SCHOOL OF ECONOMICS AND MANAGEMENT

MANAGEMENT WORKING PAPER 2006-9

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November 29, 2006

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The authors thank the Danish Social Science Research Council for financial support. The paper is the winner of the 2006 OMX Copenhagen Paper Prize Competition.

Gender, Marriage, and the Decision to Invest in Stocks and Bonds: Do Single Women Choose to Invest More in Less Risky Assets?

Abstract: Controlling for a number of background characteristics, we show that single women have a lower propensity to invest in stocks and a higher propensity to invest in bonds than married females, married males, and single males. We model the decisions to invest in stocks and bonds jointly and find that the two investment decisions are correlated. We document that single women hold a smaller share of total assets in stocks and a larger share of total assets in bonds. We correct for self-selection biases in the estimated effects on portfolio composition. We use an exceptionally comprehensive register based data set. The data set is not influenced by biases arising from self-selection because it includes both investors who do and do not invest in financial assets.

Keywords: Bond market participation; Gender; Marriage; Stock market participation.

JEL Classifications: G11, J16.

1 Introduction

Do women have a lower propensity to invest in risky assets than men?

There are several reasons why it is important to obtain well documented answers to this and related questions. First of all, as risky assets generate higher returns on average, women must expect lower rates of return from their financial investments if choosing more conservative investment strategies. Hence, the existing wealth inequality between men and women will tend to increase - an effect that is reinforced by the fact that women have higher life expectancy than men. On the other hand, if women have a higher propensity to invest in safer assets, the return that women expect will not be as volatile. Whether women have a lower propensity to invest in risky assets will thus have consequences for e.g. the expected value of their pension savings and the uncertainty surrounding the expected values of pension savings.

The general finding in the literature is that women choose less risky portfolios than men which suggests that women have a stronger aversion against taking on financial risk, see e.g. Jianakoplos and Bernasek (1998), Sundén and Surette (1998), Agnew, Balduzzi and Sundén (2003), Säve-Söderberg (2005), and Lyons and Yilmazer (2006). Women also trade less aggressively which is taken to imply that women are not as overconfident as men, see e.g. Barber and Odean (2001), Agnew *et al.* (2003), and Niessen and Ruenzi (2006).

The finding that women choose less risky portfolios only relates to the investors who actually hold financial assets. There is, however, a considerable fraction of the population (men and women alike) that does not hold stocks at all: Hong, Kubik and Stein (2004) report that 51% of U.S. households did not hold stocks in 1998 while Guiso, Haliassos and Jappelli (2003) report that 76% of the European households did not hold stocks in 1998. The high degree of non-participation in the stock market implies that results from studies using data on the investment choices of individuals who already hold stocks and/or bonds might not be representative for the behavior of the average individual in the population. For instance, the studies of Sundén and Surette (1998), Agnew *et al.* (2003), and Lyons and Yilmazer (2006) are based on investors participating in retirement-savings plans implying that their results could be influenced by self-selection of individuals into jobs that offer certain pension plans. A related kind of bias may arise if the investors of the discount brokerage firm that is examined in Barber and Odean (2001), or the mutual-fund managers examined in Niessen and Ruenzi (2006), are not representative for the average individual, who, as mentioned, has a very high probability of not participating in the stock market at all.

The purpose of this paper is to examine whether (single) women have a lower propensity to invest in assets that are relatively risky compared to men and vice versa for less risky assets. Taking into account self-selection into the group of active investors, we also (re)examine

whether (single) women really hold less risky financial wealth portfolios. We use a very comprehensive data set that includes not only the individuals who invest in stocks and/or bonds, but also the majority of the population that do not. The data set forms a representative sample and it contains the year-end investment decisions of 10% of the Danish adult population for the period 1997-2001; all in all, 1,849,943 observations of individual investor decisions. The data set also contains a number of background characteristics that we use to document that the results are not caused by systematic differences in observable financial and socioeconomic background characteristics. Given that the data are register based and concern a large representative sample, our results are not influenced by self-selection issues.

For a married couple it is not clear *a priori* that the decision of one of them to invest in stocks and/or bonds is unrelated to the decision of the partner. Indeed, Sundén and Surette (1998), p. 209, report that "...it is not gender alone that determines investment choice. Rather, investment decisions seem to be driven more by a combination of gender and marital status..." and Barber and Odean (2001) report that single men are even more likely to be overconfident than married men. For these reason, we specifically investigate whether *single* women have a lower probability of holding stocks and a higher probability of holding bonds than men (single or married) and married women.

