

An Investigation into the Differences of Investment Decisions and Risk Aversion between Genders in the United States for 401(k) Accounts

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**An Investigation into the Differences of Investment Decisions and Risk
Aversion between Genders in the United States for 401(k) Accounts**

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Abstract

Risk level of investments helps to determine investment return in the long run. Consequently, it is important to understand how investors determine their acceptable level of risk. Previous studies have suggested that women have a lower risk tolerance in investing than men. This is troubling because it means that women are likely to make lower returns on investments than men. This difference in acceptable risk could lead to income inequality between men and women during retirement as people rely on wealth generated from investments made during their lifetime to live during this stage of life. This study seeks to explain what motivates women to choose their acceptable level of investment risk by expanding on the models of previous studies, which are believed to be overly simplistic in their treatment of gender.

I. Introduction

People consider many factors when deciding how to allocate their assets. One of the most important decisions investors must make is the acceptable level of risk for their investment portfolios. This decision is of primary importance because the amount of risk an investor is willing to take on determines the range of returns that can be realized on their investments. This implies that investors who accept greater risks will require higher returns on their investments; therefore, it is essential to understand how investors determine what level of risk is tolerable for their investment portfolios.

Recent surveys and studies suggest that gender is one characteristic that may determine a person's level of acceptable risk. The evidence from recent studies, including work by Sundén and Surette (1998), supports the proposition that women in the United States make more conservative investments than men. Similarly, Clark et al (2003) found that females report that they are more conservative investors than men. Dwyer et al (2002) also found evidence to suggest that women take less risk than men in their mutual fund investments. It is important to understand the underlying reasons for these findings. The concern is that because women tend to have a lower risk tolerance they consequently will realize lower overall returns, and over time, this will lead to considerable discrepancies in accumulated investment assets between men and women.

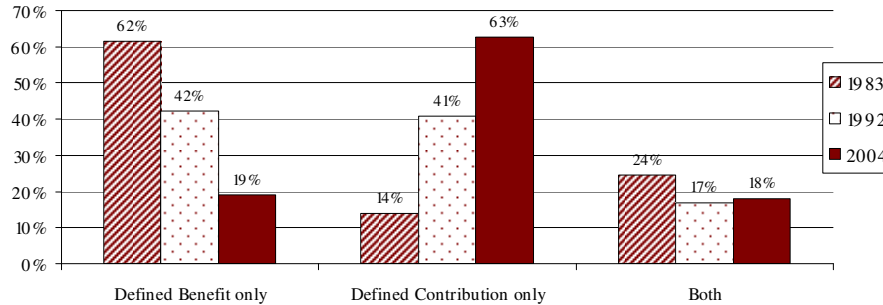
This pattern of more conservative investing is especially important because women already face many hurdles for achieving adequate retirement savings. One

such hurdle is that on average women make less money than men due to the gender gap in education achievement (Spraggins, 2005). Consequently, women have traditionally had less disposable income with which to invest and save. Also, women are less likely than men to have access to a 401(k) program (Sundén and Surette, 1998), a valuable tool for long-term retirement saving.

Growing evidence suggests that these trends significantly affect women during their retirement years. In the United States, 17.2 percent of women over age 65 live near the poverty line in comparison to 11.4 percent of men in this group (He et al, 2005). Similarly, among the population in the United States age 65 and over, 10.6 percent of women live below the poverty line compared with only 7.1 percent of men (He et al, 2005). This discrepancy increases as people age. Among the population in the United States age 75 and older, 14.3 percent of women lived below the poverty line in 2003 compared with just 7.5 percent of men (He et al, 2005). It is clear women need to save more and improve their financial knowledge, so that women will be able to invest more wisely and live comfortably in their golden years.

Access to 401(k)s and other investment vehicles is increasing for women. One reason for this is that many companies have stopped offering traditional pensions, which are defined benefit plans, and offer 401(k)s now. This trend can be observed below in Chart 1 (Center for Retirement Research at Boston College, 2005). This chart shows that the percentage of defined benefit plans among wage and salaried workers with pension coverage decreased from 62 to 19 percent from 1983 to 2004. During this same time period, defined contribution plans increased from 14 to 63 percent.

Percent of Wage and Salary Workers with Pension Coverage
by Type of Plan, 1983-2004



Source: Center for Retirement Research at Boston College, 2005

Similarly, the need to be financially savvy is increasing. Publicly traded companies are increasingly offering stock options to their employees (Kennickell et al, 2000), and proposals have been made to restructure the Social Security system so that individuals would be allowed to allocate their assets within the Social Security system. Therefore, it is important to understand the thought processes involved in making investment decisions in order to implement programs which help people to make more efficient asset allocations. Evidence suggests that asset allocation determines more than 90 percent of investors' return (Allebrand, 2007). Consequently, it is of paramount importance that women's investment decisions are studied and understood so that they can increase their retirement income. Encouraging and educating women to make better asset allocation decisions will help to accomplish this goal.

