontrivial way, suggesting that focusing only on the financial head may be an oversimplification.

We next construct a more direct measure of perceived gender norms and link it to bargaining power in the cross-section of households. The HILDA Survey includes three questions to elicit each individual's perception of gender

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norms. The topics range from attitudes toward traditional gender roles to the division of housework and childcare duties, and both the husband and wife need to answer these questions separately. We find that households with progressive attitudes toward gender norms are more likely to elect the wife as the financial head, thereby empowering women with more power in financial decisions. Interestingly, these effects apply to the perception of both the wife and the husband, suggesting that it is important to bring awareness to both women and men when promoting more egalitarian intrahousehold dynamics.

A division of labor may exist in intrahousehold decision-making: perhaps spouses with less bargaining power in the domain of portfolio choice are compensated by having greater bargaining power in other domains such as consumption and child-rearing decisions (Becker 1985; Becker and Murphy 1992). However, when testing the correlation between financial decisions and other labor and consumption decisions, we have no evidence to support this labor division view. In many households, investment and consumption decisions are made by the same individual. We also discuss the welfare implications of our findings. The data set does not contain information on portfolio returns and, therefore, does not allow for a comparison of performance across households. However, we argue that the gender gap suggests a welfare loss for wives in expected utility, as their preferences are incorporated to a lesser extent into household decisions than the preferences of husbands.

We apply this framework using data from two other national panels: the German Socio-Economic Panel (GSOEP) Survey and the U.S. Health and Retirement Study (HRS). In both settings, we find even larger gender gaps. For instance, in the average German household, the weight placed on the husband's risk preference is about 0.69, while the weight placed on the wife's risk preference is 0.31. More strikingly, observable gender differences such as wage and employment status can only explain around a quarter of the gap, leaving the majority explained by gender effects. This greater gender gap in Germany is consistent with its more traditional attitude toward gender (Ke 2018).

This paper proposes a new framework for understanding the bargaining process within a household. In particular, the structural approach we propose 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, we model the household's risk preference as a result of bargaining inspired by the collective bargaining model developed by Chiappori (1988b, 1992). This model, which is traditionally applied to consumption and labor supply decisions (e.g., Chiappori 1988b; Browning et al. 1994), is adapted to analyze asset allocation decisions, as risk preferences play a crucial role in this domain. Our framework can also be extended to analyze bargaining over other types of preferences and beliefs.

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Second, we contribute to the literature on gender differences in financial decisions. Earlier studies have revealed the existence of a gender gap in domains such as trading behavior and performance (Barber and Odean 2001), housing returns (Goldsmith-Pinkham and Shue 2023), and stock market participation and other financial decisions (Addoum 2017; Olafsson and Thornquist 2018; Ke 2021; Kim 2021; Guiso and Zaccaria 2023). By quantifying the bargaining weights of husbands and wives in investment decisions, we demonstrate the existence of a substantial gender gap. This new insight adds to the growing body of literature on gender disparities in financial decision-making.

Third, our paper quantitatively evaluates the relative importance of different factors in determining bargaining power. While existing papers have studied consumption and labor supply decisions (e.g., Chiappori 1992; Pollak 2005; Bourguignon, Browning, and Chiappori 2009; Pollak 2012; Attanasio and Lechene 2014; Flinn, Todd, and Zhang 2018), we are primarily concerned with financial decisions. We find that income and employment status, among other factors, are the most important determinants of bargaining power, whereas other factors matter to a lesser extent. In this regard, the closest paper to ours is Bertocchi, Brunetti, and Torricelli (2014), who also examine the factors that influence bargaining power but only uses the financial head of the household as a proxy.

Fourth, we find supportive evidence that traditional gender norms constrain women's power in intrahousehold decisions. The two papers closest to ours are Ke (2021) and Guiso and Zaccaria (2023), but with some key differences. Ke (2021) studies how men and women of similar financial sophistication affect their household's stock market participation decisions differently. Guiso and Zaccaria (2023) use household headship to proxy for gender norms and find that egalitarian gender norms lead to higher stock market participation and better financial returns. Apart from the aforementioned methodological differences, our paper differs in two other aspects. First, as discussed above, our identification of bargaining power relies on the revealed preference of the household portfolio choice. Second, our measures of gender norms are directly based on survey responses rather than on proxies based on household headship.

1. Data and Stylized Facts

1.1 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 1.3, we review household-level surveys conducted in other countries and argue that the HILDA Survey is most suitable for analyzing intrahousehold decision-making.

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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 interview and questionnaire cover a wide range of topics concerning 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. Therefore, we rely on the four preceding waves for information on personality traits. Cognitive ability is only collected in waves 12 and 16. We assume that cognitive ability is persistent at the individual level and use the average value of waves 12 and 16 for all four waves.

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 outside 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 9,357 household-wave observations with completed information, representing 4,336 unique households.[6]

1.2 Summary statistics

Table 1 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, including individual stocks and mutual funds.[7] The overall participation rate in the stock market is 48%, higher than those in many other developed countries (for a recent international comparison, see Badarinza, Campbell, and Ramadorai 2016). The median household income is AU$104,000. The median total wealth and financial wealth are AU$975,000 and AU$241,000, respectively, suggesting good coverage of relatively affluent families.[8] The average value of equity holdings is AU$75,000, while the median level is zero. The distributions of income, total wealth, financial wealth, and equity value are, as expected, positively skewed. On average, a household has fewer than one child.

[5] Australia legalized same-sex marriage in 2017, but we do not have sufficient data to analyze same-sex couples.

[6] In the Internet Appendix, Section A.1 discusses the filters in detail, and Table A.1 compares the raw and the baseline samples.

[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 ask how retirement accounts are invested.

[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 and nonfinancial wealth (the HILDA Survey variable HWNFII).

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Table 1
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)	119	108	51	104	158			
Total wealth (AU$1,000)	1,431	1,602	560	975	1,703			
Financial asset (AU$1,000)	504	809	99	241	568			
Equity (AU$1,000)	75	303	0	0	20			
Number of children	0.82	1.09	0	0	2			
Individual characteristics								
Age	49.72	15.04	38	49	61	50.92	48.51	2.42***
Education	12.96	2.57	12	12	15	13.01	12.92	0.10*
Employment	0.64	0.48	0	1	1	0.68	0.60	0.08***
Earnings (AU$1,000)	47	57	0	36	73	61	33	29***
Risk aversion	3.30	0.67	3	3	4	3.18	3.42	−0.24***
Cognitive ability	0.15	0.85	-0.47	0.29	0.80	0.33	−0.04	0.37***
Extraversion	4.42	1.08	3.67	4.50	5.17	4.30	4.55	−0.25***
Agreeableness	5.42	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	−0.20***
Stability	5.28	1.03	4.67	5.33	6.00	5.27	5.29	−0.03
Openness	4.19	1.00	3.50	4.17	4.83	4.26	4.13	0.12***

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 standardized scores of self-reported math skills. Extraversion, Agreeableness, Conscientiousness, Stability, and Openness are based on 36 personality questions, and their values range from 1 to 7 (see Section A.3 of the Internet Appendix for more details). US$1 ≈ AU$1.2. *$p < .1$; **$p < .05$; ***$p < .01$.

For individual characteristics, most of the demographic variables, such as age and education, cover a wide spectrum, consistent with the HILDA Survey's national coverage. A more interesting set of statistics concerns the comparison between husband and wife. Overall, in an average household, the husband is 2.4 years older, is 8% more likely to be employed, makes AU$29,000 more every year, and has a similar level of education to the wife. It is worth noting that these differences themselves can also be gendered: for example, the difference in labor income may reflect patriarchal social norms that lower women's pay even for the same job (Akerlof and Kranton 2000; Fortin 2005; Bertrand, Kamenica, and Pan 2015).

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 variables.

1.2.1 Risk preferences. 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 (i.e., 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

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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 1 shows, the average risk aversion is 3.18 for husbands and 3.42 for wives, suggesting that wives, on average, are more risk-averse than husbands.

While the question's phrasing explicitly elicits one's own risk attitude, we cannot fully rule out the possibility that the reported risk attitude may partially capture the risk attitude of one's spouse. For example, Serra-Garcia (2022) shows that spouses' risk preferences become more alike over time after marriage. If this is the case, then answers to this question may already reflect an outcome of bargaining. To address this concern, we introduce measurement errors in the risk measurement equation to capture potential biases between the "reported" and "true" risk attitude. We will further allow measurement errors to be correlated between husband and wife within the same household.

1.2.2 Cognitive ability. The survey asks respondents to rate their math skills on a 0-10 scale relative to the "average or typical Australian adult." We standardize the responses for the items to form a scale of math skills and use it as a proxy for cognitive ability. In our sample, husbands have higher cognitive ability, scoring 0.37 higher than wives.

1.2.3 Personality traits. The HILDA Survey collects information about the Big Five personality traits: openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability.[10] Each trait is measured on a scale from 1 to 7.[11] Overall, as shown in Table 1, husbands are less extraverted, less agreeable, less conscientious, and more open to experiences than their wives.

1.2.4 Financial head. The HILDA Survey also collects information on the financial head of the household. In a self-completion questionnaire, each

[9] There is a fifth option: I never have any spare cash. We exclude individuals who choose this last option in our baseline sample, because it is unclear how to classify these individuals. If the respondent reports that they never have any spare cash, they are asked to imagine what they would do if they had any spare cash available for investment and savings using the first four options from above. In Section A.2 of the Internet Appendix, we construct an additional sample in which respondents who report never having any spare cash are coded into the above categories given their hypothetical answers to what they would do if they did have spare cash.