We estimate a bivariate probit model in order to investigate what makes individual investors hold stocks and bonds. Two issues are important to emphasize here. First, by investigating what influences the decisions of the individual investor to participate at all in the bond and/or the stock market, we differentiate ourselves from the previous literature. In the related studies the dependent variable is generally a measure of the riskiness of the portfolio of the investor: Jianakoplos and Bernasek (1998) investigate whether single women hold a higher fraction of risky assets in their portfolio, Sundén and Surette (1998) investigate whether single women are reported to hold "mostly stocks" or "mostly bonds" relative to a "diversified" portfolio, Agnew *et al.* (2003) regress the "percentage allocation to equity" on gender characteristics (and other characteristics), and Säve-Söderberg (2005) evaluates directly whether women hold portfolios with higher "portfolio risk". As we investigate what makes investors decide to hold financial assets, we take a different approach which allows us to explicitly take into account the fact that many investors do not hold stocks or bonds at all. Second, a large literature has investigated what makes individuals participate in the stock market, see e.g. Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Guiso, Haliassos and Jappelli (2003), Vissing-Jørgensen (2004) and Christiansen, Joensen and Rangvid (2006). We contribute to this literature by investigating not only what makes people hold stocks, but also what make people hold bonds, and we allow the two investment decisions (to hold bonds and stocks) to be correlated.

In addition to investigating what makes investors decide to hold stocks and bonds, we use the Heckman (1979) selection model to investigate the fraction of the investor's total assets that are invested in stocks and bonds, respectively. This model takes self-selection into the groups of bond investors and stock investors into account when analyzing the effect of marital status and gender on portfolio composition. This part of the analysis provides a robustness analysis of the previous studies cited above as well as an extension in that it takes self-selection into account.

Our main result is that single women indeed have a higher propensity to invest in bonds and a lower propensity to invest in stocks when controlling for a number of background characteristics. Corroborating with previous literature, we also find that single women hold more bonds and less stocks in their asset portfolio when controlling for a number of background characteristics and correcting for selection bias arising from self-selection into the group of active investors on the bond and the stock market, respectively. We conclude that the finding that women make less risky investment decisions than men also holds in a large data set that is not influenced by self-selection issues and that takes into account that a large fraction of the population does not invest in financial assets. Moreover, our analysis documents that the decision to invest in stocks and bonds occurs jointly.

We draw a number of other interesting conclusions. Most importantly, we find that previous high returns on the stock market induce more people to invest in stocks and less people to invest in bonds, i.e. fluctuations in aggregate stock returns cause individuals to tilt their asset-allocation decision. This finding confirms general thinking, but is nevertheless - to our knowledge - novel to the literature. The relative fraction of total assets invested in stocks depends positively on the previous year's stock market return and vice versa for the ratio of bonds to total assets. Our finding here is related to the findings in Massa and Simonov (2005) on how gains and losses from the portfolios of individual Swedish investors influence the asset-allocation decisions of these investors. The novelty of our result is that we show that individual investors react to aggregate stock-market returns by changing their individual stock and bond positions.

The reminder of the paper is organized as follows. Section 2 presents the data and Section 3 introduces the empirical methodology. The empirical results are presented in Section 4, and finally Section 5 concludes.

2 Data

We use a very rich register-based panel data set comprising a random 10% sample of the Danish population covering the period 1997-2001.[1] The data set is hosted by the Institute of Local Government Studies in Denmark (AKF), and it stems from Statistics Denmark, who have gathered the data from different sources, mainly from administrative registers.

Firstly, the data provide the gender and martial status of the investor.[2] In addition, we have access to the year-end value of a number of financial variables for each investor (originally collected for tax reporting purposes): cash holdings, value of stock holdings, value of bond holdings, taxable property value, the compulsory (labor-contract based) pension contributions, and the contributions to private pension funds.[3] We also know the yearly income measured by the gross non-capital income. The data source also contains information on a number of socioeconomic factors including the age of the investor, the number of children living at home, and the length of the education of the investor.

We restrict the sample to individuals older than 18 years (the age of majority).[4] We have 1,849,943 observations of individual investor decisions for the period 1997-2001. The data form an unbalanced panel data set since some people enter the sample when they turn 18 and other leave the sample as they die or move abroad.

2.1 Stock and Bond Market Participation Rates

An investor is defined to participate in the stock market if the investor holds stocks with a value in excess of a threshold value of DKK 1,000 (around USD 141) at year end, and an investor is said to participate in the bond market if the investor owns bonds at year end (excluding mortgage backed-bonds and bond debt).[5] Hereby, we obtain the stock and bond market participation indicators for each individual for each year.

During the five-year period, on average 22.8% of the individuals participate in the stock

[1] In 1997, financial institutions started to automatically register holdings of stocks, whereas investors had to self-report to the tax authorities before 1997. As a consequence, there are clear biases in the data for the degree of stock market participation before 1997.

[2] Here, we include marriage and not cohabitation. Our results are robust towards also including cohabitation in the definition of marriage.

[3] Mutual fund investments in equity funds are included in the stock holdings, and mutual fund investments in fixed-income funds are included in the bond holdings. Mixed mutual funds (both bonds and stocks) are counted in the stock holdings. The mixed mutual funds account only for around 5% of the Danish mutual funds.

[4] We exclude the 1% fractiles with the highest and lowest income to assure that outliers are not driving our results; more on this follows below.