As a result of this compelling evidence and these trends, it is very important to analyze the differences in investment decisions between men and women in the United States. This paper will use the Survey of Consumer Finance (SCF) to analyze the investment decisions made by men and women in their 401(k) accounts. Analyzing the assets of a 401(k) is important because the retirement income produced by these plans depends on the success of the participant's investment choices and because 401(k) assets often represent the bulk of a family's financial assets (Munnell and Sundén, 2005). The risk level of each investor's portfolio will be determined by the proportion of the portfolio allocated toward investment in equities. The higher the allocation an investor allows for equities, the riskier the portfolio. A higher allocation of bonds and other fixed income investment holdings in a portfolio represent a more conservative portfolio. Using this method, this paper will test whether or not women are more conservative investors than men, and will control for other factors that would be expected to affect investment decisions.

II. Review of the literature

Interesting research has investigated the motivations behind investment decisions. Many studies have found that gender does play a role in determining an investor's level of acceptable risk (Sundén and Surette, 1998; Clark et al, 2003, Dwyer et al, 2002). Unfortunately, many of the previous studies in this area have overly simplified the differences in investing behavior between men and women. In order to accurately evaluate the role of gender in making investment decisions, it is important to examine the effect of gender conditioning on other related variables. These conditioning variables include demographic and household variables that have already been shown to affect investment behavior. If all of these variables are not considered, it is difficult to determine whether gender per se has a significant effect on investment behavior in women. An accurate measure of the gender effect on investment behavior can only be found through isolating conditioning variables to prevent biased estimates of the coefficients on the independent variables in the model.

This problem is highlighted in a study by researchers Sundén and Surette (1998). The authors rectify this problem by including variables for marital status, risk-aversion measures, and the portfolio of assets held outside of defined contribution (DC) plans. Although these conditioning variables help to better explain how women make investment decisions, the study still leaves out other important variables that have been proven to affect investment behavior and acceptable risk.

Sundén and Surette's model only accounts for the number of children less than 12 years of age, and does not explain this variable. In American society today, most children live with their parents until at least 18 years of age and into their early

twenties; consequently, the presence of any children in the household are likely to impact their parents' saving and investing decisions. In 2004, 11.05 percent of people worried most about saving for reasons related to their children (Survey of Consumer Finances, 2004). 4.39 percent of respondents of the 2004 SCF said that saving for their children's inheritance was the most important reason for saving. This response was also the fifth most popular choice among respondents out of 37 possible responses. This evidence suggests that parents with children of all ages are likely to have unique investment behavior. The researchers' treatment of this variable also counts respondents with children over 12 years of age as though they do not have any children at all. Clearly this treatment is undesirable, because it is likely that having children results in lower risk tolerance level. For example, parents who need to save for college may spend less time and money investing for their retirement, and will be deterred from investing what they can afford to save for retirement in a risky investment vehicle, where they could experience huge losses.

Barber and Odean (2001) have also explored this subject and have developed a model to demonstrate the differences in risk tolerance between men and women. Their model includes a variable to test the effects of the presence of children on investment decisions and of risk aversion between genders. Barber and Odean do not use the SCF; instead, they use data from a discount brokerage firm. To evaluate differences in investment decisions between the sexes, these researchers tested two hypotheses. The first hypothesis tested was that men trade more often than women. The second hypothesis tested by Barber and Odean was that by trading more, men are more likely to negatively impact their investment performance. Both of their

hypotheses were confirmed during their tests, and they concluded that men took more investment risk than women because men were overconfident in their investment knowledge and ability.

Investment knowledge is a highly important factor in making investment decisions as they relate to risk. This was shown by the work of Barber and Odean and has been confirmed by many other researchers. People who feel that they have a lack of investing knowledge avoid financial risk taking (Allebrand, 2007). Similarly, Lusardi and Mitchell (2006) found that financial knowledge and planning were clearly interrelated with tolerance of investment risk. Individuals for whom retirement is the most important reason to save and plan are also most likely to have advanced financial knowledge of retirement investing, and consequently are expected to accept more risk. Also, people who engage in risky behaviors, such as smoking, drinking and gambling are more likely to accept higher levels of investment risk (Barsky et al, 1997). Both financial knowledge and planning and risky behaviors are good indicators of how much risk investors are willing to accept. Sundén and Surette's model only includes one measure of risk tolerance, and it is a self-reported variable. Consequently, it may inaccurately reflect the true risk tolerance of respondents, since it relies on the respondents' opinion. Male respondents typically feel overconfident in their investment ability and are more likely to report a higher level of acceptable risk than is actually acceptable to them (Barber and Odean, 2001).

