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Household investment decisions and offspring gender: parental accounting

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Numerous behavioural factors have been identified as having an impact on household stockholding decisions. Given there is both theoretical and empirical evidence to support the premise that offspring gender can influence specific types of parental preferences, I test the theory that offspring gender has an effect on parental investment decision-making. I find that offspring gender does influence household stock market participation. Specifically, I find that having only female offspring can significantly increase the probability of stockholding. Given stockholding can have large effects on household wealth levels and that family wealth levels affect intergenerational transfers, this finding could have important implications for understanding distributional welfare issues.

Keywords: investments; stockholding; offspring; parental behaviour

JEL Classification: G11; D14

I. Introduction

> *There are two kinds of fathers in traditional households: the fathers of sons and the fathers of daughters … Letty Cottin Pogrebin (20th Century Writer)*

For several decades, finance scholars have been investigating investment decision-making behaviour and attempting to reconcile observed investment behaviour with theoretical asset pricing models. The determinants of stock market participation has been one of the key questions of interest. For example, with regard to stockholding behaviour, individual/household stock market participation is much lower than would be predicted by the consumption Capital Asset Pricing Model (CAPM) and other models, given the risk-adjusted expected returns from holding stock. Historically, portfolio choices of stock have been vital to economic advancement and wealth building. However, not all of the cross-sectional variation in portfolio behaviour has been explained in the empirical finance literature on portfolio choice. Household characteristics that influence portfolio choice could lead to distributional welfare issues that are important to understand (Bogan and Fertig, 2013, forthcoming). This article investigates an influence on household decision-making that has received comparatively less attention: the role of offspring gender.

Several determinants of household stock market participation have been well established. Stock market participation is strongly increasing in wealth, increasing in household education, sensitive to transaction costs and influenced by neighbour and peer effects (Haliassos and Bertaut, 1995; Bertaut and Haliassos, 1997; Hong *et al.*, 2004; Bogan, 2008; Brown *et al.*, 2008). Bertaut and Haliassos (1997) show that participation costs are affected by the degree of risk aversion, labour income

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risk and bequest motives. Both physical health (Rosen and Wu, 2004) and mental health (Bogan and Fertig, 2013, forthcoming) influence stockholding behaviour. Further, behavioural factors have been empirically identified as having an impact on stockholding decisions. Malmendier and Nagel (2011) find behavioural factors due to experiencing macroeconomic shocks to affect stockholding and bondholding decisions. Bogan *et al.* (2013, forthcoming) find that traumatic experiences influence risky asset holding behaviour.

In general, gender has been shown to be a key issue within the area of investment behaviour. There is an expanding body of literature that documents evidence of (decision-maker) gender linked biases that influence investment decision-making (Jianakoplos and Bernasek, 1998; Fehr-Duda *et al.*, 2006; Croson and Gneezy, 2009). Barber and Odean (2001) specifically document that overconfidence affects male trading and investment behaviour. Correspondingly, they show that marriage ameliorates some of the behavioural biases males express with respect to investment decisions.

There is both theoretical and empirical evidence to support the premise that offspring gender influences specific types of parental preferences (Lundberg and Rose, 2002; Washington, 2008; Oswald and Powdthavee, 2010). When these types of preferences (biases) affect investment decisions, there is a clear link between offspring gender and financial decisions. Davies and Zhang (1995) show that when bequest constraints bind, investment in offspring education can differ along gender lines. Whereas offspring gender related preferences have been linked to bequests, this is another possible avenue through which child gender and financial decisions could be connected.

Since there is evidence of both gender linked biases that influence investment behaviour and offspring gender linked biases which influence parental behaviour, an open question exists as to whether offspring gender has any effect on household investment decisions. Given investment decisions affect family wealth levels which in turn have an effect on offspring educational attainment, intergenerational wealth transfers and socio-economic status, the relationship between household investment decisions and children is an important topic. In this article, I attempt to add to this area of research by considering the possibility that children can influence parental portfolio allocation. To the best of my knowledge, offspring gender characteristics have not been previously associated with parental stockholding or bondholding. I test the hypothesis that stockholding and bondholding decisions are influenced by offspring gender. I find that having only female children increases the probability of holding stock (risky assets) for married respondents and having only male children increases the probability of holding stock for single females.

The remainder of the article proceeds as follows. Section II gives an overview of related literature. Section III reviews the data used in the empirical analysis. Section IV presents the econometric analysis and discusses the main results. Section V summarizes key findings and provides concluding remarks.

II. Literature Review

Most any person with a sibling of a different gender can attest to the fact that occasionally specific parental decisions *seem* to be influenced by the gender of the child affected by the decision. Downey *et al.* (1994) documented that generalized views on parenting are developed through maternal experiences in the family which are shaped by the sex composition of progeny. More rigorously, within the economics literature, offspring gender has been shown to affect many aspects of parental behaviour: views on issues related to gender equity (Warner, 1991; Warner and Steel, 1999); congressional voting (Washington, 2008); political party preferences (Oswald and Powdthavee, 2010); divorce, fertility and marriage (Dahl and Moretti, 2008); parental labour supply (Lundberg and Rose, 2002); investment in child education (Parish and Willis, 1993).

This article connects with several strands of current economics and finance literature. Many elements of family structure have been linked to aspects of financial decision-making behaviour (see, for example, Smith and Ward, 1980; Browning, 1992; Hao, 1996; Keister, 2003). The number of children a couple has, the average spacing between siblings and the timing of births within a marriage all have been shown to have important impacts on family savings. This relationship between family size and household savings has long been a popular theme in the demographic and development literature and the postulated negative correlation between them is thought to be a contributing factor in limiting capital formation and economic growth. Others have demonstrated that family size is not the relevant constraint with regard to savings and that any savings effects are related primarily to the age of children (Espenshade, 1975). Smith and Ward (1980) find that young children depress savings for young families but increase savings for marriages of duration greater than 5 years. The principal channel through which children act to reduce savings is the decline in female earnings associated with the child-induced withdrawal of wives from the labour force.