[5] To participate in the stock market, investors have to hold stocks in excess of a small threshold value. This excludes individuals who e.g. have been given a single stock by their employer as a Christmas present.

market and 8.1% in the bond market. In addition, more men participate in the stock market: 24.4% of men versus 21.2% of women. Basically, equivalent proportions of men and women participate in the bond market: 8.1% of men versus 8.0% of women.

Figures 1 and 2 show the time series of average stock and bond market participation rates, respectively. The figures show the participation rates for all men, single men, and married men, and equivalently for women. The proportion of stockholders is always larger amongst married men than amongst single men and equivalently for married and single women. Relatively speaking, most married men hold stocks and the lowest proportion is for single men. The proportion of stockholders amongst single women is second lowest and very close to that of single men. The proportion of bond holders is larger for single females than for married females. In contrast, the proportion of male bond holders is larger amongst the married men than among the single men.

It is interesting to observe how the fraction of individuals that hold stocks increases during the 1998-2000 period, just to fall after the collapse of the bull market. In addition, the exact reverse pattern holds for the individuals' holdings of bonds. The pattern is more pronounced for bonds than for stocks.

2.2 Summary Statistics

Table 1 shows various summary statistics. On average, men have higher income than women. Men also have higher wealth, measured by for instance the value of the house they own. In general, married men (married women) are better off financially than single men (single women).

The average ratios of stocks to total assets are only based on those investors who hold stocks and equivalently for the bond ratio. On average, 19% of the investor's total assets are invested in stocks and 21% of the investor's total assets are invested in bonds (total assets are defined as the sum of an investor's holdings of stocks, bonds, cash, and real estate). So, on average, each financial asset category account for around one fifth of total assets. The proportion of the value of stocks in the portfolio of total assets is larger for females than for males (averages of 23% and 16%). The proportion of stocks to total assets is much larger for single males than for married males (24% compared to 11%), whereas the stock to total assets proportion is almost identical for single and married females (23% and 24%, respectively). The proportion of bonds to total assets follow the same pattern across gender and marital status as that for stocks. On average, the value of the individual's stock holdings is much larger than the value of the individual's bond holdings; in fact, on average it is four times larger.

The average ratio of the value of stocks to bonds is calculated only amongst the subset of investors that participate in both markets. For those investors, the value of stocks is around 15 times more valuable than for bonds. The ratio is larger for the male investors (about 19) than for the female investors (about 10). The ratio for females is almost identical for married and single females, whereas the ratio is somewhat larger for single males than for married males.

3 Empirical Methodology

The first objective of this paper is to investigate, using a comprehensive representative data set, whether single women have a lower propensity to hold stocks and a higher propensity to hold bonds. In addition, we want to make sure that the results we report are not caused by the fact that women on average have lower income and wealth, i.e. we want to control for other relevant background factors likely to affect the stock and bond market participation decisions. The second objective of this paper is to investigate whether single women also hold less risky assets in their wealth portfolios, i.e. less stocks and more bonds, when correcting for the fact that some individuals do not participate at all in the respective financial markets. The first part of the analysis is based on the bivariate probit model, and the second part of the analysis applies the Heckman (1979) selection model.

3.1 Bivariate Probit Model

We use a probit model to examine how the probabilities of investing in stocks and bonds are influenced by the gender and martial status of the investor, at the same time taking into account differences in various background characteristics. Furthermore, as we expect the decision of participation in the stock and bond markets to be correlated, we use the bivariate probit model that accounts for the endogeneity of the two related choices.

At the end of each year t we observe the amount held in stocks and the amount held in bonds by individual i, denoted by S_{it}^* and B_{it}^* respectively, $i = 1, ..., N$ and $t = 1, ..., T_i$. Note that we allow for an unbalanced panel data set. We focus on the two binary choice variables $S_{it} = \mathbf{1}\left[S_{it}^* > \text{DKK } 1000\right]$ and $B_{it} = \mathbf{1}\left[B_{it}^* > 0\right]$, where S_{it} is an indicator for active participation in the stock market of individual i at time t and B_{it} is an indicator for participation in the bond market of individual i at time t. The simultaneous system of estimation equations is given by:

$$\begin{aligned} S_{it} &= \mathbf{1}\left[X_{it}\beta_S + \varepsilon_{S_{it}}\right] \\ B_{it} &= \mathbf{1}\left[X_{it}\beta_B + \varepsilon_{B_{it}}\right], \end{aligned} \tag{1}$$

where X_{it} represents the relevant explanatory background factors, β_S and β_B are the corresponding parameter vectors, and $\varepsilon_{S_{it}}$ and $\varepsilon_{B_{it}}$ are the error terms. The error term vector $\varepsilon_{it} = (\varepsilon_{S_{it}}, \varepsilon_{B_{it}})$ for individual i at time t is assumed to be independent both over individuals and over time (IID) and follow a bivariate standard normal distribution with correlation coefficient ρ.

The likelihood function for the bivariate probit model is given by the product across the four possible choice probabilities times their associated probabilities. The parameters β_S, β_B, and ρ are consistently estimated by maximum likelihood.