This paper will expand on previous research studies by accounting for the explanatory variables that previous studies have excluded. Sundén and Surette's model accounts for risk in assets held outside of the 401(k), marriage, and one risk

aversion measure. Barber and Odean's model excludes the explanatory variables included by Sundén and Surette, but includes the presence of children of all ages. All of these variables are known to affect investment decisions; therefore, is it important to combine them into a new model to investigate differences in risk tolerance by gender. By taking the explanatory variables from these models and incorporating them into a new model that includes additional related variables, this paper will more effectively explain the motivational factors that determine investment decisions and whether women are truly more risk averse than men.

III. Methodology

This study will use an econometric model in order to test the effects of independent variables on risk aversion in women. The base model follows that used by Sundén and Surette, which incorporated data from the 1992 and 1995 Surveys of Consumer Finances (SCF). This survey is a triennial survey conducted by the Federal Reserve Board. It includes information on the balance sheet, pension, income, and other demographic characteristics of U.S. families. I will conduct my investigation by expanding upon the model of Sundén and Surette, and I will include information obtained from the 2004 survey to update the results.

I will expand the model of Sundén and Surette in order to include all children regardless of age, the perceived importance of saving for retirement, and whether or not smokers are more prone to assume greater risk in their investment portfolios. Earlier studies have shown that these three variables have an effect on investment behavior, and it will be interesting to observe how these factors compare to other variables in the model.

The model of Sundén and Surette employs a multinomial logit model to analyze investment behavior. This type of model is used because the SCF reports consumer investment choices in a categorical manner with no logical ordering. The categories used by the SCF are: investments mostly in stocks, investments mostly in interest earning assets (bonds), investments divided between stocks and bonds (diversified). The diversified category is used as the base category for the multinomial logit model. This means that the model shows how the independent

variables affect the probability of choosing the mostly stocks category or mostly bonds category in relation to the probability of choosing the diversified category.

Sundén and Surette's model contains twenty-eight independent variables, including gender, marriage and interaction term of the two. These three variables allow the model to account for the possibility that the effects of gender on investment decisions may be affected by marital status (Sundén and Surette, 1998).

The next factor in the model controls for the effects of age on investment behavior. Age is an important variable for two primary reasons. First, age is likely to be positively correlated with the investment experience of an individual. Second, the level of risk tolerance is also likely to be positively correlated with age. Based on investment theory, younger individuals are more likely to invest to maximize returns by selecting relatively risky investments, such as stocks. This conclusion is based on the human capital argument. This argument states that as people approach retirement they have fewer salary payments to receive, and greater financial wealth from what has been accumulated over their working years (Munnell and Sundén, 2005). As people age, they stabilize the risk in their portfolio by increasing proportion of bonds as the number of period to receive salary payments decreases. Younger investors have a greater proportion of stocks in their portfolios because they have a larger number of salary payments to receive. As a result, young investors are likely to hold more stocks than older investors. Sundén and Surette's model includes the variables age and age² in order to account for age. Age² is used to identify a non-linear effect of age on investment behavior. I expect both age and age² to have a negative

impact on an investor's decision to choose mostly stocks, and a positive impact on an investor's decisions to choose mostly bonds.

The model also includes three indicator variables for levels of schooling. These variables are used as proxy variables for financial knowledge. This variable is important because evidence indicates that financial knowledge is an important determinant of investment decisions. People with little knowledge of investing usually choose to invest in interest earning assets because they get confused by investing in riskier and more complicated stocks.

The SCF also has information on the respondents' levels of acceptable risk. This is very important because the allocation of assets within retirement plans is likely to be correlated with the willingness of individuals to trade risk for return. Starting with the 1983 survey, the same question on financial risk tolerance has been asked in each survey except for the 1986 SCF. The SCF question is the only risk tolerance question that has been asked of a national sample representing all adults over an extensive period of time. The question asks which level of risk the respondent is willing to take on when saving or making investments: substantial risk expecting to earn substantial returns, above average risk to earn above average returns, average risk expecting to earn average returns, and not willing to take any financial risks. This measure is self-reported, meaning that the measure is based on the respondents' opinion of their own investment risk. As a result, it is important to note that this measure may be somewhat flawed, as male respondents typically feel overconfident in their investment ability and consequently may report a higher level of acceptable risk than is truly acceptable to them (Barber and Odean, 2001).