Closely related work involves investigations of US asset accumulation data and has indicated that rapid child-bearing early in marriage inhibits asset growth and that these effects persist over a couple's lifetime

(Coombs and Freedman, 1970; Freedman and Coombs, 1996). Keister (2003) explored the relationship between family size in childhood and adults' wealth accumulation patterns. She shows that siblings reduce the material and nonmaterial resources available for each child in a family and that this diminishment of resources reduces educational attainment and direct intergenerational financial transfers. Hao (1996) finds that family net wealth varies with family structure along three lines, marriage – remarriage, marriage – cohabitation and male – female single parenthood and that marriage is a wealth-enhancing institution. Chiteji and Stafford (1999) find that a young family's likelihood of owning transaction accounts and stocks is affected by whether parents held these financial assets. Love (2010) shows that a family shock with respect to marital status has an impact on portfolio choice and household savings.

III. Data

Overview

To empirically evaluate the question of whether offspring gender influences investment decisions, I use US data from the National Longitudinal Survey of Youth 1979 (NLSY79). The NLSY79 is a nationally representative sample of young men and women who were 14–22 years old when they were first surveyed in 1979. These individuals were interviewed annually through 1994 and are currently interviewed on a biennial basis. Since their first interview, many of the respondents have made transitions from school to work, and from their parents' homes to being parents and homeowners. These data provide an opportunity to study a large sample that represents American men and women born in the 1950s and 1960s, and living in the United States in 1979. Although a primary focus of the NLSY79 survey is labour force behaviour, the content of the survey is considerably broader. The survey contains questions on income and assets, earnings, occupation, marital status, fertility, family structure, child characteristics, computer use and educational attainment. These types of data make the NLSY79 a good survey to use to address issues relating to portfolio allocation and family structure. I use data collected in the 1979, 1998 and 2004 surveys since those survey years contain the variables relevant to my analysis and allow for controls of lagged variables. A detailed description of all variables used can be found in the Appendix.

Descriptive statistics

Tables 1 and 2 provide summary statistics of the data used in the econometric analysis.[1,2] From Table 1, one can see

Table 1. Summary statistics – respondent characteristics (2004)

	Mean			
		Single		
	Full sample	Females	Males	Married respondents
Average age	43.29	43.24	43.15	43.33
Avg. years of education	13.79	13.45	13.34	13.98
Percent male	51.77	–	–	–
Percent white	60.63	43.08	51.72	67.41
Average net income	$80 500	$43 400	$54 200	$96 500
Average net worth	$253 300	$103 100	$170 700	$312 700
Average savings account value	$18 800	$9 700	$15 900	$22 000
Percent that have voluntary contribution pension	76.45	73.44	70.98	78.52
Percent that own stock	20.85	12.72	14.78	24.44
Percent that own US savings bonds	14.42	10.04	8.20	17.03
Percent that own mutual funds	17.09	12.08	10.82	19.89
Percent that own fixed income securities	0.85	0.89	0.26	0.97
Percent that use computers	81.32	71.88	61.48	88.41
Average number of children	1.80	1.50	1.20	2.02
Respondents	2484	448	379	1657

[1] The interviews record information about the sources and amounts of income received during the past calendar year by the respondent and his or her spouse or partner. Data on income sources of an opposite-sex partner are available beginning in 1990. If a respondent volunteers such information for a same-sex partner, that information also is recorded. Income sources identified include the respondents' and their spouses' or partners' wages and salaries, income from military service, profits from a farm or business, social security, pensions and annuities, and alimony/child support.

[2] All dollar amounts are in real 2004 dollars.

Table 2. Summary statistics – assets and family structure (2004)

	Total respondents with			
	No children	Male and female children	Male children only	Female children only
Net worth				
Mean	230 400	278 000	242 000	238 100
Median	107 800	133 500	140 000	113 800
Net income				
Mean	68 900	85 000	80 700	82 800
Median	53 500	71 600	67 000	67 600
Savings account value				
Mean	21 600	18 600	19 100	16 100
Median	5 000	4 000	5 000	4 500
Home value				
Mean	215 500	238 900	214 700	222 200
Median	173 500	170 000	162 000	170 000
Stock value				
Mean[a]	45 900	57 100	47 800	30 500
Median[a]	16 700	15 000	10 000	10 000
Mutual value				
Mean[a]	53 700	65 500	44 400	41 900
Median[a]	20 000	30 000	25 000	20 000
Fixed income securities value[b]				
Mean[a]	13 300	29 400	15 100	5 900
Median[a]	15 000	18 000	5 000	6 500
US savings bond value				
Mean[a]	3 700	4 200	3 200	2 900
Median[a]	1 500	2 000	2 000	1 500
Average No. of children	–	2.77	1.75	1.72
Percent male	53.44	49.39	54.48	51.92
Percent married	40.89	76.67	70.15	69.02
Percent risk averse	69.07	72.99	73.62	71.02
Observations	494	986	536	468

Notes: [a]Does not include zero values.
[b]Note that there are less than 10 observations of fixed income securities value in each group.

that the average age of the respondent in the sample is 43. Approximately half of the sample is male, over 60 % of the sample is white and respondents have an average of 13 years of education. The average net income is $80 500 and the average net worth is $253 300. Each respondent has an average of approximately two children. Figure 1 shows the distribution of total number of children, total number of sons and total number of daughters. Over 97% of the sample has four or fewer children.