Note that two univariate probit models are nested in the bivariate probit model, namely when the error terms of the two processes driving the choices are uncorrelated, $\rho \equiv 0$. We use the likelihood ratio test (LR) to test the hypothesis that the bivariate probit model fits the data better than two univariate probit models, H_0: $\rho = 0$. If the hypothesis is rejected, the decisions of participating in the stock and bond markets are significantly correlated.

We estimate both the joint as well as the marginal probabilities of an investor participating in the stock market and/or the bond market given the investor's background characteristics. Our primary interest lies in the marginal effects of the explanatory variables on the marginal choice probabilities. The marginal effect of an explanatory variable on the choice probability is given by the change in the probability for an infinitesimal change in the explanatory variable for continuous explanatory variables holding other variables constant at their sample means. For indicator variables, the marginal effect is the change in probability resulting from a change in the value of the explanatory variable from 0 to 1 holding all other variables at their sample means. For discrete explanatory variables, the marginal effect on the choice probability is that of changing the value of the explanatory variable from k to $k+1$ all else at sample means.

3.2 Selection Model

The rich data set also allows us to examine the effect of gender and marital status on various measures of portfolio riskiness. The measures of portfolio riskiness we consider are the proportion of total assets invested in stocks, $\frac{S^*_{it}}{A_{it}}$, and bonds, $\frac{B^*_{it}}{A_{it}}$, respectively.[6] Since these measures of portfolio riskiness only make sense for those investors who participate in the relevant financial market, we have to correct for potential self-selection bias arising from limited participation.

The Heckman (1979) selection model for the proportion of bonds to total assets is given

[6] All the estimated results are robust to replacing total assets with total wealth.

by the regression equation:

$$\frac{B_{it}^*}{A_{it}} = X_{it}'\beta_{BA} + \varepsilon_{BA_{it}}, \tag{2}$$

and the selection/participation equation indicating that $\frac{B_{it}^*}{A_{it}}$ is only observed if $B_{it}^* = X_{it}\beta_B + \varepsilon_{B_{it}} > 0$. The distribution of the error terms is given by $\varepsilon_{BA_{it}} \sim N(0, \sigma)$, $\varepsilon_{B_{it}} \sim N(0, 1)$, and $corr(\varepsilon_{BA_{it}}, \varepsilon_{B_{it}}) = \rho_B$. Since the proportion of bonds in the portfolio of total assets is only observed for those investors who participate in the bond market, an ordinary least squares regression of (2) would produce biased estimates if $\rho_B \neq 0$. This is the case because $E[\varepsilon_{BA_{it}}|X_{it}, B_{it} = 1] \neq 0$ when $\rho_B \neq 0$, even if $E[\varepsilon_{BA_{it}}|X_{it}] = 0$. We estimate a Heckman (1979) two-step selection model to account for the correlation between the error terms, and get consistent estimates of the parameters in the bonds to total asset regression equation (2). The exclusion restriction, i.e. the variable included in X_{it} but not in X_{it}, is the lagged bond market participation indicator, B_{it-1}. Thus, it is imposed that lagged bond market participation affects current bond market participation, but it only affects the share of total assets invested in bonds through its effect on current participation. This is a conventional assumption in the literature, see e.g. Vissing-Jørgensen (2004).

The model for the proportion of stocks to total assets is specified equivalently.

4 Empirical Results

4.1 Bond and Stock Market Participation

The first part of the results are based on the bivariate probit estimations where the explained variables are the stock market participation indicator and the bond market participation indicator. The explanatory variables of primary interest are the indicators for married female, married male, and single male. Thereby, the reference group is single women.

In addition to the gender-marriage variables, the control variables we apply in the baseline model are the following: Age of the investor, length of the investor's education, an indicator for having children below 7 years old living at home (1 if yes), an indicator for having children between 7 and 18 years old living at home (1 if yes), the non-capital income of the investor, the lagged participation decision, and finally the return on the Danish stock market in the previous year (captured by the return on the OMXC20, a blue chip index).[7] We use non-capital income in order to avoid problems of endogeneity of income that could otherwise arise if parts of income arose from stock dividends and/or interest payments from bonds. Including the lagged participation decision makes the model dynamic. The decision to participate in

[7] During the sample period, the Danish blue chip index was denoted the KFX index. Now, it is known as the OMXC20 index.

the stock market this year is most likely greater if the investor also participated in the stock market last year because part of the participation cost has already been paid, e.g. the start up costs associated with getting to know the workings of the stock market. Similar arguments hold for the bond market. The return from the aggregate stock market is common to all investors, whereas the other variables are investor specific.