Investments outside of defined-contribution plans could also have an effect on the allocation of assets within 401(k)s, and this effect needs to be controlled for. This is an essential aspect to consider because assets within a defined-contribution plan only account for one part, albeit frequently a large part, of an individual's portfolio. As a result, it is likely that investments within these plans are correlated with positions held outside of these plans. It is possible that the investments in a 401(k) are primarily bonds in order to offset the risk assumed by an outside portfolio consisting of equities. It is also possible that a person does not diversify in or outside of their defined-contribution plan. This variable will allow the model to investigate this relationship. In the model, a linear spline function is used to create variables that are used to specify the level of risk outside respondents' 401(k)s. The first variable shows the proportion of equities in their non-retirement assets. This indicates if stocks comprise 0 to 20 percent, 20 to 80 percent, or 80 to 100 percent of their remaining portfolio. Another variable shows the proportion of bonds in their non-retirement assets. The linear spline function for bonds indicates if bonds comprise 0 to 33 percent, 33 to 67 percent, or 67 to 100 percent of their remaining portfolio. Based on this approach, the higher the ratio of stocks to bonds, the riskier the portfolio is deemed, and the higher the ratio of bonds to stocks, the more conservative the portfolio is deemed. Similarly, an indicator variable is used to show whether or not an individual has access to a defined benefit plan.

This model also includes a variable to account for the number of children less than 12 years of age in a household. This means that if a household has only children older than 12 they are counted as having no children at all. As a result, the model

does not account for the unique saving and investing pattern of households with older children. There is also no discussion in the article of why the researchers chose 12 as the cut off age for including children in the model. Unfortunately, the ages of the respondents' family members were not released to the public for the 2004 SCF; therefore this model is only an approximate representation of the original. In place of children under age 12, the model will begin by using family members identified by the respondents as children living in their households.

The model includes eleven other variables related to demographic information and other investment information that is known to affect investment behavior. These variables are: a variable for non-financial assets, financial assets, percent invested in other assets (this includes investment in assets such as gold and art), debt, tenure at current job, income, occupation, IRA/Keogh assets and indicator variables for homeownership, no financial assets, and race.

After updating the results using the 2004 survey, I will then adjust the model to include the children living elsewhere, the respondents' perceived importance of saving for retirement, and for smokers. I will also replace the income variable with a variable for the log of income in the above model (Model 2). Using the log of income may produce a better model than using simply income because this variable has a very large range. After determining which variation of income to use, I will then construct another model that adds a variable to account for the effect of the number of children a respondent has living elsewhere and its effect on risk aversion (Model 3). I will also include an indicator variable for the perceived importance of saving for retirement and an indicator variable for whether or not the respondent is currently

smoking. I will use these models to test the effects of the independent variables including the number of children elsewhere, the importance of saving for retirement, and smoking on the dependent variable -- risk aversion -- using the 2004 SCF.

The heads of many households in the United States are now not married, but this does not mean they do not have children over 12 or children living outside of the home. In many American households, the head of household is single with one or more children. This is mainly due to the high divorce rate in the United States. Consideration must also be given to the issues surrounding child custody. As of 2004, 83.1 percent of custodial parents were mothers compared with 16.9 percent who were fathers (Grall, 2006). Also, 30.5 percent of custodial mothers had never been married according to the 2004 data (Grall, 2006). Consequently, by including the total number of children will enable the model to account for those people with children over 12 who are not married. Similarly, many individuals have children who do not live with them. This is likely to affect their investing behavior, as they need to provide child support for these children. Even children over 18 are likely to affect the investing behavior of their parents, since many parents hope to leave an inheritance for their children and help fund their education. The original model may have overstates the importance of gender to due to the fact it failed to account for children over age 12.

Similarly, financial planning is highly correlated with financial literacy and investment risk. Research has shown that more financially literate people are willing to accept higher investment risk (Lusardi and Mitchell, 2006). Research has also indicated that individuals who engage in risky behaviors, such as smoking, are also

willing to make riskier investments than their counterparts who do not engage in these behaviors (Barsky et al, 1997).

Using Model 3, I will perform tests to determine if children, the respondents' perceived importance of saving for retirement, and smoking have a statistically significant effect on risk aversion through the application of the multinomial logit model. I will also perform a joint significance test to examine whether these three variables have a jointly significant effect on risk aversion.

I hypothesize that Model 1 will show that gender has a statistically significant effect on risk aversion in investing. I also believe that a joint test on this model will show that marriage, gender and the interaction variable have more of an effect on risk aversion than gender alone. One reason for this hypothesis is that this model fails to account for all children of a respondent, which is highly correlated with marital status. Using this treatment, marriage is likely to be correlated with the effect that children have on investing, which will make the joint test appear more statistically significant than gender alone.

I also hypothesize that the tests on Model 3 will show that children living elsewhere, the perceived importance of saving for retirement, and smoking will have a statistically significant effect on risk aversion. I believe that gender will have less of an effect on risk aversion alone after accounting for these independent variables that were originally missing from the model. As previously stated, these variables have been shown to have an effect on investment decisions. Consequently, adding these independent variables to the model will yield more accurate measures of the coefficients of all the other independent variables, including the effect gender has on

risk aversion. I believe that the joint test including gender, the perceived importance of saving for retirement, children living elsewhere, and smoking will prove to be the most statistically significant test and will not be rejected at even the most extreme confidence intervals. This is because I hypothesize that children living elsewhere, the perceived importance of saving for retirement, and smoking have more of an impact on investing risk than marriage alone, especially in today's society.