I analyse the full sample but I also will separately study three groups: single male households, single female households and households of married respondents. I separate the sample in this way because empirical evidence suggests that the financial decisions of couples differ from single individuals (Lundberg *et al*., 2003; Kirchler *et al*., 2008; Love, 2010; Bogan and Fertig, 2013, forthcoming) and women have different preferences than men (Browning, 1992; Jianakoplos and Bernasek, 1998; Barber and Odean, 2001; Croson and Gneezy, 2009). Couples are different from single individuals because there may be some bargaining between partners or sharing of decision-making power with respect to financial behaviours (Lundberg *et al*., 2003; Kirchler *et al*., 2008). The fact that men and women have different levels of risk aversion (Jianakoplos and Bernasek, 1998; Croson and Gneezy, 2009) and different discount rates (Browning, 1992; Bradford, 2010) would suggest that men and women prefer different portfolio strategies. In general, these various differences imply that offspring gender effects may have differing impacts on a family's portfolio depending on the household composition. Table 1 also shows the summary statistics for the three subgroups of interest.

The NLSY79 does not indicate whether or not the respondent is the household head or the financial decision-maker. The issue of the financial decision-maker is straightforward with regard to nonmarried respondents. However, a married respondent may or may not be the financial decision-maker for the household. One could conjecture that married respondent response rates for the asset questions could differ in a manner that could influence the results. Figure 2 compares nonresponse rates for

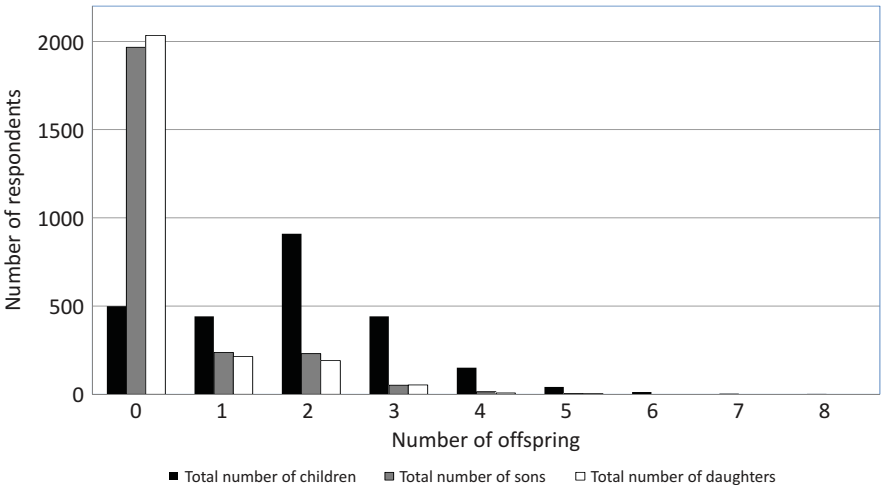

Fig. 1. Number of children per respondent (2004)

the specific questions about stock and bondholding. Overall the percentage of respondents that answered *'Don't Know'* or refused to answer the questions is less than 2.0%. Additionally, from Fig. 2, one can see that for each subgroup less than 1.0% answered '*Don't Know*' to the stock and bondholding questions. However, the nonresponse rate for the married subgroup is generally higher than for the single respondents. I will address this issue in the empirical analysis by analysing married respondents separately.

Table 2 shows the mean and median asset values for respondents by offspring gender. Difference in means tests indicate that for the respondent group with only male children and the respondent group with only female children, there are no statistically significant differences in means for net worth, net income, savings account value, home value, mutual fund value or bond value. Notably, there is a weakly statistically significant difference (p-value of 0.1209) in mean values for the value of stock holdings for the respondent group with only male children and the respondent group with only female children.

Table 3 summarizes asset holdings for respondent subgroups by offspring gender. From Table 3, one can see that for single female and single male respondents, those with no children have the highest percentage of stockholding, mutual fund holding, fixed income security holding and US savings bond holding. For married respondents, those with only female children have the highest percentage of stockholding and fixed income

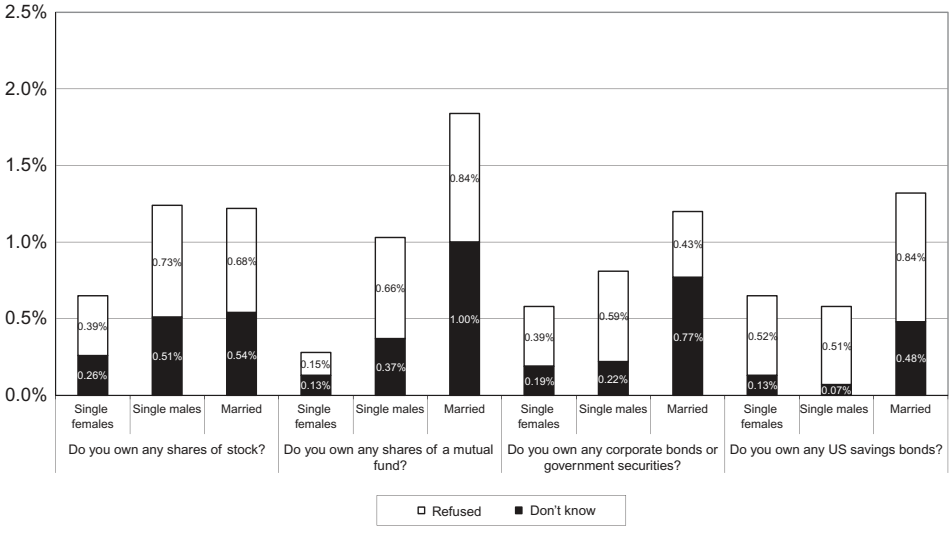

Fig. 2. Nonresponse rates by subgroups (2004)