[10] For overviews of the Big Five, see Costa Jr and McCrae (1990); McCrae and John (1992); John and Srivastava (1999).

[11] More details are included in Section A.3 of the Internet Appendix.

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spouse answers who makes the decisions about 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 themselves to be the only financial head of the household.

This question is similar to the question about "final say" used in other surveys (e.g., HRS), which asks, "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; Guiso and Zaccaria 2023). Second, it has been used as a measure of gender norms: husband-headed families are associated with more patriarchal gender norms (Ke 2021). In this paper, we follow the second approach and use household headship to proxy for traditional gender norms.

Based on the "financial head" question, we first classify all households into three main 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, spouses give slightly different answers to the same question, resulting in two other types: "husband-shared," in which one spouse reports husband and the other reports shared equally, and "wife-shared," in which one reports wife and the other reports shared equally.[12]

Figure 1 plots the distribution of household types by year. Depending on the specific wave, 58% 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 28% of the households report the husband as the financial head, while only 13% to 16% report the wife. Across the four waves, the fraction of each household structure remains rather steady. There is a slight trend toward wife-headed and wife-shared households, but the magnitude is relatively small.

1.3 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

[12] In rather rare cases (1.3% of the sample), the husband and wife give opposite answers; we drop these responses in subsequent analyses.

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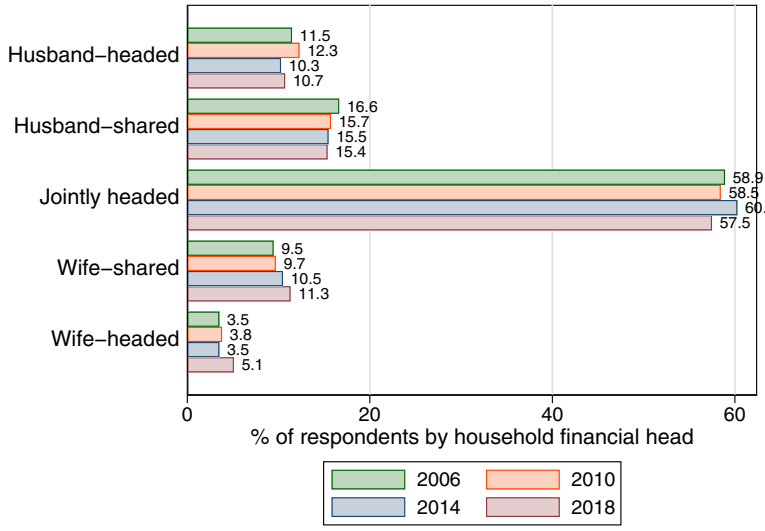

Figure 1
Distribution of the financial head of the household by years
This figure shows the distribution of five household types in four different years (2006, 2010, 2014, 2018). The five types of households are "husband-headed," in which both spouses report the husband makes financial decisions; "jointly 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."

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. 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 not 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 include information about financial heads. 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. Given these considerations, we cannot replicate our

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Table 2
Percentage of households by the risk preference of each spouse

		Wife				
		1	2	3	4	Total
Husband	1	0.1	0.4	0.7	0.7	1.9
	2	0.2	1.8	6.4	2.9	11.4
	3	0.3	2.2	30.3	20.3	53.1
	4	0.2	0.5	8.2	24.8	33.6
	Total	0.8	4.9	45.6	48.8	100.0

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.

full analysis in any of these data sets. However, it is still feasible to repeat the main part of our estimation using two data sets: HRS for the United States and GSOEP for Germany. We will discuss these exercises later in Section 5.

1.4 Stylized facts

1.4.1 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 2 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, and the off-diagonal terms represent cases in which the two spouses have different risk preferences. Overall, two robust patterns emerge. First, consistent with the prior literature (e.g., Dohmen et al. 2012), we find assortative mating on risk preferences: more than 50% of the couples have the same risk preference. It is unclear whether sorting happens before marriage or spouses become more alike after marriage. Second, in 43% of households, 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.

1.4.2 Risk preference and stock market participation. To illustrate the quantitative importance of risk preference to stock market participation, we run a simple linear probability model by regressing the dummy of stock market participation on various household characteristics.[13] Column 1 in Table 3 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 a key determinant of

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

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Table 3
OLS regression of the stock market participation rate on risk preferences

	Couples		Singles	
	(1)	(2)	(3)	(4)
Risk aversion	−0.112***	−0.081***	−0.132***	−0.103***
	(0.008)	(0.007)	(0.014)	(0.013)
Risk aversion (wife)	−0.129***	−0.090***		
	(0.009)	(0.008)		
Age/10		−0.087**		−0.029
		(0.042)		(0.024)
Age/10, squared		0.010**		0.007**
		(0.004)		(0.003)
Age/10 (wife)		0.023		
		(0.042)		
Age/10 (wife), squared		0.003		
		(0.004)		
Education		0.005**		0.014***
		(0.002)		(0.003)
Education (wife)		0.001		
		(0.002)		
No. children in HH		−0.003		−0.011
		(0.005)		(0.008)
log HH earning		0.038***		0.029***
		(0.007)		(0.009)
log HH earning, squared		−0.001		−0.002**
		(0.001)		(0.001)
log net wealth		−0.067***		−0.114***
		(0.023)		(0.013)
log net wealth, squared		0.006***		0.009***
		(0.001)		(0.001)
2010		−0.066***		−0.029
		(0.015)		(0.022)
2014		−0.155***		−0.060***
		(0.014)		(0.020)
2018		−0.202***		−0.079***
		(0.014)		(0.020)
Female			0.037	−0.123*
			(0.084)	(0.073)
Female × Risk aversion			−0.022	0.027
			(0.023)	(0.020)
Constant	1.280***	0.512***	0.726***	0.555***
	(0.031)	(0.155)	(0.050)	(0.090)
Observations	9,357	9,357	3,213	3,213
R^2	.069	.206	.061	.251

This table analyzes the impact of risk aversion on stock market participation. 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 in HH* is the number of children in the household. Columns 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. Robust standard errors are in parentheses. $*p < .1$; $**p < .05$; $***p < .01$.

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. Columns 3 and 4 repeat the analysis for single households and show a similar pattern.

1.4.3 Financial head of the household. Table 4 reports household characteristics by sorting households into three different types: husband-headed, jointly

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Table 4
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	50.79	52.19	49.39	2.80***	50.21	51.38	49.03	2.35***	49.06	50.34	47.78	2.56*
Education	13.57	13.95	13.20	0.75***	12.80	12.83	12.77	0.06	12.58	12.13	13.03	−0.89***
Employment	0.58	0.66	0.49	0.17***	0.64	0.67	0.60	0.08***	0.61	0.63	0.59	0.04
Earnings (AU$1,000)	52	80	25	55***	45	57	32	25***	42	45	39	6
Risk aversion	3.11	2.85	3.36	−0.51***	3.35	3.25	3.45	−0.19***	3.35	3.37	3.33	0.04
Cognitive ability	0.22	0.62	−0.19	0.81***	0.13	0.29	−0.03	0.31***	0.10	0.03	0.16	−0.13*
Extraversion	4.31	4.18	4.45	−0.27***	4.43	4.33	4.53	−0.20***	4.46	4.33	4.59	−0.27**
Agreeableness	5.38	5.06	5.69	−0.62***	5.45	5.23	5.67	−0.44***	5.32	5.10	5.55	−0.45***
Conscientiousness	5.27	5.33	5.22	0.11*	5.29	5.18	5.40	−0.22***	5.07	4.74	5.40	−0.66***
Stability	5.20	5.27	5.13	0.15**	5.33	5.31	5.36	−0.05*	5.16	5.07	5.25	−0.18*
Openness	4.26	4.37	4.15	0.22***	4.16	4.22	4.11	0.11***	4.23	4.21	4.26	−0.05
Household characteristics												
Stock participation	0.64				0.45				0.42			
HH earnings (AU$1,000)	144				109				108			
Total wealth (AU$1,000)	2,181				1,285				1,309			
Financial asset (AU$1,000)	888				440				426			
Equity (AU$1,000)	200				47				105			
No. children in HH	0.95				0.78				0.86			

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 ≈ AU$1.2. *$p < .1$; **$p < .05$; ***$p < .01$.

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headed, and wife-headed; we omit the two other household types for simplicity. At the individual level, members of husband-headed households are slightly older, more educated, less likely to be employed (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 financial assets.

A more interesting comparison concerns the difference between husband and wife in their individual characteristics. Generally, when a spouse is better off in education, employment, income, risk-taking capacity, and cognitive ability, this person is more likely to become a financial head. Indeed, in an average husband-headed household, the husband is generally better off in these dimensions, and vice versa in an average wife-headed household.

2. Model

2.1 Baseline model

2.1.1 Assets. The economy has two assets: a risk-free asset with a constant interest return r_f and a risky asset (stock) with return $r_f + \tilde{x}$, where $\tilde{x}$ represents the equity premium and follows a normal distribution $N(r_x, \sigma_x^2)$. For simplicity, we assume that r_x is homogeneous across households and abstract away from heterogeneous expectations.[14] Household i has total wealth w. Consider a static portfolio allocation between risky asset holding a and risk-free asset holding $w-a$, where a represents the household's choice variable.