It is also important to mention the SCF over-samples wealthy people. As a result, it will be necessary to use the weights provided by the SCF to correct the effects of this sampling bias.

IV. Results

After completing the multinomial logit for Model 1, it was found that the variables female, married and their interaction term were statistically significant and that all three variables negatively affect the probability that a person will choose the mostly stocks option. This means that if someone is female or married, or both, she is less likely to choose mostly stocks than if the person was male or single, or male and single. Consequently, a man is more likely to choose to invest mostly in stocks. The female and marital status variables also had a statistically significant negative effect on choosing the mostly bonds category. The joint test of all three gender-marital coefficients indicated that married women do significantly differ from other groups in their probability of choosing mostly stocks. Selected information for Model 1 can be found below in Table 1. Full results for Model 1 can be found in the Appendix.

Table 1: Descriptive Statistics, Multinomial Logit Results of Model 1

Multinomial Logistic Regression				
Independent Variable	Mostly Stocks		Mostly Bonds	
	coef	se	coef	se
Gender	-0.391***	0.140	-0.290*	0.160
Marital Status	-0.260**	0.128	-0.258*	0.145
Female*Married	-0.917*	0.543	-1.089	0.759
_cons	0.808	0.672	0.373	0.836
note: *** p<0.01, ** p<0.05, * p<0.1			Observations: 5,399	

Model 2 was then used to determine if income or the log of income provided a better measure and a better model. After running a multinomial logit for Model 2, it was determined that using the log of income provides a model that is closer to the true model than using simply income. This was determined by comparing the pseudo R^2 for models 1 and 2. This number indicates the amount of variability the model is able

to predict. Hence, the larger the pseudo R^2 measure is, the closer the model is to the true model. The model using the log of income provided a higher pseudo R^2 than the original model without the log of income. Consequently, the log of income was then used in all succeeding estimations. Also notable is that the log of income was statistically significant at the 1 percent level in Model 2, whereas in Model 1 income was not found to be statistically significant. Full results for this Model 2 can be found in the Appendix.

The results from the multinomial logit of Model 3 show that female, female*married and the perceived importance of saving for retirement have statistically significant effects on choosing mostly stocks. If an individual is female or female and married, this person is less likely to choose mostly stocks. The effect being of female is statistically significant at the 5 percent level and the effect of being a married female is statistically significant at the 10 percent level. If an individual perceives retirement as the most important reason to save the person is more likely to choose the mostly stocks category. This effect is statistically significant at the 1 percent level.

The effect of these same variables on the probability an investor would choose the mostly bonds category was interesting. Female did not have a statistically significant effect on choosing mostly bonds, but the interaction term of female and married did. This variables had a negative, statistically significant effect on choosing the mostly bonds category at the 10 percent level. It is notable; however, that female did have a positive effect on choosing mostly bonds, as was predicted. The interaction terms, female*retirement_importance and female*smoking, both had

statistically significant negative effects on the probability of choosing bonds. If an individual is female and perceives retirement to be the most important reason to save, or is female and smokes, she is less likely to choose mostly bonds. The addition of the three new independent variables also improved the predictive power of the model, as the pseudo R^2 increased in Model 3 to 0.0668 from 0.0561 in Model 1 and 0.0591 in Model 2.

The joint tests performed on Model 3 also yielded interesting results. A joint test showed that female, married and the interaction of these two variables are jointly significant. A joint test of children living elsewhere, the perceived importance of saving for retirement, and smoking showed that these variables have a jointly statistically significant effect on the model. The last joint test was performed on the joint significance of female*retirement_importance, female*smoking, and female. The null hypothesis, that these variables are not jointly significant, was rejected, and it was found these have a statistically significant joint effect on the model. Selected information from Model 2 can be seen below in Table 2. Full results can be found in the Appendix.