The likelihood function for the bivariate probit model using all observations cannot be optimized, since some of the most extreme income observations predict one single joint participation decision perfectly. In order to get a well-behaved likelihood function and for outliers not to drive our results, we restrict the sample to exclude the 1% of individuals with the highest and the 1% with the lowest income.[8]

Table 2 contains the results from estimating the bivariate probit model. The table shows the marginal effects on the marginal bond and stock market participation probabilities from each of the explanatory variables. The most important result in this connection is that the marginal effect of being a married man, a married woman, or a single man are all significantly negative in the bond market participation equation and positive in the stock market participation equation (only single male is significantly positive). The interpretation is as follows: Given that the reference group is single women, a positive coefficient to, for example, the indicator for being a single man in the stock market participation equation indicates that a representative single man has a higher propensity to invest in stocks than has a representative single woman. In other words, given that we keep the control variables constant at their sample averages when we calculate the marginal effects, we find that a representative single woman has a lower propensity to hold stocks than has a representative single man who has the same income, age, and so on as the representative single woman. The representative single woman also has a higher probability of holdings bonds than has the representative single man, the representative married male, and the representative married woman.

The predicted participation rates for single females, married females, single males, and married males are almost identical to the actual participation rates which indicates a good fit of the bivariate probit model to the data (not tabulated).

Other findings. Apart from our focus on gender and civil status effects, our probit model yields a number of additional interesting results.

We find that the marginal effect of the age of the investor is significantly positive for both the bond and stock market participation decision. So, the older the individual is the more likely it is that the individual is a financial investor. The marginal effect of having children

[8] As a robustness check, we estimate two univariate probit models using the full sample. The overall results on the effects of marital status and gender hold.

(both below 7 and between 7 and 18 years old) living at home is significantly negative for both stock and bond market participation, implying that children dampen the propensity of being a financial investor.

Like in the stock market participation literature we find that the stock market participation decision is positively linked to income and length of education, see e.g. Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Guiso, Haliassos and Jappelli (2003) and Vissing-Jørgensen (2004). As a novel feature, we report that the same effects hold for the bond market participation decision. This implies that wealthier individuals are more likely to invest in bonds and stocks which is hardly surprising. The level of education is also of importance for whether or not an investor participates in the bond and stock market. More well-educated individuals are more likely to be financial investors.

The stock market participation decision this year is strongly and positively related to the stock market participation last year. So, once an investor enters the stock market is it very likely that the investor will continue being a stock market investor. The same applies to the bond market although the persistence is smaller than for the stock market.

It is interesting that the marginal effect from the lagged aggregate stock market return is of opposite sign in the stock and bond market participation equations. This means that an increase in the return from the aggregate stock market leads to a significantly positive effect on the stock market participation decision and a significantly negative effect on the bond market participation probability. This corresponds well with the popular notion that when the stock market is rising, more investors are interested in investing in stocks, and when the stock market is falling more investors turn to the bond market. This is also consistent with the unconditional averages shown in Figures 1 and 2. Massa and Simonov (2005) study how individual investors react to prior gains and losses on their own portfolios using a detailed Swedish data set. Our findings are related although they concern reactions to aggregate stock market movements and not to own portfolio returns.

The point estimate of the correlation between the error terms of the two processes that drive the choices of participation in the stock and bond market is equal to -0.06 and this is significantly different from zero according to the LR test. This implies that it is important to model the two interdependent decisions jointly. The negative correlation coefficient implies that the unobserved factors that determine whether an investor participates in the stock market are negatively correlated with the unobserved factors that determines whether he or she participates in the bond market.

4.1.1 Robustness. The rich data set allows us to investigate the influence of additional control variables. Here we investigate the effects of including the following additional control

variables: cash holdings, taxable property value, public pension contribution, and private pension contribution.[9]

In order for the likelihood function of the bivariate probit model to be well-behaved, we restrict the sample and exclude the top and bottom 1% fractiles with respect to cash-holdings, taxable-property value, public pension contribution, and private pension contribution.[10]

The marginal effects from the estimated model are presented in Table 3. The table shows that the artifact that single women have a lower propensity to hold stocks and a higher propensity to hold bonds goes through, also in this setting where we include a host of additional control variables. The result is actually stronger here because now both the married female indicator and the single male indicator are significant in the stock market participation equation. In addition, the marginal effects of the added financial control variables are all estimated with positive signs in both equations, i.e. an increase in one of the added financial control variables increase the likelihood that the investor holds stocks and/or bonds. The marginal effects from the remaining variables are unaltered compared to the base line model.

Finally, the results are also found to be robust to allowing for non-linear age effects and non-linear effects of the length of education of the investor. The results are not tabulated, but are available upon request.

4.2 Portfolio Riskiness

We relate the rich attributes of the data to the previous literature by examining the effect of gender and marital status on the riskiness of individuals' wealth portfolios. The results from the Heckman (1979) selection model are presented in Table 4. The table shows the coefficients from the regression equation (2). The probit selection equation (results not shown, since they are similar to those in Table 2) includes lagged participation as explanatory variable in addition to the explanatory variables in the regression equation (2). Hence, we impose the conventional exclusion restriction that lagged participation only affects the share of total assets invested in bonds and stocks, respectively, through its effect on current participation.