Given the empirically low stock participation rate, a common approach for matching this moment is to impose a participation cost, which can be either a lump-sum cost or per-period fee (e.g., Vissing-Jørgensen 2002; Gomes and Michaelides 2005; Alan 2006). We follow this approach and assume a one-time lump-sum cost of C_i for each household participating in the stock market. Subscript i indicates that C_i is heterogeneous across households. While the prior literature has often interpreted this cost as the physical effort of opening a brokerage account or the mental effort of learning about financial markets, our interpretation is more flexible. As we will discuss later, we use the cost as an absorbing term that captures any factor affecting stock market participation other than risk aversion.

2.1.2 Utility function. The mean-variance utility function of household i is specified as

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

[14] We cannot use household-level expectations data in our portfolio choice problem since the survey data (HILDA and GSOEP) do not include information about stock market return expectations. Instead, we rely on the existing literature to pre-set the mean (r_x) and standard deviation (σ_x) of the premium distribution in our estimation.

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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 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 Internet Appendix shows the proof. In Equation (2), there are two sources of household 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 asset.

Next, we specify participation cost C_i. Because we view it as an absorbing term, we adopt a rather flexible specification as a linear/quadratic 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 earnings, household net wealth, and the number of children, respectively. The literature suggests that this set of characteristics influences stock market participation decisions (Campbell 2006). At this point, because we are primarily concerned with household-level characteristics, we use the average value between the two spouses for age, education, and cognitive ability; later, differences in individual characteristics between spouses will enter the bargaining equation. We include quadratic earnings, wealth, and age terms to account for nonlinear effects. We also include three year dummies, using the year 2006 as the reference group. The inclusion of wealth in the participation cost function breaks the wealth neutrality commonly implied by a mean-variance utility. Therefore, although household wealth does not directly show up in the portfolio solution, it still indirectly affects stock market participation through C_i. In our estimation, heterogeneous participation cost C_i is not a fitted value but an endogenous object estimated jointly with other model parameters (see Section 2.2 for more detail).

2.1.3 Risk aversion and bargaining power. Next, we specify how household risk aversion γ_i is aggregated from individual preferences; for simplicity, we now drop subscript i.[15] We focus on heterosexual marriage in which a

[15] In theory, household members may also differ in their time preference or expected returns as well, and they will need to bargain in these dimensions as well. A full exploration, however, needs to extend our static model to a dynamic setup. To the best of our knowledge, such a model (dynamic intrahousehold decisions in the financial domain) has not yet been developed in the literature and could be an interesting avenue for future work.

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household consists of a husband (h) and a wife (w). We assume that couples are fully committed to staying in their marriage and do not consider the case of divorce. 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 as $\frac{1}{\gamma^h}$ and $\frac{1}{\gamma^w}$, respectively:

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

where β^h and β^w can be interpreted as the bargaining power of the husband and the wife, respectively; $\beta^h + \beta^w = 1$. With this formulation, we are assuming that greater bargaining power means a greater ability to incorporate one's own risk preference into the household's portfolio choice.[16]

We make two remarks based on our functional form choices. First, under mean-variance utility, portfolio decisions follow a cut-off rule which simplifies the subsequent estimation. As we show later, though simple, this utility function turns out to fit the data rather well. Second, in Equation (4), risk aggregation uses the reciprocal of individual risk aversion rather than risk aversion itself. Under the conditions detailed in Section B of the Internet Appendix, this gives an equivalent expression as in 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 1988a, 1992).[17] Therefore, in our model, aggregating individual risk preferences is equivalent to aggregating individual utility functions.[18]

2.1.4 Determinants of bargaining power. Finally, we specify the determinants of bargaining power. In 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 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

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

---

[16] Under this specification, an increase in the risk aversion of an individual member always increases household risk aversion. This is not necessarily true under alternative settings (Mazzocco 2004).

[17] One key condition is that the total participation cost C_i is a weighted average of individuals' participation costs, where the weights are the same as the bargaining power coefficients, β^h and β^w. Without this condition, we lose the equivalent expression, but the model's estimation remains valid.

[18] It is possible to interpret β^h and β^w in Equation (4) as the Pareto weights in a collective bargaining model. One of the key conditions required is the full commitment assumption. However, empirical tests consistently rejected this assumption (e.g., Mazzocco 2007). For examples illustrating how to relax the full commitment assumption, refer to Addoum, Kung, and Morales (2016).

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X_t^h and X_t^w represent the observed characteristics of the husband and wife in period t, respectively, 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, $\left(X_t^h - X_t^w\right)\delta_x$, captures the contribution of the observed differences between husband and wife to bargaining power. Here, we assume the effects are gender-neutral. 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 differ across periods in our model. The next term, μ, captures unobserved household heterogeneity, which is assumed to be fixed for the same household over multiple periods; we will 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 $N\left(0, \sigma_\epsilon^2\right)$.

2.2 Econometric specification and maximum likelihood function

We now introduce some parametric assumptions required for model estimation. To simplify exposition, we continue suppressing subscript i and will bring it back later when introducing the likelihood function.

2.2.1 Observable individual and household characteristics. We use Ω_t to represent the observed characteristics in period 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 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. Directly using discrete variables may be noisy and induce measurement errors, leading to attenuation biases and inconsistent coefficient estimates (e.g., Beauchamp, Cesarini, and Johannesson 2017). Therefore, we introduce measurement errors, $\{\xi_t^h, \xi_t^w\}$, to map the survey-based risk aversion to the true risk aversion, $\{\gamma_t{}^h, \gamma_t{}^w\}$:

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

where coefficients $\{\zeta_0^h, \zeta_0^w, \zeta_1^h, \zeta_1^w\}$ are gender-specific. This means the same answers may reflect different risk preferences depending on gender. We assume $\xi_t = \{\xi_t^h, \xi_t^w\}$ follows a joint normal distribution, specified by

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

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where ρ_{ξ} represents the correlation between spouses' measurement errors. This parameter is used to capture the potential correlation between spouses' reported risk attitudes. The lognormal functional form is a common choice in the literature and ensures that the risk preference is nonnegative and computationally simple.[19] In addition, 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, Sahm, and Shapiro 2008).

2.2.2 Outcome variables. Next, we specify the outcome variables. We focus on both the extensive and intensive margins of stock market participation. We use d_t to indicate whether a household has a positive holding in equities, and $\overline{a}_t$ measures the reported holdings in equities (in AU$). To account for measurement errors, we assume $\overline{a}_t$ is also a noisy measure of the true asset value a_t

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

where ϵ_t^a is a residual term and follows a normal distribution $N(0, \sigma_a^2)$.

The last parametric assumption we need to make is about the distribution of μ in Equation (6), which captures the persistent unobserved heterogeneity of each household. Following Heckman and Singer (1984), we model μ as a random effect using the nonparametric mass points approach.[20] In particular, we assume that μ is drawn from a discretized distribution of K mass points $\mu \in \{\mu_1, \mu_2, \ldots, \mu_K\}$ and use notation $p = \{p_1, p_2, \ldots, p_K\}$ as the associated probability weights.[21] In practice, we assume four types, that is, $K = 4$. We also restrict its mean value to be zero to separately identify μ and δ_{jt}^H.

2.2.3 Likelihood function. We now discuss the construction of the likelihood function. We start with a type-k household with observable characteristics Ω_t in a given period t. In the model, the decision of whether to participate in the stock market is fully pinned down by $(\Omega_t, \epsilon_t, \xi_t, \mu_k)$. Therefore, we can write the model implied decision as $\tilde{d}(\Omega_t, \epsilon_t, \xi_t, \mu_k)$. Furthermore, for a household investing in the stock market, the probabilistic distribution of risky asset holdings is fully determined by $(\Omega_t, \epsilon_t, \xi_t, \mu_k)$ and the distributional

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

[20] An alternative approach is to model μ as a fixed effect. However, the inclusion of fixed effects increases the set of parameters by thousands, substantially reducing the degrees of freedom. In addition, this can produce inconsistent estimates when the model is nonlinear.

[21] Alternatively, we can 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 assumption performs better in terms of precision and bias.

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assumptions we make about the error term ϵ_t^a.[22] Therefore, for a type-k household with observable characteristics Ω_t, we can write the likelihood function as the joint probability of making the discrete choice d_t and the continuous choice $\overline{a}_t$:

$$l_{kt} = \int_{\xi_t} \int_{\epsilon_t} 1\left(\tilde{d} = d_t | \Omega_t, \epsilon_t, \xi_t, \mu_k\right) P_a(\tilde{a} = \overline{a}_t | \Omega_t, \epsilon_t, \xi_t, \mu_k)^{1(d_t=1)} d\epsilon_t d\xi_t, \quad (9)$$

where $1(\tilde{d} = d_t)$ indicates whether the model implied decision $\tilde{d}$ matches with the observed decision d_t, and $P_a(\tilde{a} = \overline{a}_t)$ denotes the probability that the model implied amount of asset holding $\tilde{a}$ matches with the observed amount of risky asset $\bar{a}_t$. This term enters the likelihood function when the household does participate in the stock market, that is, $1(d_t = 1) = 1$. For estimation, maximum likelihood estimation (MLE) takes into account the fact that we do not know the values of ϵ_t and ξ_t for each household by integrating out both terms.