Table 2: Descriptive Statistics, Multinomial Logit Results of Model 3

Multinomial Logistic Regression				
Independent Variable	Mostly Stocks		Mostly Bonds	
	coef	se	coef	se
Gender	-0.417**	0.198	0.062	0.192
Marital Status	-0.143	0.130	-0.103	0.154
Female*Married	-0.938*	0.533	-1.402*	0.789
Importance of saving for retirement	0.394***	0.099	-0.025	0.119
Number of children living elsewhere	-0.005	0.037	-0.029	0.042
Currently smoking	-0.014	0.131	-0.006	0.153
Female*Importance of saving for retirement	-0.071	0.210	-0.640***	0.225
Female*Currently smoking	-0.276	0.255	-1.207***	0.320
cons	4.258***	1.048	3.985***	1.337
note: *** p<0.01, ** p<0.05, * p<0.1			Observations: 5,389	

V. Conclusions

People consider many factors when deciding how to allocate their assets. One of the most important decisions an investor must make is how much risk is acceptable for his or her investment portfolio. This decision is of primary importance because the amount of risk an investor is willing to take on determines the range of returns that can be realized. In the long run, investors who accept greater risk are usually rewarded with higher returns; therefore, it is very important to understand how investors determine what level of risk is tolerable to them. Economic policies and investment education programs can then be implemented to aid investors in making informed decisions about their investment options. More efficiently managed individual portfolios should lead to a corresponding increase in the economic wellbeing of the United States.

This paper helps to determine the role gender plays in determining the acceptable level of risk for individuals as they consider their investment options. It evaluates the evidence that women tend to make more conservative investment choices than men in the United States (Sundén and Surette, 1998). It is important to understand the underlying reasons behind this trend, since investment risk will affect investment returns. Investment returns will determine the overall status of a person's retirement portfolio. Consequently, investing too conservatively will hamper a woman's ability to achieve long-term financial security.

This paper used the SCF to analyze the investment decisions made by men and women in their 401(K) accounts. Analyzing the assets of a 401(K) is important because retirement income in 401(K) plans relies on a participant's investment ability

and because it often comprises the majority of a family's financial assets (Munnell and Sundén, 2005). A large amount of information is available for 401(k) accounts, as well, which makes them a useful subject to use to conduct research.

A multinomial logit model with three categories was used to measure the effect of independent variables on investment risk, using the diversified category as the base group of the model. The model measured risk level by determining the likelihood an investor would invest in each of the three categories. The greater the chance an investor's portfolio is mostly invested in equities, the higher the risk level is deemed to be. The greater the chance an investor's portfolio is mostly invested in bonds, the lower the risk level is deemed to be. Using this method, the paper tested whether or not women are more conservative investors than men, and the effects that children out the household, the perceived importance of saving for retirement, and smoking have on the investment decisions of women.

Previous studies have neglected to include certain segments of society and other considerations which are known to affect investment behavior. This paper investigated the effects of children outside the household, the perceived importance of saving for retirement, and whether or not an individual currently smokes as they affect a woman's investment behavior. The tests confirmed the hypothesis that smoking and a person's perceived importance of saving for retirement have a statistically significant effect on the probability of choosing between mostly stocks, mostly bonds or diversified categories. Children living elsewhere did not have a statistically significant effect on the probability of choosing amongst these categories, even when it was tested in a joint test with children living in the household. Adding

these variables did eliminate the statistical significant negative effect that being married had on the probability of a person choosing the mostly stocks category. Women were still less likely to choose mostly stocks even after accounting for these variables, although by a lesser extent. Hence, adding more variables to the model did eliminate some of the effect of gender on investing risk, which implies that previous models oversimplified their models on gender and investment risk.

It is noteworthy that the models showed that individuals who identified retirement as the most important reason to save were more comfortable taking on risk than those who did not identify this reason as most important. Those who identified retirement as the most important reason to save had a statistically significant higher probability of choosing the mostly stocks category. This finding implies that it may be possible to help women take on more investment risk if they are educated about the importance of saving money for retirement. This possibility is supported by the fact that the interaction of female and the perceived importance of saving for retirement did have a statically significant negative effect on the probability of investing in the most conservative category, mostly bonds.

The models also showed that women who smoke are less likely to be conservative investors. Females in the survey who currently smoke were found to have a statistically significant smaller probability of choosing to invest mostly in bonds than their peers who do not smoke. This discovery implies that at least one part of a woman's acceptable level of investment risk is determined by her predisposition and choice to engage in risky behaviors. It implies that some women have higher investment risk tolerance than other women. This finding also suggests it

might be impossible to change risk tolerance in some women, even with education on investments and finance, due to their predisposition to refrain from risky behavior.

These conclusions support the theory that previous studies took an overly simplistic approach in studying the role of gender in determining investment risk tolerance. Previous studies failed to include variables for social, behavioral and financial characteristics within households. These oversights resulted in an overstatement of the importance of gender on investing. Consequently, additional independent variables are included in this model to account for the effects of all children, the perceived importance of saving for retirement, and for smoking, which other studies did not consider. The model successfully proved that gender does play a significant role in investment behavior, but this behavior is not as pronounced as previous studies suggested when additional explanatory variables are included. The model in this study removes all children from the error term, which is particularly important as it is likely to be highly correlated to gender. It removes financial planning and knowledge from the error term, which other studies have correlated with investment risk. It also removes an individual's inherent risk-seeking behavior from the error term. Upon adding these variables, being married was found not to have any statistically significant negative effect on the probability of choosing mostly stocks or on the probability of choosing mostly bonds. This indicates that by including more variables that measure risk, this model is closer to the true model and was able to remove variables from the error term that caused the effects of being female and of being married to be overstated. This model is closer to the true model than those of

other studies and provides a more realistic measure of the role gender has on investment risk, as indicated by the relatively high pseudo- R^2 measure.