Table 3. Summary statistics – asset holdings (2004)

	Respondents with			
	No children	Male and female children	Male children only	Female children only
Total respondents				
Percent holding stock	19.03	20.59	22.01	22.01
Percent holding mutual funds	18.81	16.14	19.10	14.99
Percent holding fixed income securities	0.61	0.91	0.75	1.07
Percent holding US savings bonds	12.96	14.62	16.04	13.70
Single female respondents				
Percent holding stock	19.55	8.22	15.91	6.17
Percent holding mutual funds	21.97	6.85	11.36	6.17
Percent holding fixed income securities	2.27	0.00	0.00	1.23
Percent holding US savings bonds	15.04	10.27	4.55	7.41
Single male respondents				
Percent holding stock	18.24	11.90	12.50	12.50
Percent holding mutual funds	14.47	7.14	9.72	7.81
Percent holding fixed income securities	0.00	1.19	0.00	0.00
Percent holding US savings bonds	11.32	7.23	5.56	4.69
Married respondents				
Percent holding stock	19.31	23.94	25.27	27.86
Percent holding mutual funds	20.20	18.94	22.73	18.63
Percent holding fixed income securities	0.00	1.06	1.06	1.24
Percent holding US savings bonds	12.87	16.27	20.74	17.08

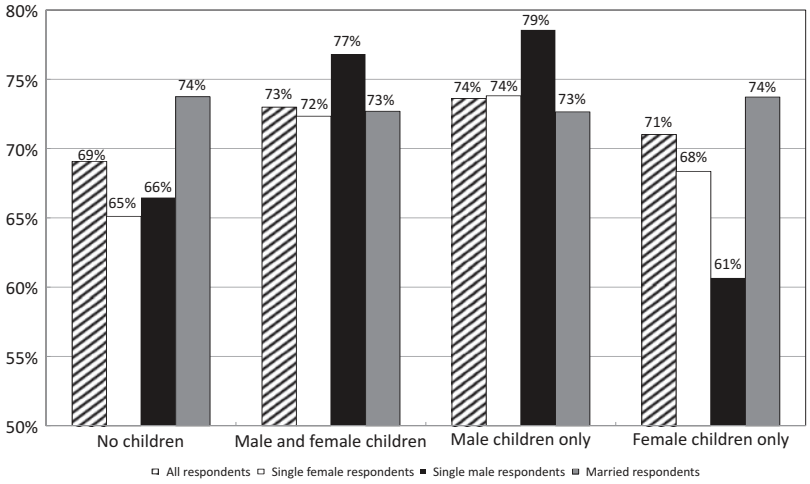

Fig. 3. Percent risk averse respondents by subgroup (2004)

security holding. For married respondents, those with only male children have the highest percentage of mutual fund holding and US savings bond holding. Figure 3 shows the percent of respondents displaying risk aversion by subgroup.[3] Figure 3 shows that across subgroups, respondents with only male children are the most risk averse.[4]

IV. Econometric Analysis and Results

Empirical framework

This article posits that offspring gender may affect household portfolio decisions. If this is the case, one should expect that households with only female children will hold different

[3] I classify a respondent as risk averse if (s) he prefers a certain salary to a lottery between a 50% chance of doubling his/her salary and a 50% chance of getting his/her salary cut by $\frac{1}{3}$.

[4] Households with only male children are more risk averse than households with only female children. This difference is statistically significant for the single female and single male subgroups.

portfolios than households with only male children. The empirical analysis below tests this hypothesis using probit models which are similar to those used by Bogan (2008).

V. Probit model specification

To analyse the effect of offspring gender on the probability of holding a particular type of asset (the extensive margin), I use univariate probit models in which the dependent variable is a binary variable for (stock, mutual fund, fixed income or US savings bond) market participation in 2004, and the independent variables include dummy variables for household offspring gender composition, number of children dummy variables, child age control variables and respondent characteristic control variables that have been previously identified as influencing investment behaviour. Notably, I control for inertia in holding financial assets with a dummy variable indicating if the respondent held stocks or bonds in a previous year; the effects of information and transaction costs with a computer usage dummy (Bogan, 2008); health effects on asset holding behaviour (Rosen and Wu, 2004; Bogan and Fertig, 2013, forthcoming) and aspects of the respondents' occupation or training that could lead to increased market participation.[5] A detailed description of all of the variables can be found in the Appendix.[6,7]

The model specification is

$$OWN\ ASSET_i = \beta_0 + \sum_{j=1}^{J} \beta_j CHILDRENGENDER_{ij} + \sum_{k=4}^{K} \beta_k X_{ik} + \sum_{l=13}^{L} \beta_l Z_{il} + \varepsilon_i \quad (1)$$

where X_{ik} is the set of child characteristic variables and Z_{il} is the set of respondent characteristic control variables.[8]

Since the gender of one's biological offspring is exogenous, this model specification is advantageous in that causality can be established.[9] Whereas the gender of an individual's offspring could influence investment decisions, it is much less plausible that investment decisions determine the gender of an individual's offspring.[10]

VI. Results

In the first column of Table 4, one can see that in addition to the usual factors affecting stockholding behaviour (net worth, income, pension plan participation, education), having only female children increases the probability of holding stock by 0.0438 with a *p*-value of 0.0850. Having only male children variable has a positive point estimate of 0.0306 but the coefficient is not significant.[11] When an income risk aversion variable is added to the model specification, the significance of the only female children variable declines but the point estimate is relatively stable.