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

$$L = \prod_i \left[\sum_{k=1}^{K} p_k \Pi_{t \in \{2006,2010,2014,2018\}} l_{kt}^i \right] \quad (10)$$

where i indexes each household. To calculate the overall likelihood, we first take the product of the likelihood function over multiple periods for the same type-k household i. Then, we sum over the K types of household heterogeneity (μ_k, where $k = 1, 2, \ldots, K$). Finally, we integrate all households to arrive at the total probability function. Standard errors are computed using the BHHH algorithm (Berndt et al. 1974).

2.3 Identification

In this section, we discuss how each parameter is identified in the model. In our model, individual characteristics can enter the likelihood function, specified in Equation (10), through two channels: stock market participation cost C and household risk preference γ. When explaining the intuition of the identification, we are first concerned with C and γ. Assuming that C and γ have been identified, we then proceed to the other parameters. In practice, however, C and γ are jointly estimated with other model parameters in one step through an MLE procedure.

Suppose that we have a sufficiently large group of households that are homogeneous in their characteristics Ω (except for γ), which leads to an identical participation cost C, but are different in their risk preferences γ.

[22] Specifically, $(\Omega_t, \epsilon_t, \xi_t, \mu_k)$ implies a theoretical level of risky holding a_t. In our model, there is also a measurement error ϵ_t^a. Therefore, the probability of holding risky asset $\bar{a}_t$ is $P_a(\bar{a}_t | \Omega_t, \epsilon_t, \xi_t, \mu_k) = P_a(\bar{a}_t | a_t) = \phi\left(\frac{\epsilon_t^a}{\sigma_a}\right) = \phi\left(\frac{\log \bar{a}_t - \log a_t}{\sigma_a}\right)$, where ϵ_t^a is the measurement error in the asset equation (8), and a_t is the true asset value implied in equation (2).

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According to Equation (2), among those invested in the stock market, γ can be identified from the household's holding of risky assets: in Equation (2), among households with $\gamma \leq \frac{r_x^2}{2\sigma_x^2 C}$, a one-to-one mapping exists between the amount of risky holding a and the household risk aversion γ. Moreover, for the marginal households whose risk aversion is $\gamma = \frac{r_x^2}{2\sigma_x^2 C}$, their risky holding equals $a = \frac{2C}{r_x}$, which means that C can be backed out from the households with the minimum risky holding within the group. Once $\{C, \gamma\}$ are identified for the subset of households participating in the stock market, coefficients $c = \{c_i\}_{i=0}^{12}$ can be recovered based on the cost function, specified in Equation (3), and coefficients $\delta = \{\delta_x, \{\delta_{jt}^H\}_{j=1}^5\}$ can be recovered based on the bargaining weight function, specified in Equations (5) and (6). Similarly, parameters $\zeta = \{\zeta_0, \zeta_1^h, \zeta_1^w\}$ in the risk preference measurement Equation (7) can be recovered by comparing the risk preference γ inferred from the model and the risk preference $\bar{\gamma}$ reported in the survey data. More detailed proofs can be found in Section C of the Internet Appendix.

3. Estimation Results

3.1 Model estimates

Table 5 and 6 report the estimation results in the bargaining Equation (6). Table 5 reports the estimates for the spousal differences in observed characteristics. Column 1 reports the coefficients, and column 2 reports the standard errors. In column 3, we calculate the percentage change in bargaining weight in response to a one-standard-deviation change in a given characteristic. Employment, earning, and cognitive ability stand out as the most important determinants of bargaining power. All coefficients are positive, and a one-standard-deviation change in employment, earnings, and cognitive ability increases the bargaining weight by 6.47%, 12.80%, and 3.11%, respectively. Therefore, much of the cross-sectional variation in the allocation

Table 5
Model estimates for spousal differences in observed characteristics in the bargaining equation

Characteristic	Value (1)	SE (2)	$\Delta\beta$ (3)
Age/10	0.384	0.152	0.54%
Education	0.275	0.059	2.24%
Employment	0.409	0.067	6.47%
Earning	0.080	0.008	12.80%
Cognitive ability	0.055	0.009	3.11%
Extraversion	−0.053	0.009	−3.34%
Agreeableness	−0.062	0.010	−3.56%
Conscientiousness	0.040	0.008	2.37%
Stability	−0.061	0.011	−3.21%
Openness	0.031	0.007	1.66%

This table reports the estimates for the spousal difference in observed characteristics in the bargaining equation. Each characteristic is defined as the value difference between the paired husband and wife. Column 1 reports the coefficients, and column 2 reports the standard errors. Column 3 shows, for each characteristic, the change in bargaining weight from the baseline level (50%) when that characteristic increases by one-standard-deviation.

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Table 6
Model estimates for gender effects in the bargaining equation

	Period t			
	2006	2010	2014	2018
Husband-headed	2.500	2.448	2.101	2.164
	(0.051)	(0.005)	(0.012)	(0.005)
Husband-shared	0.868	0.525	0.511	0.656
	(0.003)	(0.042)	(0.023)	(0.000)
Jointly headed	0.068	0.128	0.077	0.200
	(0.059)	(0.515)	(4.866)	(3.029)
Wife-shared	−0.001	−0.070	−0.702	−0.644
	(1.901)	(2.838)	(0.206)	(0.182)
Wife-headed	−0.344	−0.606	−0.985	−1.088
	(0.207)	(0.528)	(0.775)	(0.842)

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 are 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; and "wife-shared," in which one spouse reports wife and the other reports shared equally.

of intrahousehold bargaining power is driven by these three characteristics. Age and education also positively affect bargaining power but with a smaller magnitude. Notably, personality traits also matter: higher scores in conscientiousness and openness lead to more bargaining power, while higher scores in extraversion, stability, and agreeableness lead to less bargaining power (Flinn, Todd, and Zhang 2018; Jiang, Peng, and Yan 2024).

Table 6 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. In any given year, coefficients exhibit a monotonically increasing pattern from wife-headed to jointly headed to husband-headed households. Therefore, financial heads have disproportionally large bargaining power in household portfolio decisions. However, without a proper simulation exercise, it is difficult to interpret the coefficients' contribution to bargaining power. We will perform this exercise later in Section 3.5.

Table 7 reports the estimates for the rest of the model.[23] 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. Similarly, the coefficients for the log of net wealth and the squared term are both negative. Meanwhile, the effects of age and cognitive ability on participation cost are both negative, indicating

[23] Table A.6 in the Internet 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.

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Table 7
Model estimates for the rest of the parameters in the bargaining equation

Parameter	Value	SE	Parameter	Value	SE
Participation cost (AU$100)			*Risk measure equation*		
c_0(Intercept)	5.367	0.091	σ_ξ	2.623	0.051
c_1(log HH earning)	−0.023	0.006	ρ_ξ	−0.980	0.005
c_2(log HH earning, squared)	−1.055	0.051	ζ_0^h	−0.245	0.012
c_3(log net wealth)	−0.020	0.005	ζ_0^f	−0.192	0.009
c_4(log net wealth, squared)	−0.007	0.003	ζ_1^h	0.317	0.005
c_5(Age/10)	−0.017	0.002	ζ_1^f	0.268	0.003
c_6(Age/10, squared)	−0.034	0.003			
c_7(Education)	0.014	0.002	*General parameters*		
c_8(Cognition)	−0.120	0.018	σ_ϵ	0.550	0.042
c_9(No. children in HH)	0.141	0.021	σ_a	2.115	0.023
c_{10}(2010)	0.326	0.053			
c_{11}(2014)	1.089	0.077			
c_{12}(2018)	15.000	0.842			

This table reports estimates for the rest of the parameters in the bargaining equation. 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 the bargaining equation; σ_a is the standard deviation of the measurement error term for the log asset.

that stock market participation decisions are easier for households with more experienced and intelligent 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, consistent with estimates from the previous literature.[24]

The upper-right panel of Table 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.[25] The lower-right panel of Table 7 reports the other parameters.

To highlight the differences between structural estimation results and ordinary least squares (OLS) regression results, Table A.4 in the Internet Appendix regresses financial headship on various observed characteristics. Overall, OLS regression results exhibit both similarities and differences with the structural estimation results. For example, in both methods, education and cognitive ability positively contribute to bargaining power. However, factors

[24] For example, Vissing-Jørgensen (2003) finds that a per-period cost of $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-Jørgensen (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.

[25] 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.