This model did fail to completely eliminate the statistically significant effect the female had on the probability of choosing the mostly stock category. One reason for failure is that no model could possibly include every explanatory variable of female on investment risk. A second and very important reason for this, is that risk tolerance is likely different between gender. Society conditions men and women to react to risk differently. As children, boys are taught to embrace risk. Boys are given race cars to play with and taught to aspire to be soldiers, presidents, race car drivers and astronauts. These are professions where very risky decisions must be made on a normal basis, consequently boys become accustomed to risk at an early age. Girls, on the other hand, are taught to be passive and non-confrontational. Girls are given dolls and dress-up clothes. They are taught to aspire to be mothers, teachers, and models. These professions do not require risky decisions to be made, and never become comfortable with making such decisions. Similarly, there are inherent biological differences between men and women that could lead to differences in risk tolerance. A study by Coates and Herbert (2008) found that men with high levels of the male hormone, testosterone, take greater risks trading than their counterparts with low testosterone. This implies that women will never take the same amount of investment risk as men, because they lack comparable amounts of this hormone. It is known, however, that men smoke more than women, but that this gap is decreasing (Schroeder, 2005). It is possible that this partially reflects the same biological differences that cause differences in investing behavior, so when smoking is included

as an explanatory variable some of the explanatory weight is taken away from biology.

This study did improve upon previous models that measure the effect of gender on investment risk by including more explanatory variables. This enabled the model to be closer to the true model and eliminated some of the effect that gender has on investment risk by providing a less biased estimated of its coefficient. The gender effect could not be completely eliminated, because it is impossible to include all variables that result in a biased measure of the effect of being female, and there are actually tangible differences in risk tolerance in men and women due to societal conditioning and biological differences.

VI. References

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VII. Appendix

Model 1 Results – Original Model using 2004 SCF data

Multinomial Logistic Regression				
Independent Variable	Mostly Stocks		Mostly Bonds	
	coef	se	coef	se
Gender	-0.391***	0.140	-0.290*	0.160
Marital Status	-0.260**	0.128	-0.258*	0.145
Female*Married	-0.917*	0.543	-1.089	0.759
Age	0.021	0.029	-0.052	0.037
Age-squared	8.15E-06	3.14E-04	8.81E-04	4.03E-04
No high school degree	-0.495*	0.280	-0.782***	0.260
Some college	0.172	0.127	0.057	0.149
Bond_percent: (0-33%)	-0.541	1.297	-2.834*	1.480
Bond_percent: (33-67%)	-13.854**	5.449	6.084**	2.960
Bond_percent: (67-100%)	-1,122.876***	85.772	-9.763**	4.779
College graduate	-0.202*	0.110	-0.027	0.148
Self-reported Financial Risk	-0.317***	0.054	0.359***	0.066
Stock_percent: (0-20%)	-2.188**	0.938	-2.102	1.298
Stock_percent: (20-80%)	1.588***	0.553	0.395	0.832
Stock_percent: (80-100%)	-2.349	2.622	-12.767***	4.672
Pension	-1.011***	0.272	-0.616*	0.320
Number of children in Household	-0.031	0.045	0.079	0.050
Non-financial assets	-1.97E-08	4.66E-08	-1.33E-07	9.31E-08
Financial portfolio assets	3.98E-09	7.82E-09	-3.27E-07	1.04E-07
Percent of other assets	-1.926**	0.931	1.643**	0.668
Debt	7.27E-08	1.28E-07	4.24E-07	2.52E-07
Tenure of full-time position	-0.014**	0.006	-0.012*	0.007
Occupation	-0.056	0.035	0.059	0.048
Income	1.16E-08	4.54E-08	-2.89E-07	3.18E-07
Assets in IRA	1.48E-05	6.69E-06	9.92E-06	6.46E-06
Homeownership	0.238	0.186	0.447*	0.254
No financial assets	-0.436**	0.208	-0.791***	0.271
Race	-0.159	0.114	-0.660***	0.114
_cons	0.808	0.672	0.373	0.836
note: *** p<0.01, ** p<0.05, * p<0.1			Observations: 5,399	