We find that it is important to correct for self-selection bias, since the coefficient to the inverse Mills' ratio is significantly positive, indicating that investors who have unobserved characteristics that make them hold a higher share of bonds (stocks) in their asset portfolio are more likely to participate in the bond (stock) market.

[9] An indicator function captures that the private pension contribution is not registered during the first two years of the sample.

[10] The overall results on the effects of marital status and gender go through in two separate univariate probit estimations on the full sample.

Regarding the determinants of the fraction of total assets held in bonds, the results are clear: Single women hold a larger proportion in bonds relative to total assets than married women and men (single and married), as can be seen from the significantly negative estimate of β_{BA} for married females, single males, and married males. This result is found when we control for a number of background characteristics and correct for bias arising from self-selection into the group of active financial investors.

The picture is not as clear regarding the choices of how much to invest in stocks. Single women hold a lower proportion in stocks relative to total assets than married women and single men, but a larger proportion than married men.

Other findings. Children, age, and income have negative effects on the ratio of both bond and stock holdings to total assets. We also find that the larger the non-capital income of the investor the smaller a fraction of assets is invested in stocks and equivalently for bonds. Investors with a long education invest a larger fraction of asset in stocks and bonds.

The lagged stock market return has a positive effect upon the ratio of stock to total assets and a negative effect upon the bond to total assets ratio. This is congruent with the finding that the propensity to be a stock market investor increases with lagged stock market return and the propensity to be a bond market investor is negatively dependent of the lagged stock market return.

These results are also robust to including the additional wealth control variables from Section 4.1.1 above. The results are not tabulated, but are available upon request.

5 Conclusion

This paper started out posing the question whether women have a lower propensity to invest in risky assets than men?

Laboratory experiments have provided mixed results. Schubert, Brown, Gysler and Brachinger (1999) provide sceptical conclusions regarding the overall question of whether women are more risk averse than men. On the other hand, Dohmen and Falk (2006) find evidence of gender-specific risk attitudes and Dohmen, Falk, Huffman, Sunde, Schupp and Wager (2005) present evidence that the willingness to take on risk is negatively related to age and being female, and show that their experimentally validated survey risk measure has some predictive power in relation to portfolio choice. Studies from other areas of economics, for instance purchases of life insurances, support the view that women are more risk averse; see Halek and Eisenhauer (2001). On the other hand, Datta Gupta, Poulsen and Villeval (2005) find that men and women are equally risk averse. However, women's choices of labor payment schemes are

mainly driven by their degree of risk aversion, while men's are not. A general survey of the literature on gender differences in preferences is provided by Croson and Gneezy (2004).

The results from the literature that examines the actual portfolio allocations and trading behavior of investors have generally concluded that single women have a higher probability of holding less risky portfolios and a lower probability of holding risky portfolios (Jianakoplos and Bernasek, 1998; Sundén and Surette, 1998; and Agnew *et al*, 2003). This literature, however, has mainly used data sets that not necessarily reflect the behavior of the average individual in the population where, in particular, many individuals do not hold bonds or stocks at all.

In this paper, we have extended upon the findings of the previous literature that single women have a higher probability of holding less risky portfolios and a lower probability of holding more risky portfolios by using a comprehensive representative sample. In particular, we have simultaneously investigated what makes individuals participate in the stock market *and* in the bond market. The result that single women have a lower propensity to invest in stocks and a higher propensity to invest in bonds, than have married women and men (married and single), is robust. Furthermore, single women tend to hold a smaller ratio of stocks and a larger ratio of bonds in their asset portfolio, even after correcting for the fact that some individuals are not participating in the stock and the bond market at all.

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Table 1: Descriptive Statistics

	Mean/Proportion						
		Males			Females		
Variable	All	All	Single	Married	All	Single	Married
Bond Market Participation Rate	0.081	0.081	0.058	0.108	0.080	0.095	0.066
Stock Market Participation Rate	0.228	0.244	0.191	0.305	0.212	0.198	0.227
Married	0.512	0.507	NA	NA	0.517	NA	NA
Male	0.494	NA	NA	NA	NA	NA	NA
Children 0-6 Years	0.141	0.132	0.079	0.185	0.151	0.111	0.188
Children 7-18 Years	0.169	0.156	0.059	0.254	0.182	0.105	0.255
Age	45.30	44.56	37.18	51.72	46.02	42.25	49.56
Length of Education	11.28	11.39	11.32	11.55	11.17	11.16	11.19
Non-capital Income	225,070	260,310	226,335	329,428	190,688	181,594	202,382
Cash Holdings	-14,059	-29,126	-27,626	-45,751	640	8,293	-7,265
Taxable Property Value	342,190	456,094	253,534	731,829	231,061	199,686	269,138
Private Pension Contribution	2,250	2,669	1,649	4,480	9,258	1,250	2,500
Public Pension Contribution	10,728	12,236	9,461	17,245	1,841	7,312	11,164
Stock Value	35,393	36,180	21,442	50,161	34,612	53,573	16,919
Bond Value	34,932	41,346	21,655	60,025	28,564	38,020	19,739
Ratio Stock/Total Assets Value	0.19	0.16	0.24	0.11	0.23	0.23	0.24
Ratio Bond/Total Assets Value	0.21	0.18	0.22	0.16	0.24	0.24	0.23
Ratio Stock/Bond Value	14.89	18.90	20.04	18.35	10.43	10.17	10.78

The table shows the mean or proportion (as appropriate) for each variable for various sub groups. The ratio of stocks (bonds) to total assets is the average amongst the investors who participate in the stock (bond) market. The ratio of the value of stocks to bonds is the average amongst the investors who hold both stocks and bonds. The amounts are in real 2000 DKK. The average exchange rate in 2000 was 0.1237 USD/DKK.