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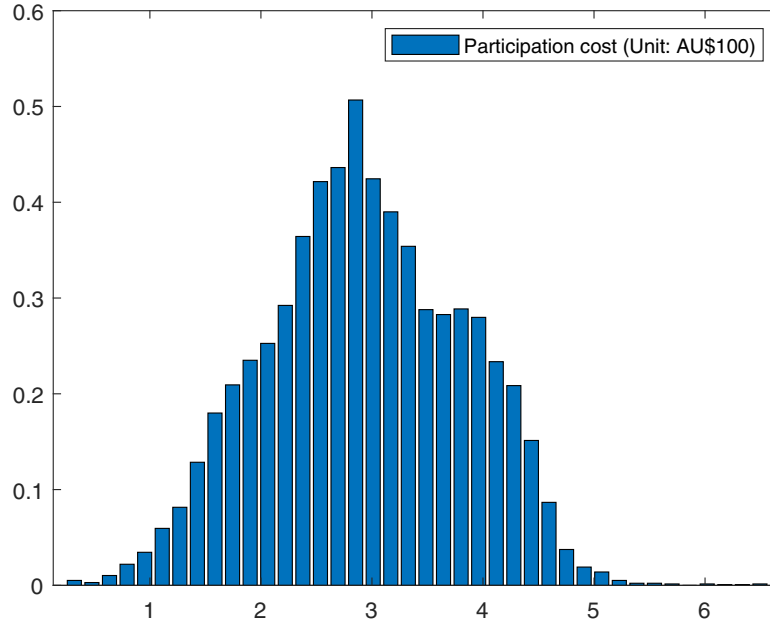

Figure 2
Distribution of participation cost (Unit: AU$100)
The figure shows the histogram of participation costs for each household. The x-axis represents the participation costs (Unit: AU$100). The y-axis represents density. The participation costs are defined in Equation (3).

such as age, employment, and earnings do not have a significant effect on bargaining power in OLS regressions. Therefore, the structural approach we take can lead to different conclusions on the determinants of bargaining power.

3.2 The model's goodness of fit

In this section, we compare the conditional moments from the model simulation and those from the real data to examine whether the model does a good job of 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 holdings. We calculate both variables for each household, average them by household head types and risk preferences, and compare the average values across different groups. Table 8 reports the results: the first two columns concern stock market participation, and the last two concern the level of risky asset holdings for the subgroup of households invested in the stock market. 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 its empirical distribution

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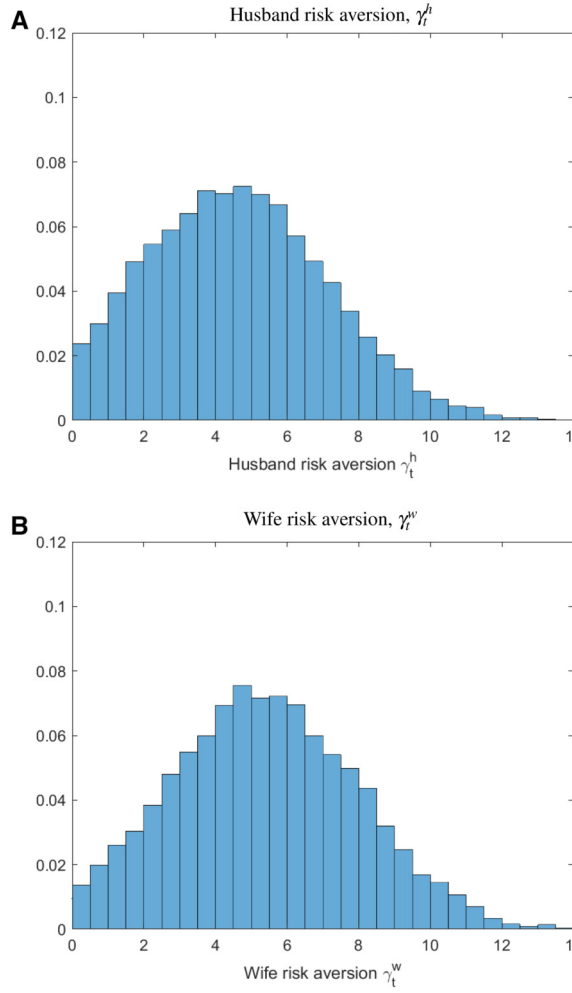

Figure 3
Distribution of risk aversion
This figure plots the distribution of the estimated risk aversion for both husbands (panel A) and wives (panel B) as a histogram. The x-axis represents the value of risk aversion. It is nonnegative, and a larger value means greater risk aversion. The y-axis represents density.

(in blue histogram) for households holding positive risky assets. Overall, the model does a good job of capturing the empirical distribution of risky asset holdings.

3.3 Gender asymmetry and its sources

Next, we quantify the distribution of bargaining power between husband and wife through a series of simulation exercises. In each exercise, we shut down part of the model and focus on the mechanism we are interested in. We then

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Table 8
Marginal distributions of portfolio choice

	Stock market participation		Risky asset (log value)	
	Sim	Data	Sim	Data
By the financial head of the household				
Husband-headed	0.659	0.642	10.56	11.03
Husband-shared	0.531	0.535	10.16	10.24
Jointly headed	0.466	0.447	9.99	9.74
Wife-shared	0.433	0.429	10.00	9.51
Wife-headed	0.461	0.424	10.11	9.95
By husband's risk preference				
Risk-taking	0.575	0.561	10.25	10.24
Risk-averse	0.334	0.319	9.64	9.20
By wife's risk preference				
Risk-taking	0.606	0.592	10.31	10.31
Risk-averse	0.375	0.361	9.77	9.48

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 risky asset holdings. We simulate bargaining weights and financial decisions for each household. In the upper panel, we average these outcomes 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 as 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 as 4.

simulate both the distribution of bargaining power and the two key moments of financial decisions. The benchmark case is when spouses have an equal say, with a 50-50 split in the distribution of bargaining power. This means setting $\beta = 0.5$ for all households, and the first line of Table 9 presents the results. In this benchmark case, the stock market participation rate is 44.8%, substantially lower than the actual number (48%). Similarly, the holdings of risky assets are also lower than the actual moment.

The next line presents our full heterogeneity case, including 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 60%, whereas the wife's is 40%.[26] This suggests a 20-percentage-point gap in bargaining power; in relative terms, this suggests that husbands, on average, have 50% greater bargaining power than wives. The fact that husbands have more bargaining power, combined with them having lower risk aversion on average, implies a stock market participation rate higher than the benchmark case. Indeed, the simulated stock participation rate has increased to 49.1%, close to the actual number (48%).

[26] It is worth noting that this goes in the opposite direction of the OLS regression results in Table 3, in which the risk aversion of the wife has stronger explanatory power for stock market participation. In Section A.6 of the Internet Appendix, we confirm that both measurement errors in risk preferences and the treatment of household heterogeneity contribute to these observed discrepancies.

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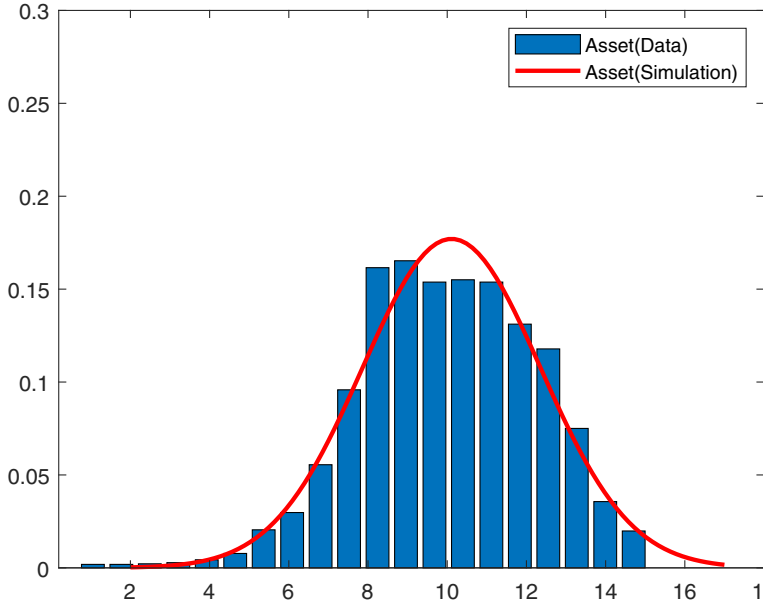

Figure 4
Distribution of the risky asset, log(*a*)
This figure plots the distribution implied by the model (in red line) against the empirical distribution (in blue histogram). The x-axis represents the log value of the risky asset. The y-axis represents density. The asset value is top-coded in the HILDA 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.

The next two lines present the two cases in which we consider only gender effects and only spousal differences in observable characteristics. Overall, both channels matter, with each channel alone generating a 14-percentage-point (57% vs. 43%) gap and a 10-percentage-point (55% vs. 45%) gap in bargaining power, respectively. Therefore, observable differences do not fully explain the gender gap: although the typically higher income and better employment status of husbands can partially justify their greater bargaining power, about half of the gap remains unexplained and can be traced to gender effects. Our subsequent analysis speaks to the sources of this gender effect.

The rest of Table 9 reports the explanatory power of each variable alone.[27] Because of the potentially significant covariance between variables, the sum of all individual effects would not equate to the total effect. Income and employment appear to be the main contributors to the cross-sectional variations

[27] Household unobserved heterogeneity μ, in principle, could affect the gender gap in bargaining power. However, since we have restricted $E[\mu]=0$, this channel does not affect the average gender gap in the population by construction. Our decomposition exercise confirms this result. We, therefore, ignore the impact of μ in our following analysis.