Model 2 Results –Original model with log of income using 2004 SCF data

Multinomial Logistic Regression				
Independent Variable	Mostly Stocks		Mostly Bonds	
	coef	se	coef	se
Gender	-0.477***	0.141	-0.385**	0.162
Marital Status	-0.144	0.127	-0.125	0.152
Female*Married	-0.895*	0.542	-1.078	0.775
Age	0.031	0.030	-0.041	0.038
Age-squared	-8.03E-05	3.18E-04	7.72E-04	4.10E-04
No high school degree	-0.485*	0.282	-0.768***	0.265
Some college	0.206	0.127	0.096	0.151
Bond_percent: (0-33%)	-0.515	1.303	-2.693*	1.503
Bond_percent: (33-67%)	-13.964***	5.319	5.597*	2.984
Bond_percent: (67-100%)	-1,080.742***	83.923	-9.346*	4.777
College graduate	-0.139	0.112	0.026	0.149
Self-reported Financial Risk	-0.335***	0.054	0.331***	0.067
Stock_percent: (0-20%)	-1.980**	0.945	-1.904	1.291
Stock_percent: (20-80%)	1.604***	0.560	0.454	0.834
Stock_percent: (80-100%)	-2.995	2.685	-13.488***	4.704
Pension	-0.976***	0.271	-0.609*	0.325
Number of children in Household	-0.033	0.045	0.072	0.050
Non-financial assets	6.96E-08	5.16E-08	-3.61E-08	8.98E-08
Financial portfolio assets	2.44E-08	2.04E-08	-2.58E-07	9.68E-08
Percent of other assets	-1.913**	0.917	1.593**	0.666
Debt	1.53E-07	1.49E-07	4.88E-07	2.33E-07
Tenure of full-time position	-0.012*	0.006	-0.010	0.007
Occupation	-0.081**	0.035	0.033	0.048
Log(income)	-0.313***	0.078	-0.385***	0.105
Assets in IRA	1.45E-05	6.56E-06	9.68E-06	6.36E-06
Homeownership	0.306	0.191	0.532**	0.261
No financial assets	-0.469**	0.211	-0.825***	0.275
Race	-0.150	0.114	-0.653***	0.114
_cons	3.948***	1.045	4.267***	1.335
note: *** p<0.01, ** p<0.05, * p<0.1			Observations: 5,399	

Model 3 Results – Expanded model using 2004 SCF data

Multinomial Logistic Regression				
Independent Variable	Mostly Stocks		Mostly Bonds	
	coef	se	coef	se
Gender	-0.417**	0.198	0.062	0.192
Marital Status	-0.143	0.130	-0.103	0.154
Female*Married	-0.938*	0.533	-1.402*	0.789
Age	0.028	0.030	-0.018	0.038
Age-squared	-8.07E-05	3.22E-04	5.11E-04	4.15E-04
No high school degree	-0.476*	0.285	-0.713***	0.267
Some college	0.216*	0.127	0.089	0.153
Bond_percent: (0-33%)	-0.893	1.317	-2.580*	1.521
Bond_percent: (33-67%)	-12.860***	4.902	5.539*	3.060
Bond_percent: (67-100%)	-1,038.317***	79.228	-9.108*	4.845
College graduate	-0.164	0.114	-0.033	0.148
Self-reported Financial Risk	-0.322***	0.055	0.329***	0.066
Stock_percent: (0-20%)	-2.384**	0.957	-1.963	1.284
Stock_percent: (20-80%)	1.710***	0.557	0.538	0.832
Stock_percent: (80-100%)	-3.274	2.705	-13.578***	4.615
Pension	-0.950***	0.267	-0.687**	0.326
Number of children in Household	1.71E-04	4.56E-02	4.60E-02	5.12E-02
Non-financial assets	1.03E-07	5.25E-08	-3.25E-08	8.92E-08
Financial portfolio assets	2.69E-08	2.08E-08	-2.58E-07	9.87E-08
Percent of other assets	-1.635*	0.893	1.507**	0.664
Debt	1.05E-07	1.51E-07	5.23E-07	2.27E-07
Tenure of full-time position	-0.013**	0.006	-0.006	0.007
Occupation	-0.079**	0.036	0.022	0.048
Log(income)	-0.347***	0.078	-0.408***	0.105
Assets in IRA	1.43E-05	6.36E-06	9.26E-06	6.18E-06
Homeownership	0.313	0.193	0.495*	0.260
No financial assets	-0.494**	0.210	-0.832***	0.276
Race	-0.186	0.115	-0.595***	0.116
Importance of saving for retirement	0.394***	0.099	-0.025	0.119
Number of children living elsewhere	-0.005	0.037	-0.029	0.042
Currently smoking	-0.014	0.131	-0.006	0.153
Female*Importance of saving for retirement	-0.071	0.210	-0.640***	0.225
Female*Currently smoking	-0.276	0.255	-1.207***	0.320
_cons	4.258***	1.048	3.985***	1.337
note: *** p<0.01, ** p<0.05, * p<0.1		Observations: 5,389		