In contrast, having only female children does not significantly affect the probability of holding mutual funds, fixed income securities or US savings bonds. Table 4 also shows that having only male children does not significantly affect the probability of owning stocks, mutual funds, fixed income securities or US savings bonds.

Both theoretical and empirical finance literature tells us that single male, single female and married respondent groups should be evaluated separately. When the analysis is done by subgroup, one can see different effects with respect to stockholding (Table 5). For single female respondents, having only male children increases the probability of holding stock by 0.0694 with a *p*-value of 0.065. For married respondents having only female children increases the probability of stockholding by 0.0586 with a *p*-value of 0.072. These finding show that offspring gender effects do have differing impacts on a family's portfolio depending on the household composition. The fact that the effects are different for each subgroup is consistent with literature that shows preferences exhibit gender differences (Croson and Gneezy, 2009) and that couple decision-making differs from single individual decision-making due to bargaining or sharing of financial decision-making responsibilities (Lundberg *et al*., 2003; Kirchler *et al.*, 2008).

[5] The education, income and voluntary contribution pension variables also serve to control for aspects of a respondent's occupation or training that could lead to increased stock market participation.

[6] The probit models contain those variables previously shown to be significant in explaining the probability of holiding stock in the US (see, for example, Bertaut, 1998; Hong *et al*., 2004; Bogan, 2008).

[7] In additional robustness checks of the model, I also control for respondent region of residence with region dummy variables (Northeast, Midwest, South and West). Regional controls do not affect the results in any meaningful way.

[8] Due to data limitations, it is not possible to perform a true fixed effects analysis. The hold stock variable was only collected in 2004. In previous years, respondents were asked if they held either stocks or bonds in one question.

[9] While the gender of each offspring is exogenous, the gender composition of the family may not be completely exogenous due to fertility choice. Thus, I control for family size with dummy variables for no children, one child, two children and three children. Notably, households with all female children have the same average number of children as households with all male children.

[10] Some controversial areas of evolutionary biology assert maternal effects on the sex of offspring (see Grant). This notion is not widely accepted in the science literature. Nonetheless in the robustness checks section, I will perform an analysis to address this issue.

[11] Furthermore, the magnitude of the having only male children coefficient is significantly lower than the having only female children coefficient.

Table 4. Full sample probit regressions – marginal effects of key variables

	Stock ownership		Mutual fund ownership		Fixed income ownership		Savings bond ownership	
Own stocks or bonds in 1998	0.1697***	0.1682***	0.1156***	0.1198***	0.0017***	0.0016*	0.0683***	0.0716***
	(0.0223)	(0.0225)	(0.0193)	(0.0196)	(0.0015)	(0.0014)	(0.0181)	(0.0184)
Log of net worth 2004	0.0601***	0.0584***	0.0511***	0.0492***	0.0015***	0.0015***	0.0220***	0.0216***
	(0.0091)	(0.0091)	(0.0077)	(0.0078)	(0.0008)	(0.0008)	(0.0072)	(0.0073)
Log of net income 2004	0.0398**	0.0417***	–0.0061	–0.0044	–0.0002	–0.0002	–0.0129	0.0134
	(0.0167)	(0.0170)	(0.0134)	(0.0135)	(0.0008)	(0.0008)	(0.0131)	(0.0135)
Log of savings 2004	0.0146***	0.0136***	0.0125***	0.0114**	0.0001	0.0001	0.0101**	0.0098**
	(0.0054)	(0.0054)	(0.0051)	(0.0052)	(0.0002)	(0.0002)	(0.0049)	(0.0049)
Pension plan participation 2004	0.0365**	0.0386**	–0.0176	–0.0192	–0.0002	–0.0002	0.0414***	0.0420***
	(0.0171)	(0.0173)	(0.0159)	(0.0162)	(0.0009)	(0.0008)	(0.0146)	(0.0148)
Own Home 2004	–0.0826***	–0.0858***	0.0316	0.0357	–0.0001	–0.0001	0.0227	0.0210
	(0.0304)	(0.0306)	(0.0211)	(0.0211)	(0.0016)	(0.0015)	(0.0213)	(0.0217)
Male children only dummy	0.0306	0.0223	0.0163	0.0166	–0.0005	–0.0005	0.0057	0.0047
	(0.0244)	(0.0241)	(0.0209)	(0.0209)	(0.0009)	(0.0009)	(0.0198)	(0.0199)
Female children only dummy	0.0438*	0.0315	–0.0147	–0.0152	0.0005	0.0006	–0.0155	–0.0099
	(0.0267)	(0.0263)	(0.0190)	(0.0192)	(0.0011)	(0.0011)	(0.0195)	(0.0202)
Respondent characteristic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income risk aversion control	–	Yes	–	Yes	–	Yes	–	Yes
No. of children and child age controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2484	2434	2477	2428	2067	2026	2475	2426
Log likelihood	–1019.40	–996.66	–894.09	–873.79	–90.20	–89.24	–928.71	–912.20

Notes: Standard errors in parentheses.
***, ** and * denote statistic significance at the 1%, 5% and 10% levels, respectively.