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Table 9
Source of bargaining power heterogeneity

	Bargaining weight (β_t^H)		Stock	Risky asset
	Mean (1)	SD (2)	participation (3)	(log values) (4)
Equal weight ($\beta=0.5$)	0.500	0.000	0.448	9.97
All heterogeneity	0.600	0.226	0.491	10.11
Gender effects (δ_{jt}^H)	0.567	0.147	0.465	10.03
All observed variables (δ_x)	0.551	0.146	0.464	10.00
Age	0.520	0.036	0.450	9.97
Education	0.513	0.343	0.532	10.36
Employment	0.542	0.255	0.510	10.63
Earning	0.562	0.242	0.497	10.21
Cognitive ability	0.540	0.116	0.461	9.99
Extraversion	0.470	0.179	0.465	10.02
Agreeableness	0.485	0.036	0.448	9.97
Conscientiousness	0.496	0.026	0.447	9.97
Stability	0.500	0.022	0.450	9.97
Openness	0.498	0.026	0.448	9.97

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 change one particular component each time in the bargaining equation and simulate the bargaining weight and financial decisions (stock market participation and the level of risky 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 an equal say about financial decisions with the bargaining power of $\beta=0.5$ in our model. The next line presents the full heterogeneity 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.

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. Therefore, 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. Overall, the net effect of observed characteristics is dominated by income and employment and leans toward husbands, resulting in more bargaining power for husbands in financial matters.

In our model, we take the spousal differences in individual characteristics as given and attribute all the gender effects to the fixed effects. Some other papers may adopt a relatively broader concept and attribute the observed gender difference in characteristics as additional sources of gender effects as well (Bertrand, Kamenica, and Pan 2015). In reality, spousal differences are also likely to capture a gender effect, which we do not model. In this regard, our estimated gender effect can serve as a lower bound for the gender gap in bargaining power.

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3.4 Correlated risk preferences

One concern with survey-elicited risk attitudes is that, within a household, one's reported risk attitude may partially reflect the risk attitude of one's spouse. It has also been shown that a couple's risk preferences tend to converge over time (Serra-Garcia 2022). So far, we have allowed for correlated measurement errors in the risk measurement specification in Equation (7). To address the above issues more explicitly, we consider an extended specification for risk measurement:

$$\begin{aligned}\log \overline{\gamma}_t^h &= \zeta_0^h + \left(\zeta_1^h + \zeta_{1d}^h \text{Duration}_t\right)\log \gamma_t^{\,h} + \left(\zeta_2^h + \zeta_{2d}^h \text{Duration}_t\right)\log \gamma_t^{\,w} + \xi_t^h \\ \log \overline{\gamma}_t^w &= \zeta_0^w + \left(\zeta_1^w + \zeta_{1d}^w \text{Duration}_t\right)\log \gamma_t^{\,w} + \left(\zeta_2^w + \zeta_{2d}^w \text{Duration}_t\right)\log \gamma_t^{\,h} + \xi_t^w\end{aligned}, \tag{11}$$

where Duration_t is measured as the duration of the marriage in years.

The above specification allows us to consider three nested specifications. The *Baseline* case is when $\zeta_{1d}^h = \zeta_{1d}^w = \zeta_2^h = \zeta_2^w = \zeta_{2d}^h = \zeta_{2d}^w = 0$, which degenerates to the same specification as in Equation (7). In this case, one's reported risk preference has three terms: a constant term, one's own true risk preference with a constant loading parameter, and an error term that is time-varying. Then, we have the *Intermediate* case, represented by $\zeta_{1d}^h = \zeta_{2d}^h = \zeta_{1d}^w = \zeta_{2d}^w = 0$, an individual's reported risk preference is influenced not only by their true risk preference but also by their spouse's true risk preference. However, the coefficients for the true risk preferences remain constant in this case. Lastly, the *Full* case maintains the *Intermediate* model's structure but with coefficients for the true risk preferences varying based on the duration of the marriage.

For each of the three specifications, we estimate using MLE. Table 10 reports the results. Comparing between *Baseline* and *Intermediate*, we see that ζ_2^h and ζ_2^w are both positive and significant, suggesting that self-reported risk preference indeed captures the spouse's risk preference. However, the predominant source of variation continues to be one's own risk preference. Further comparing between *Intermediate* and *Full*, we see that marriage duration also matters. For each additional year of marriage, a husband would decrease their own weight by 4% (ζ_{1d}^h/ζ_1^h) and increase their spouse's weight by 6% (ζ_{2d}^h/ζ_2^h) when reporting their risk preference. However, a wife would reduce their own weight by 2% (ζ_{1d}^w/ζ_1^w) and increase their spouse's weight by 9% (ζ_{2d}^w/ζ_2^w). In Table 10, the last three lines present p-values for likelihood ratio (LR) tests and show the *Full* case, given the added flexibility from the extra parameters, indeed fits the data better. Table 11 presents the distribution of bargaining power across the three specifications. For all specifications, our main finding remains the same: there is a significant and substantial gender gap in bargaining power in intrahousehold financial decisions. Therefore, our conclusion is robust to the above considerations about correlated risk aversions between spouses and marriage duration.

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Table 10
Parameter estimates under alternative heterogeneity specifications

	(1) *Baseline*	(2) *Intermediate*	(3) *Full*
ζ_0^h	−0.236	−0.429	−0.348
	(0.013)	(0.017)	(0.013)
ζ_0^w	−0.195	−0.527	−0.515
	(0.011)	(0.016)	(0.019)
ζ_1^h	0.317	0.304	0.229
	(0.005)	(0.005)	(0.004)
ζ_1^w	0.267	0.281	0.296
	(0.003)	(0.004)	(0.004)
ζ_2^h		0.042	0.031
		(0.003)	(0.002)
ζ_2^w		0.035	0.033
		(0.002)	(0.003)
ζ_{1d}^h			−0.0099
			(0.0004)
ζ_{1d}^w			−0.0045
			(0.0004)
ζ_{2d}^h			0.0018
			(0.0002)
ζ_{2d}^w			0.0030
			(0.0003)
σ_ξ	2.627	2.394	2.671
	(0.061)	(0.059)	(0.064)
ρ_ξ	−0.980	−0.980	−0.980
	(0.008)	(0.007)	(0.005)
Obs.	8,508	8,508	8,508
log L	−14,600	−14,531	−14,444
LR tests		(1) & (2)	(2) & (3)
p-value		<.001	<.001

This table reports estimates of three nested model specifications. The *Baseline* case is when $\zeta_{1d}^h = \zeta_{1d}^w = \zeta_2^h = \zeta_2^w = \zeta_{2d}^h = \zeta_{2d}^w = 0$, which reduces to the original specification in Section 3.2. In the *Intermediate* case, represented by $\zeta_{1d}^h = \zeta_{2d}^h = \zeta_{1d}^w = \zeta_{2d}^w = 0$, an individual's reported risk preference is influenced not only by their true risk preference but also by their spouse's true risk preference. However, the coefficients for the true risk preferences remain constant in this case. Lastly, the *Full* case maintains the *Intermediate* model's structure but with coefficients for the true risk preferences varying based on the duration of the marriage. Standard errors are reported in parentheses. The row labeled log L displays the likelihood values for the three specifications. The "p-value" row presents the results of the likelihood ratio (LR) test, evaluating the current specification against the preceding one.

Table 11
The distributions of bargaining weights

	(1) *Baseline*	(2) *Intermediate*	(3) *Full*
10%	0.287	0.180	0.167
25%	0.431	0.328	0.383
50%	0.604	0.642	0.688
75%	0.781	0.872	0.882
90%	0.909	0.951	0.961
Mean	0.598	0.598	0.621

The distribution of simulated bargaining weights attributed to husbands across the three specified specifications.

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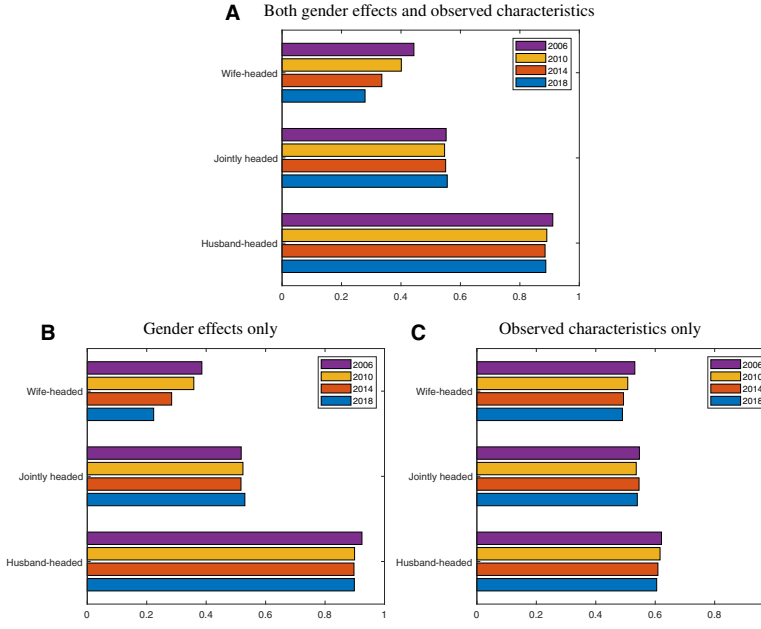

Figure 5
Husband's bargaining power, by financial head structure
The figure plots the average bargaining power a husband has across household head types. "Husband-headed" represents the group in which both spouses report the husband makes financial decisions; "jointly headed" represents the group in 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. Panel A plots, for each household type in any given wave, the average bargaining power a husband has in the baseline model. Panel B reports the simulated average husband bargaining weight when we retain gender effects, and panel C reports the simulated average husband bargaining weight when we retain the heterogeneity from the observed characteristics.