Table 2: Baseline Bivariate Probit Results

	Marginal Effects			
Explanatory variable	**Stocks**		**Bonds**	
Married Female	0.0005	(0.0012)	-0.0097	(0.0003) *
Married Male	0.0005	(0.0012)	-0.0079	(0.0003) *
Single Male	0.0073	(0.0012) *	-0.0053	(0.0004) *
Age	0.0011	(0.0000) *	0.0009	(0.0000) *
Children 0-6 Years	-0.0164	(0.0012) *	-0.0089	(0.0004) *
Children 7-18 Years	-0.0236	(0.0011) *	-0.0090	(0.0004) *
Length of Education	0.0035	(0.0001) *	0.0019	(0.0001) *
OMXC20 Lagged Return	0.0736	(0.0019) *	-0.0688	(0.0007) *
Non-Capital Income /1,000,000	0.1707	(0.0033) *	0.0183	(0.0011) *
Lagged Stock/Bond Participation	0.8915	(0.0006) *	0.8093	(0.0014) *
Correlation Coefficient	-0.0621 (0.0035) *			

The table shows the results from the baseline bivariate probit model; the marginal effect of each explanatory variable upon the probability of participating in the stock market and bond market, respectively. The last row shows the estimated correlation coefficient between bond and stock market participation. Standard errors in parentheses. * indicates that the variable in significant at 1% level of significance.

Table 3: Robustness of Results to Additional Control Variables

	Marginal Effects			
Explanatory variable	**Stocks**		**Bonds**	
Married Female	0.0031	(0.0011) *	-0.0074	(0.0003) *
Married Male	0.0011	(0.0012)	-0.0075	(0.0003) *
Single Male	0.0098	(0.0012) *	-0.0042	(0.0003) *
Age	0.0004	(0.0000) *	0.0005	(0.0000) *
Children 0-6 Years	-0.0127	(0.0012) *	-0.0065	(0.0004) *
Children 7-18 Years	-0.0193	(0.0010) *	-0.0064	(0.0003) *
Length of Education	0.0024	(0.0001) *	0.0014	(0.0000) *
OMXC20 Lagged Return	0.0776	(0.0019) *	-0.0518	(0.0007) *
Non-Capital Income /1,000,000	0.1018	(0.0042) *	-0.0062	(0.0013) *
Lagged Stock/Bond Participation	0.8841	(0.0006) *	0.7807	(0.0017) *
Cash Holdings /100,000	0.0209	(0.0003) *	0.0069	(0.0001) *
Taxable Property Value /100,000	0.0214	(0.0009) *	0.0091	(0.0003) *
Private Pension Contribution /10,000	0.0127	(0.0006) *	0.0042	(0.0002) *
Public Pension Contribution /10,000	0.0073	(0.0003) *	0.0005	(0.0001) *
Correlation Coefficient	-0.0917 (0.0038) *			

The table shows the results from the bivariate probit model with additional explanatory variables; the marginal effect of each explanatory variable upon the probability of participating in the stock market and bond market, respectively. The last row shows the estimated correlation coefficient between bond and stock market participation. Standard errors in parentheses. * indicates that the variable in significant at 1% level of significance.

Table 4: Heckman (1979) Selection Model

	Regression Coefficients			
Explanatory variable	**Stocks/Total Assets**		**Bonds/Total Assets**	
Constant	0.3773	(0.0032) *	0.3009	(0.0030) *
Married Female	0.0167	(0.0014) *	-0.0049	(0.0013) *
Married Male	-0.0666	(0.0014) *	-0.0572	(0.0012) *
Single Male	0.0019	(0.0015)	-0.0185	(0.0014) *
Age	-0.0023	(0.0000) *	-0.0005	(0.0000) *
Children 0-6 Years	-0.0658	(0.0017) *	-0.0306	(0.0023) *
Children 7-18 Years	-0.0335	(0.0015) *	-0.0313	(0.0018) *
Length of Education	0.0022	(0.0002) *	0.0014	(0.0001) *
OMXC20 Lagged Return	0.1082	(0.0022) *	-0.0314	(0.0022) *
Non-Capital Income /1,000,000	-0.3203	(0.0036) *	-0.2334	(0.0033) *
Mills Lambda	0.0219	(0.0008) *	0.0033	(0.0005) *

The table shows the estimated coefficients from the regression equation of the Heckman (1979) selection model. First, the explained variable is the ratio of the value of stocks to total assets, and second, it is the ratio of the value of bonds to total assets. Standard errors in parenthesis. * indicates that the variable is significant at 1% level of significance.