Table 5. Stockholding: marginal effects of key variables for subsample analyses

	Single females	Single males	Married
Own stocks or bonds in 1998	0.0653**	0.2383***	0.1757***
	(0.0399)	(0.0722)	(0.0271)
Log of net worth 2004	0.0368***	0.0249**	0.0743***
	(0.0096)	(0.0121)	(0.0131)
Log of net income 2004	0.0261	–0.0094	0.0568**
	(0.0185)	(0.0158)	(0.0244)
Log of savings 2004	0.0015	0.0177**	0.0162**
	(0.0055)	(0.0081)	(0.0079)
Pension plan participation 2004	0.0267	–0.0047	0.0526**
	(0.0183)	(0.0246)	(0.0240)
Own home 2004	–0.0418*	–0.0522	–0.0793*
	(0.0471)	(0.0355)	(0.0515)
Male children only dummy	0.0694*	0.0173	0.0147
	(0.0486)	(0.0539)	(0.0306)
Female children only dummy	0.0069	0.0593	0.0586*
	(0.0427)	(0.0716)	(0.0340)
Respondent characteristic controls	Yes	Yes	Yes
No. of children and child age controls	Yes	Yes	Yes
Observations	448	377	1657
Log likelihood	–122.59	–96.28	–762.27

Notes: Standard errors in parentheses.
***, ** and * denote statistic significance at the 1%, 5% and 10% levels, respectively.

Within my main model specification, I do control for potential nonlinear effects of total number of children on asset holding behaviour with dummy variables for the respondent's total number of children (no children dummy, one child dummy, two children dummy and three children dummy). However, the decision to have children is not exogenous. Hence, I analyse the effects of offspring gender on stockholding behaviour utilizing a subsample of only respondents that have children. In Table 6, for married respondents with children, one can see that having only female children significantly increases the probability of holding stock by 0.0608 (p-value of 0.067). Having only male children does not significantly affect the probability of holding stock.

Moreover, if we limit the sample to respondents that just have one child to control for any unobserved heterogeneity between families with different numbers of children, the results are still consistent. For single female respondents with only one child, having a female child decreases the probability of stockholding. For single male respondents with one child, having a female child does not significantly affect the probability of stockholding. For married respondents with one child, having a female child increases the probability of stockholding by 0.0661 and is weakly significantly with a p-value of 0.124.[12]

Robustness checks

Alternative offspring gender specification. The previous analyses generate significant results with regard to an offspring gender and stockholding relationship. The benefit of the specification in Equation 1 is that it does not assume a specific relational form between offspring gender and stockholding. However, I also consider a model specification in which there is a single offspring gender variable that is continuous and represents the fraction of the respondent's children that are female. The model specification is

$$OWN\ ASSET_i = \beta_0 + \beta_1 PERCENTFEMALECHILDREN_{i1} + \sum_{j=2}^{J} \beta_j X_{ij} + \sum_{k=11}^{K} \beta_k Z_{ik} + \epsilon_i \quad (2)$$

where X_{ij} is the set of child characteristic variables and Z_{ik} is the set of respondent characteristic control variables.

The results of Equation 2 are presented in Table 7. One can see from Table 7 that having more female children is associated with an increase in the probability of holding stock for the married sample (0.0534 with a p-value of 0.060). These results are consistent with the

[12] The standard errors are larger due to the smaller sample available: n = 72 for the single female subgroup, n = 64 for the single male subgroup and n = 261 for the married respondent subgroup. Full regression results available upon request.

Table 6. Stockholding: marginal effects of key variables for respondents with children

	Single females	Single males	Married
Own stocks or bonds in 1998	0.0334	0.2374***	0.1936***
	(0.0366)	(0.1045)	(0.0295)
Log of net worth 2004	0.0178**	0.0336***	0.0836***
	(0.0071)	(0.0126)	(0.0147)
Log of net income 2004	0.0246*	–0.0085	0.0495*
	(0.0164)	(0.0165)	(0.0273)
Log of savings 2004	0.0046	0.0051	0.0111
	(0.0042)	(0.0082)	(0.0085)
Pension plan participation 2004	0.0069	–0.0005	0.0516*
	(0.0151)	(0.0257)	(0.0262)
Own home 2004	–0.0232	–0.0588**	–0.0946*
	(0.0220)	(0.0319)	(0.0587)
Male children only dummy	0.0447**	0.0017	0.0149
	(0.0303)	(0.0352)	(0.0312)
Female children only dummy	0.0074	0.0376	0.0608*
	(0.0242)	(0.0466)	(0.0345)
Respondent characteristic controls	Yes	Yes	Yes
No. of children and child age controls	Yes	Yes	Yes
Observations	315	219	1455
Log likelihood	–69.09	–50.35	–676.17

Notes: Standard errors in parentheses.
***, ** and * denote statistic significance at the 1%, 5% and 10% levels, respectively.

previous results presented; providing evidence that the effect is robust to differing model specifications. Notably, the point estimates and significance levels of the other variables are stable across specifications (see Tables 6 and 7).

Stockholding, offspring gender and offspring age. Within the main model specification, I control for the effects of offspring age on portfolio decisions with variables that capture the percent of offspring in each of five mutually exclusive age categories. The categories were selected to correspond with major child groupings: pre-school, elementary/middle school, high school, college and post-college. However, to examine further if age of offspring could influence offspring gender-based preferences, I segment my sample based

Table 7. Alternate offspring gender specification: marginal effects of key variables for respondents with children subsample

	Single females	Single males	Married
Own stocks or bonds in 1998	0.0278	0.2377***	0.1944***
	(0.0345)	(0.1055)	(0.0294)
Log of net worth 2004	0.0200**	0.0338***	0.0836***
	(0.0073)	(0.0127)	(0.0147)
Log of net income 2004	0.0242	−0.0079	0.0490*
	(0.0175)	(0.0170)	(0.0273)
Log of savings 2004	0.0048	0.0051	0.0112
	(0.0044)	(0.0083)	(0.0085)
Pension plan participation 2004	0.0091	−0.0011	0.0519*
	(0.0161)	(0.0264)	(0.0262)
Own home 2004	−0.0228	−0.0609**	−0.0942*
	(0.0230)	(0.0325)	(0.0586)
Percent female children	−0.0163	0.0235	0.0534*
	(0.0152)	(0.0272)	(0.0283)
Respondent characteristic controls	Yes	Yes	Yes
No. of children and child age controls	Yes	Yes	Yes
Observations	315	219	1455
Log likelihood	−70.52	−50.62	−676.17