3.5 Bargaining power across household head types

Figure 5, panel A, plots, for each household type in any given wave, the average bargaining power of a husband. Because of the monotonic trend of average bargaining power across different household types, we omit husband-shared and wife-shared without losing material information.[28] 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.

In terms of time-series patterns, wives' bargaining power has been steadily increasing over time. This finding aligns well with the global trend of women's increasing influence within households. For example, Guiso and Zaccaria (2023) find that, over the past 25 years, there is a gradual shift among Italian

[28] 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.

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families from a predominantly male-dominated "patriarchy" equilibrium to a more balanced "partnership" arrangement. This increase in bargaining power is particularly pronounced among wife-headed households, where wives' average bargaining power has increased from 53.6% in 2006 to 71.3% in 2018. In comparison, among husband-headed households, husbands' bargaining power has decreased from 92.9% in 2006 to 90.5% in 2018.

Figure 5, panels B and C, further decomposes bargaining power into two sources: gender effects and observable spousal differences. Figure 5, panel B, demonstrates the bargaining power solely attributed to gender effects, while Figure 5, panel C, shows the bargaining power arising exclusively from observable characteristics. While both can explain some heterogeneity in bargaining power across household types, gender effects emerge as the predominant contributor to this variation. Upon closer examination of Figure 5, panel B, it becomes evident that the gender effect primarily manifests within husband-headed households. In such cases, husbands retain an additional bargaining weight (about 0.3) beyond what is implied by their observable characteristics, an effect that has been persistent over time. In contrast, in wife-headed households, while wives retain more bargaining power than their spouses, the magnitude of this additional weight is notably smaller.

The patterns plotted in Figure 5 have two main implications. First, they directly compare our revealed-preference 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, Kassenboehmer, and Shields 2016). Qualitatively, our findings are consistent with this approach: 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 than his spouse's, but it could also arise because of a greater gender effect. Our structural model quantitatively compares the relative importance of these two channels and demonstrates that the gender effect is a much more important channel than observable differences in explaining heterogeneity in bargaining power across household types.

It is important to note that the choice of the financial head is clearly endogenous. In our current specification, we treat the financial head as a household characteristic without specifying the underlying process that determines it. While a full consideration of this issue is beyond the scope of this

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paper, below in Section 4.1, we show that an important consideration is gender norms. When perceived gender norms become more egalitarian, the household is more likely to have the wife as the financial head, resulting in the wife having more bargaining power in portfolio choice.

4. Discussion

4.1 Sources of the gender effect

We investigate the possible mechanisms underlying the gender effect. The literature has shown that traditional gender norms—for example, the perception that finance is a men's business—constrain women's say and participation in portfolio decisions (Ke 2018; Guiso and Zaccaria 2023). In our setting, this means that in a household with more traditional gender norms, the household's portfolio choice would disproportionally reflect the husband's risk preference, not the wife's.

To test this hypothesis, we directly measure perceived gender norms for each household. As detailed in Section A.5 of the Internet Appendix, the HILDA Survey asks three specific questions about attitudes toward gender norms to both the husband and the wife. The three questions elicit attitudes about the division of labor ("it is better for everyone involved if the man earns money and the woman takes care of the home and children"), the share of housework in the family ("if both partners in a couple work, they should share equally in the housework and care of children"), and the mother's role ("whatever career a woman may have, her most important role in life is still that of being a mother"). Answers to each question are measured on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree).[29] We recode all variables so that a higher value represents a more traditional view of gender norms.

We regress simulated bargaining weights of husbands (β_t^h) on household-level proxies of gender norms and report the regression results in Table 12. Column 1 represents the baseline specification, and column 2 adds additional controls for individual and household characteristics. Consistent with the view that traditional gender norms limit women's bargaining power, we find that, in households associated with more traditional gender norms, the husband tends to have greater bargaining power. Such effects are not limited to the husband's perception: when the wife agrees with a more traditional view of gender norms, it also increases the husband's bargaining power. From a policy point of view, this means that it is important to bring awareness to both women and men when promoting more egalitarian intrahousehold dynamics.

Another way to see the effect of perceived gender norms is through the results in column 3, which regresses the husband-headed dummy variable on perceived gender norms. Recall that in Section 3.5, we showed that the gender

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

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Table 12
Gender norms and bargaining weights

	Bargaining weight of husbands		Husband-headed
	(1) Only gender norms	(2) With controls	(3) With controls
Division of labor (husband)	0.001	0.003***	0.004**
	(0.001)	(0.001)	(0.002)
Share housework (husband)	0.004***	−0.000	0.009***
	(0.001)	(0.001)	(0.002)
Mother's role (husband)	−0.001	0.001	0.011***
	(0.001)	(0.001)	(0.003)
Division of labor (wife)	0.005***	0.004***	−0.001
	(0.001)	(0.001)	(0.003)
Share housework (wife)	−0.002	−0.001	0.003
	(0.001)	(0.001)	(0.002)
Mother's role (wife)	0.005***	0.002**	0.007***
	(0.001)	(0.001)	(0.002)
Observations	8,378	8,378	8,378

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 7-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 Internet Appendix for more details). The dependent variable in columns 1 and 2 is the simulated bargaining weight from in the bargaining equation, which is the same as the one shown in Figure 5, panel A. Column 1 reports the results of a simple OLS regression of this simulated bargaining weight of husbands on both husbands' and wives' gender norm questions. Column 2 includes extra controls: age, education, household income, household wealth, cognitive ability, and personality traits. Column 3 regresses the dummy variable indicating a husband-headed household on perceived gender norms. Robust standard errors are in parentheses. $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$.

effect toward men is the strongest among husband-headed households. Column 3 shows that, consistent with the role of gender norms in shaping intrahousehold bargaining power, households with more egalitarian views of gender norms are less likely to select the husband as the household head, resulting in women having more say in financial decisions.

4.2 Division of labor

We have shown that, when making financial decisions, husbands have disproportionally high bargaining power compared with their wives, and we argue that an important driver of this gender gap is traditional gender norms. Traditional gender norms would then imply husbands have high bargaining power in other domains of household decisions besides financial decisions. An alternative explanation for the observed gender gap is Becker's theory on the division of labor: men specialize in certain domains (such as decisions on financial matters), whereas women specialize in other domains (such as daily shopping decisions) (Becker 1985; Becker and Murphy 1992; Pollak 2012; Chiappori and Lewbel 2015). In other words, wives' less bargaining power in financial matters may be compensated by having more bargaining power elsewhere. Indeed, if utility is ultimately derived from consumption and women have more say in consumption, the gender gap we have documented may be less relevant from a welfare point of view.

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Table 13
Correlation between responses to household investment decisions and other household decisions

Domain	Correlation with savings, investment, and borrowing
Managing day-to-day spending and paying bills	0.52
Making large household purchases	0.53
The number of hours spent in paid work	0.22
The number of hours partner/spouse spent in paid work	0.12
The way children are raised	0.04
Social life and leisure activities	0.04

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; and (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; and "wife-shared," in which one spouse reports wife and the other reports shared equally.

To test this hypothesis, we utilize another feature of the HILDA Survey. Besides questions about the financial head, 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. To the extent these survey responses indeed capture bargaining power in their respective decision domains, we can use them to examine whether a division of labor exists.

Table 13 shows the correlation between the response 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 first two domains of "spending and bills" and "large household purchases." Therefore, it does not appear that women's low bargaining power in portfolio decisions is compensated by having more bargaining power in consumption decisions. The correlation between the "savings, investment and borrowing" domain and the other four domains is considerably weaker, indicating investment decisions are orthogonal to decisions on labor supply, child-rearing, and time allocation. Overall, the correlations among decisions in different domains do not support the division of labor story.

4.3 Welfare implications

In our model, utility is defined over wealth. The documented gender gap implies that wives, on average, lose to husbands in expected utility. Notice that even if wives earn higher ex post returns due to the higher risk their partners may have, it is still an ex ante welfare loss for them because they have to bear

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more risk than their own risk preference implies.[30] It is also possible that the greater bargaining power of husbands is justified if they have more skills and are better traders. The evidence, however, is rather thin. If anything, it has been documented that men trade more than women and underperform due to excessive trading (e.g., Barber and Odean 2001).

One alternative rationalization of the gender gap is based on the notion that utility is eventually derived from consumption. If consumption decisions are separated from investment decisions, and wives do not lose out to husbands in consumption decisions, then the gender gap we document has less of a welfare consequence. However, based on survey evidence, Table 13 clearly suggests that investment and consumption decisions are highly correlated and usually made by the same person. Therefore, although we do not show this directly, we conjecture that the gender gap in investment decisions may also extend to consumption decisions.

5. Evidence from Germany and the United States

In this section, we conduct a similar analysis using two additional data sets from Germany and the United States. As explained above, the HILDA survey is the most suitable data set for our analysis, and we need to amend our baseline specification to accommodate the other data sets.

5.1 Germany

For Germany, our analysis uses the German Socio-Economic Panel (GSOEP) survey, a longitudinal survey that is nationally representative and has been conducted annually since 1984. To make this exercise comparable to the previous exercise using HILDA, we select households from the years 2002, 2007, and 2012, all of which collect information about demographics and asset allocation.[31] These variables are then merged with other variables, including risk aversion, personality traits, and cognitive ability, which are only available from other waves.[32] The filters we use are detailed in Section E.1 of the

[30] Our results may initially appear to be contradictory to those in Guiso and Zaccaria (2023), who show that more egalitarian norms increase participation in financial markets, equity holdings, and returns on investments. However, notice that we do not make any claims about ex post returns. Furthermore, in our model, bargaining power is applied directly to risk aversion. In comparison, Guiso and Zaccaria (2023) are concerned with bargaining power in general, which not only works through the margin of risk aversion but could also work through margins, such as financial literacy, education, and sophistication.