Figure 1: Stock Market Participation Rates

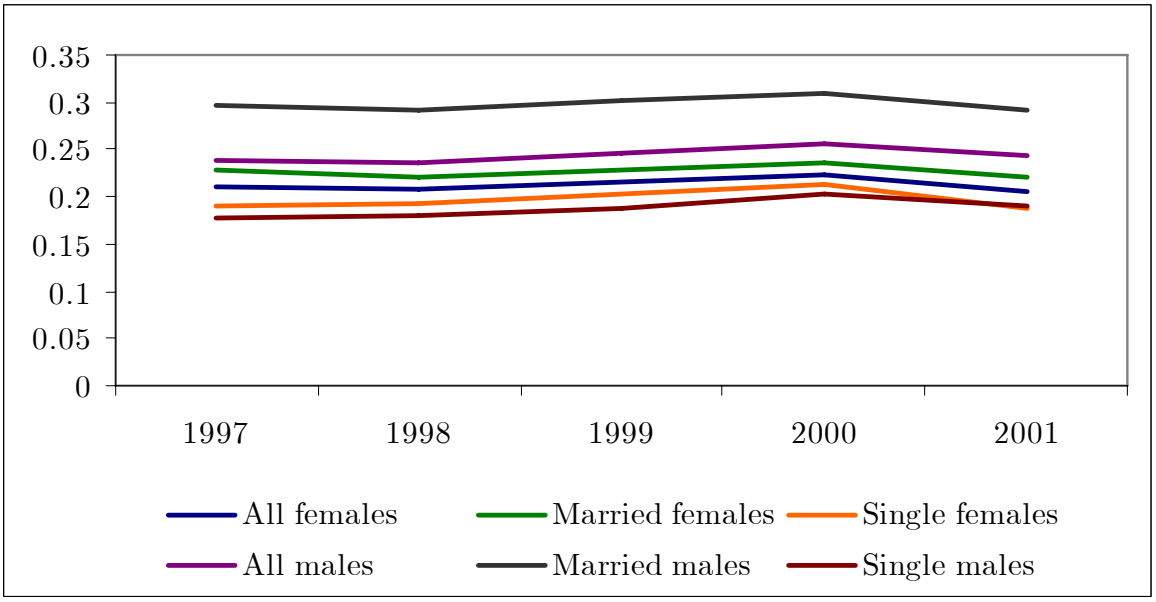
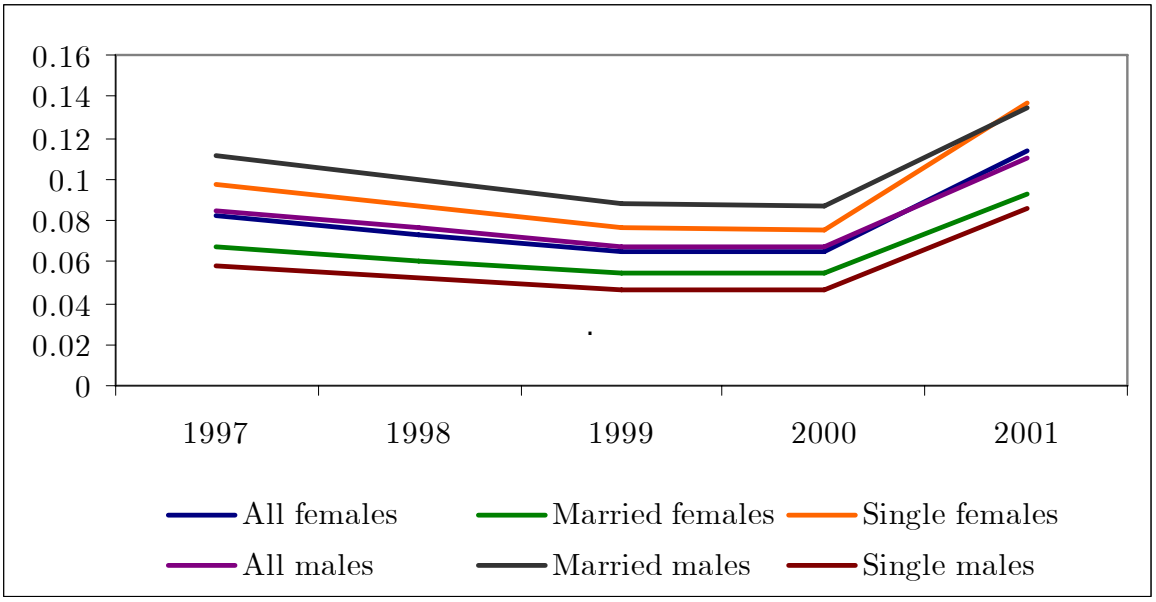


Figure 2: Bond Market Participation Rates



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