Notes: Standard errors in parentheses.
***, ** and * denote statistic significance at the 1%, 5% and 10% levels, respectively.

upon offspring age. I analyse five segments: (i) respondents with children all under the age of 6; (ii) respondents with children all between the ages of 6 and 13 (inclusive); (iii) respondents with children all between the ages of 14 and 17 (inclusive); (iv) respondents with children all between the ages of 18 and 21 (inclusive); (v) respondents with children all over the age of 21.

Table 8 shows that there is no significant effect of offspring gender on stockholding for respondents with children all between the ages of 6 and 13 or all between the ages of 14 and 17. For respondents with children all under the age of 6, having all male children increases the probability of stockholding by 0.3422 with a *p*-value of 0.099. However, for households with children all under the age of 6, the effect of having all female children is much greater on the probability of stockholding. Having all female children increases the probability of a household holding stock by 0.4927 with a *p*-value of 0.043. Having all female children all between the ages of 18 and 21 increases the probability of a household holding stock by 0.1588 also with a *p*-value of 0.034.

Bivariate probit analysis. Some controversial areas of evolutionary biology assert that maternal testosterone levels influence the sex of offspring (see Grant (2008)). If this is the case, then in theory, there could be some unobserved variable that influences both investment choices and offspring gender. For women, testosterone levels would influence both investment decisions and offspring gender. For males there would need to be an unobserved variable that causes men to be attracted to women with certain testosterone levels that also influences investment behaviour. The notion of maternal effects on the sex of offspring is not widely accepted in the scientific community. Nonetheless, I will perform a bivariate probit analysis to address this remote possibility.

With the assumptions that the error terms ϵ_i are jointly normally distributed, a bivariate probit analysis can control for unobserved heterogeneity resulting from respondent-specific factors with correlation γ between the disturbances for each respondent *i*. The bivariate probit model is set-up such that Y_1 is a binary variable for stock market participation and Y_2 is a binary variable for an offspring gender category (only female children, only male children, or male and female children). The independent variables are wealth, income, education, age and other respondent characteristics. The model generates coefficients that are used to calculate average joint and conditional probabilities (see Table 9). From these conditional probabilities, one can see that the likelihood of stock ownership is greatest if the respondent has only female children. This is consistent with the previous results demonstrating that having only female children causes increased stock market participation.

Table 8. Stockholding: marginal effects of key variables for offspring age subsamples[a]

	Under Age 6	Ages 6–13	Ages 14–17	Ages 18–21
Own stocks or bonds in 1998	0.1990	0.3254***	0.3236***	0.0607
	(0.1268)	(0.0584)	(0.0953)	(0.0698)
Log of net worth 2004	0.2825***	0.0900***	0.1003***	0.0477**
	(0.0762)	(0.0351)	(0.0333)	(0.0197)
Log of net income 2004	0.1178	0.0552	0.0082	–0.0219
	(0.1602)	(0.0590)	(0.0649)	(0.0324)
Log of savings 2004	–0.0761	0.0169	0.0028	0.0198
	(0.0464)	(0.0191)	(0.0180)	(0.0134)
Pension plan participation 2004	–0.0732	0.0982	0.0667	–0.0583
	(0.1587)	(0.0562)	(0.0570)	(0.0585)
Own home 2004	–0.5860**	–0.1564	−0.6061***	0.0010
	(0.2247)	(0.1350)	(0.1665)	(0.0552)
Male children only dummy	0.3422*	–0.0958	0.1368	0.1034
	(0.2026)	(0.0706)	(0.1041)	(0.0742)
Female children only dummy	0.4927**	–0.0006	0.0532	0.1588**
	(0.2351)	(0.0693)	(0.0937)	(0.0916)
Respondent characteristic controls	Yes	Yes	Yes	Yes
Number of children controls	Yes	Yes	Yes	Yes
Observations:	72	327	157	174
Log likelihood:	–30.93	–141.24	–57.71	–55.68

Notes: Standard errors in parentheses.
***, ** and * denote statistic significance at the 1%, 5% and 10% levels, respectively.
[a]The sample size for the subgroup with children over 21 is too small to generate any significant results.

Table 9. Conditional probability estimates of stock ownership and offspring gender

	Full sample	Respondents with children subsample
P (Owns stock)	0.2082	0.2126
P (Owns stock given having only female children)	0.2267	0.2272
P (Owns stock given having only male children)	0.2143	0.2122
P (Owns stock given having male and female children)	0.2063	0.2057

VII. Concluding Remarks

Recent advances in behavioural finance have demonstrated that investors do not always behave rationally but often deviate from rationality in very systematic ways: overconfidence, excessive optimism and loss aversion. This article demonstrates the existence of a behavioural effect which is related to gender roles that could help to shed more light on questions related to household portfolio composition.