[31] While demographic information is collected every year, asset information is collected every 5 years. Following Gröbel and Ihle (2018), total household wealth has eight components: owner-occupied property, other properties (both including debts), financial assets, building loan contracts, private insurance, 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?"

[32] We collect measures of risk aversion from the most adjacent waves, namely, the years 2004, 2009, and 2014. Similarly, personality traits come from the years 2009, 2012, 2013, and 2017. Cognitive ability comes from the years 2006, 2012, and 2016. For both personality traits and cognitive ability, we take the average values across waves by implicitly assuming that both measures are persistent at the individual level.

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Internet Appendix. The final sample has 5,843 household-wave observations, representing 3,502 unique households.

Although GSOEP has a similar design to HILDA, a few significant differences are worth noting. First, in GSOEP, information on household stock market participation only pertains to whether or not the household participates (the extensive margin) and does not include the amount of equity investment (the intensive margin). As a result, we revise our model accordingly so that the likelihood function does not depend on choices on the intensive margin. Second, the measure of risk preference has a different metric. In GSOEP, individuals report their willingness to take risks in financial matters using an 11-point scale, with zero indicating complete unwillingness to take risks and 10 indicating complete willingness to take risks.[33] Third, GSOEP does not have information on the final decision-maker within the household, and we degenerate the gender effect to be an intercept term for each wave in our model. We perform maximum likelihood estimation using a likelihood function similar to Equation (10). Estimated parameters and goodness of model fit are reported in Appendix E.2. 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 one performed in Subsection 3.3.

Table 14 reports the results, where we find a greater gender gap in bargaining power in Germany. For the average household, the husband's bargaining weight is 60% in Australia but 69% in Germany. However, the difference in the average bargaining weight between these two countries is statistically insignificant at a 95% confidence level.[34] Our decomposition exercise further shows that the greater gender gap in Germany is due to more pronounced gender effects, not due to differences in individual characteristics between husband and wife. Indeed, in both countries, gender differences in observable characteristics, such as wages and employment status, have a similar effect on the gender gap in bargaining power.

5.2 The United States

For the United States, we use data from the Health and Retirement Study (HRS), a nationally representative longitudinal survey of households aged 50 and above. Similar to GSOEP, the HRS collects data on wealth, income, asset allocation, and other demographic variables. In addition, the HRS elicits risk aversion measures using a question of hypothetical income-gamble questions. Specifically, respondents are asked a series of questions about whether they would be willing to accept equal probability gambles that would either increase or decrease their income. We follow Kimball, Sahm, and Shapiro (2008)

[33] There are also similar risk attitude 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.

[34] We will revisit and elaborate on this point at the end of this section.

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Table 14
Comparison of bargaining power heterogeneity between Australia, Germany, and the United States

	Australia		Germany		US	
	Bargaining weight (β_t^H) (1)	Stock participation (2)	Bargaining weight (β_t^H) (3)	Stock participation (4)	Bargaining weight (β_t^H) (5)	Stock participation (6)
Equal weight ($\beta=0.5$)	0.500 [0.500,0.500]	0.429 [0.399,0.496]	0.500 [0.500,0.500]	0.206 [0.180,0.231]	0.500 [0.500,0.500]	0.352 [0.204,0.496]
All heterogeneity	0.600 [0.589,0.611]	0.491 [0.444,0.539]	0.685 [0.582,0.788]	0.279 [0.249,0.309]	0.609 [0.507,0.711]	0.384 [0.252,0.507]
Gender effects (δ_{jt}^H)	0.567 [0.558,0.577]	0.465 [0.416,0.514]	0.837 [0.765,0.909]	0.232 [0.204,0.260]	0.622 [0.541,0.703]	0.356 [0.207,0.498]
All observed variables (δ_x)	0.551 [0.544,0.557]	0.464 [0.417,0.510]	0.549 [0.504,0.594]	0.238 [0.213,0.263]	0.582 [0.559,0.607]	0.358 [0.215,0.495]

This table quantifies the distribution of bargaining power between husband and wife in Australia, Germany, and the United States. Our method is as follows: we change one particular component each time in the bargaining equation and simulate the bargaining weight and financial decisions (stock market participation and the level of risky asset holdings) for each household. To obtain the 95% confidence interval (displayed within brackets), we implement a bootstrap method that involves drawing sets of parameters randomly from their estimated distributions. For each set of drawn parameters, we simulate the outcomes, namely, stock market participation, the level of risky asset holdings, and bargaining power, for each household. This process of drawing and simulation is repeated $R=200$ times, providing us with a distribution of sample averages for the three aforementioned outcomes. Subsequently, we calculate the 2.5nd and 97.5th percentiles of this bootstrap distribution, which enables us to construct a confidence interval for each outcome. Columns 1 and 2 report the average bargaining weights and stock market participation rate in Australia. Columns 3 and 4 report the average bargaining weights and market participation rate in Germany. Columns 5 and 6 report the average bargaining weights and market participation rate in the United States. The first two lines present the benchmark case, in which spouses have an equal say about financial decisions with the bargaining power of $\beta=0.5$ in our model. The next two lines present the full heterogeneous case in which we consider both gender effects and spousal differences in observable characteristics in our baseline fully fledged model. The next four lines present the cases in which we consider only gender effects and only spousal differences in observable characteristics.

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to impute risk aversion measures.[35] Because the risk aversion question is only asked in earlier waves, our analysis only uses three waves: the years 2002, 2004, and 2006. The filters we use are detailed in Section F.1 of the Internet Appendix. The final sample has 7,014 household-wave observations, representing 2,664 unique households.[36]

A few differences are worth noting in the analysis of the HRS data. First, since the HRS only follows people over the age of 50, this sample is not directly comparable to earlier samples in Australia and Germany. Second, the risk aversion measure is imputed from responses to income gambles rather than the subjective assessment of risk-taking attitude in financial decisions. Third, the HRS has collected information related to cognitive function across waves. Since 2006, the HRS has also collected information on personality traits. However, if we were to include information on cognition and personality traits, we would lose two-thirds of the sample. So, we decide not to include them in the sample. Finally, the HRS only asks who the final decision-maker within the household is in its initial wave in the year 1992, which is much earlier than the period we focus on. As a result, we exclude this variable from our estimation.

We perform a maximum likelihood estimation and report our estimated parameters and goodness of model fit in Internet Appendix F.2. We then use the estimated model to quantify the distribution of bargaining power between husband and wife and report the results in Table 14. For an average household, the husband's bargaining weight is 61%, similar to the weight in Australia (60%) but smaller than the weight in Germany (69%).

Comparing across Australia, Germany, and the United States, Table 14 shows that the gender effect is most pronounced in Germany, consistent with Germany having the most traditional gender norms out of the three countries (Ke 2018). We note, however, that at the 95% confidence level, we cannot reject the hypothesis stating that the average bargaining power is statistically indistinguishable across the three countries. This is primarily attributable to the noticeably broader confidence intervals for the United States and Germany.[37]

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[35] Kimball, Sahm, and Shapiro (2008) develop a method that could eliminate measurement error and consistently measure risk aversion for all respondents over survey waves between 1992 and 2002.

[36] The total household wealth has nine components: primary residence; real estate (not the primary residence); vehicles; business; stocks, mutual funds, and investment trusts; checking, savings, or money market accounts; CD, government savings bonds, and Treasury bills; bonds and bond funds; and all other savings. Stock market participation is constructed as a dummy variable based on the following question: "Do you [or your (husband/wife/partner)] have any shares of stock or stock mutual funds?"

[37] This lesser precision aligns with our expectations, given that we obtain fewer observed characteristics that could generate heterogeneity in bargaining power across households in HRS and GSOEP. Hence, the standard error of the random component in the bargaining equation, denoted as σ_ϵ, is significantly greater in HRS ($\sigma_\epsilon = 1.997$) and GSOEP ($\sigma_\epsilon = 1.618$), than in HILDA ($\sigma_\epsilon = 0.550$).

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6. 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 longitudinal surveys from three countries: Australia, the United States, and Germany. We find substantial gender gaps in bargaining power in all three countries.

We find that the average Australian household incorporates 60% of the husband's preference but only 40% of the wife's, implying a 20-percentage-point gap in bargaining power. Half of this gender gap is driven by observable characteristics, such as income and employment, while the other half 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 the other two countries, the average bargaining power for husbands is 69% in Germany and 61% in the United States.

Several limitations should be noted about the current paper. First, our portfolio choice model is static, and future models can be extended to a dynamic model. This type of extension can also allow for bargaining over time preference. Second, bargaining in our model happens over risk preferences, but in theory, household members can bargain along other dimensions, such as expectations. Third, we assume full commitment in our model, and future work can allow for limited commitment to examine other determinants of bargaining power once spouses can be threatened with divorce.

Code Availability: The replication code is available in the Harvard Dataverse at https://doi.org/10.7910/DVN/WGMDNM.

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