The empirical results provide support for a 'parental accounting' behavioural finance model which incorporates gender biases associated with offspring. Empirically, these biases are most evident with respect to stockholding. The results also allow one to rule out explanations associated with female children increasing risk aversion. Unlike previous literature that indicates having a wife makes men *less* likely to hold stock, having only female children increases the probability of a household holding stock. For married respondents, having only female children increases the probability of holding stock with marginal effects ranging from 0.0586 to 0.0608. In contrast, the only female children variable is not significant for single respondents. For single female respondents, having only male children increases stockholding with marginal effects ranging from 0.0447 to 0.0694. Thus, within the domain of gender-based behavioural effects that influence investment behaviour, there is evidence that we also should include offspring gender effects.

There is increasing evidence that family structure characteristics like marital status and children may be comparably important for the understanding of portfolio choices. Historically, portfolio choices of stock have been critical to long-term wealth building. Given family wealth levels have an effect on intergenerational wealth transfers, offspring educational attainment and offspring socio-economic status, this parental accounting could have important implications for distributional welfare issues.

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Appendix: A Description of Variables Used in Empirical Analysis

Asset, income and wealth variables

- Own stock dummy variable – a dummy variable that is given a value of 1 if the respondent (or spouse) owns stock in 2004 and is set to 0 otherwise. Stock ownership includes owning shares of stock in publicly held corporations or investment trusts. It does not include assets in IRA accounts, Koegh accounts, 401Ks or similar defined contribution pension plans.
- Own bonds dummy variable – a dummy variable that is given a value of 1 if the respondent (or spouse) owns US savings bonds in 2004 and is set to 0 otherwise.
- Own other fixed income securities dummy variable – a dummy variable that is given a value of 1 if the respondent (or spouse) owns any corporate bonds or any government securities such as US Treasury Bills, US Treasury Bonds or state or municipal bonds in 2004 and is set to 0 otherwise.
- Owned stocks and bonds previously dummy variable – a dummy variable that is given a value of 1 if the respondent (or spouse) owned stocks or bonds in 1998 and is set to 0 otherwise. Stock ownership includes owning shares of stock in publicly held corporations or investment trusts. It does not include assets in IRA accounts, Koegh accounts, 401Ks or similar defined contribution pension plans.
- Log of net income – the natural logarithm of the respondent (and spouse) net income. Net income includes salary, wages, investment income and other income. (Base year 2004 $s)
- Log of net worth – the natural logarithm of the respondent (and spouse) net worth. Net worth includes financial assets nonfinancial assets and retirement accounts. (Base year 2004 $s)
- Log of savings – the natural logarithm of savings account value of the respondent (and spouse). (Base year 2004 $s)
- Own home dummy variable – a dummy variable that is given a value of 1 if the respondent owns a home in 2004 and is set to 0 otherwise.

Respondent characteristic variables

- Age of respondent – the age of the respondent.
- Years of education – the years of education of the respondent.
- Male dummy variable – a dummy variable that is given a value of 1 if the respondent is male in a given year and is set to 0 otherwise.
- White dummy variable – a dummy variable that is given a value of 1 if the respondent is white, nonhispanic and is set to 0 otherwise.

- African-American dummy variable – a dummy variable that is given a value of 1 if the respondent is African American and is set to 0 otherwise.
- Asian dummy variable – a dummy variable that is given a value of 1 if the respondent is Asian and is set to 0 otherwise.
- Married dummy variable – a dummy variable that is given a value of 1 if the respondent is married in a given year and is set to 0 otherwise.
- Managerial and professional occupation dummy variable – a dummy variable that is given a value of 1 if the respondent has an occupation that has a 1980 census code of managerial/professional specialties. The variable is set to 0 otherwise.
- Voluntary contribution pension dummy variable – a dummy variable that is given a value of 1 if the respondent has a voluntary contribution pension and is set to 0 otherwise.
- Computer user dummy variable – a dummy variable that is given a value of 0 if the respondent indicated that he/she did not work with computers. The variable is set to 1 otherwise.
- Not risk averse dummy variable – a dummy variable indicating if the respondent indicates risk aversion. The variable is given a value of 0 if the respondent would prefer a certain salary to a lottery between a 50% chance of doubling their salary and a 50% chance of getting their salary cut by $\frac{1}{3}$. The variable is set to 1 otherwise.
- CES-D depression score variable – a variable that gives the 7-item CES-D depression score for the respondent. This continuous variable ranges from 0 to 24 with higher values indicating a higher degree of depression.
- Poor physical health dummy variable – respondents are asked to rate their physical health at the present time on a scale from 1 (excellent) to 5 (poor). I create a dummy variables for self-rated poor physical health status that is given a value of 1 if the respondent rated their physical health fair or poor and is given a value of 0 otherwise.

Child characteristic variables

- Only female children dummy variable – a dummy variable that is given a value of 1 if the respondent has only female children and is set to 0 otherwise.
- Only male children dummy variable – a dummy variable that is given a value of 1 if the respondent has only male children and is set to 0 otherwise.
- Male and female children dummy variable – a dummy variable that is given a value of 1 if the respondent has both male and female children and is set to 0 otherwise.
- Number of children dummy variables – dummy variables for the respondent's number of children (No children dummy, one child dummy, two children dummy, three children dummy). Dummy variables for zero, one, two and three children are used since over 95% of the sample has four or fewer children.
- Percent of children between the ages of 0 and 5 (inclusive) – the percent of the respondent's children that are between the ages of 0 and 5.
- Percent of children between the ages of 6 and 13 (inclusive) – the percent of the respondent's children that are between the ages of 6 and 13.
- Percent of children between the ages of 14 and 17 (inclusive) – the percent of the respondent's children that are between the ages of 14 and 17.
- Percent of children between the ages of 18 and 22 (inclusive) – the percent of the respondent's children that are between the ages of 18 and 22.
- Percent of children over the age of 22 – the percent of the respondent's children that are over the age of 22.