Women and Risk Tolerance in an Aging World

Terrence Hallahan*
RMIT University

Robert Faff
Monash University

Michael McKenzie
RMIT University

JEL Classification: D81

Keywords: Risk Tolerance; Gender, Demographic characteristics

Acknowledgment: The authors would like to thank ProQuest Personal Financial Profiling for providing access to their database and Geoff Davey, Joint Managing Director for information on the operation of the ProQuest system.

*Corresponding author. Tel 61-3-9925 5872; fax: 61-3-9925 5986
E-mail address: terry.hallahan@rmit.edu.au

Women and Risk Tolerance in an Aging World

Abstract

Analysis of a very large database of psychometrically-derived risk profiles of adult Australians aged between 20 and 80 years provides evidence that women differ from men in their attitude to financial risk taking. Regression analysis of risk tolerance scores (RTS) on the demographic characteristics of gender, marital status, number of dependents, age, education, income, combined income and net assets reveals each of these characteristics to be significant determinants of risk tolerance, with the first four characteristics having a negative relationship with RTS. The impact of gender was explored through dummy variable enhanced regression analysis constructed to test the increment in each demographic coefficient derived from being female relative to the base case of being male. Evidence of non-linearity in the relationships between RTS and demographic characteristics was also examined.

"*While boys outnumber girls in all countries, gender differences in mortality eventually produce a changing sex balance within a population. By age 30 or 35, women start to outnumber men, and the absolute female advantage increases with age. Elderly women greatly outnumber elderly men in most nations, and therefore the health and socioeconomic problems of the elderly are, to a large extent, the problems of elderly women.*" (Kinsella and Gist, 1998)

1. Introduction

The above quotation from a U.S. Census Bureau report draws attention to looming health and welfare problems arising from demographic aging of populations around the world (Kinsella and Gist, 1998). Health and welfare issues have understandably captured the attention of researchers and governments because of their fiscal implications. One issue that has received relatively little attention however, is the implications for financial markets of a population which is ageing and becoming more predominantly female. If women have different attitudes to investing than men, then a shift in the control of personal wealth to women could be expected to impact not just upon the investment management industry, but upon the welfare of the investors themselves. In particular, the influence of women's risk tolerance[1] on their investment decisions will be an important determinant of their financial well-being in retirement.

The truth of this conjecture depends on whether women display a different attitude towards financial risk-taking relative to men. While stereotypical beliefs about gender differences are prevalent, there are now a number of studies that suggest women may be more risk averse than men in general business decision-making, and specifically in financial decision-making. Why is this significant? Studies in the US have found that while only 12% of women who have partners have sole responsibility for the family's investments, the greater longevity of females as well as the increasing divorce rate, mean that nine out of ten women will find themselves responsible for their family's finances and investments (Kover, 1999). Moreover, a 1997 report by the Bank of America found that the average age of widowhood for an American female is 56 years (Aguilar 2001). Given these factors, it should not come as a surprise that the report suggested that women had control of about 75% of total personal wealth in America. The implications of this are most apparent in the managed funds industry: as

[1] Financial risk tolerance is the term widely used in the personal financial planning industry to describe an investor's attitude towards risk. It is the inverse of the concept of risk aversion which has a central role in financial economics.

the baby boomer bulge moves through the age profile, the gender composition will shift further in favor of women.

Our study contributes to the literature by providing evidence that women do differ from men in their attitude to financial risk taking. This finding is based on the analysis of a database consisting of psychometrically-derived risk profiles for around 20,000 adult Australians. As much of the extant literature uses US data, our use of Australian data provides an important response to the concerns raised by Jiankoplos and Bernasek (1998) that much of what we know about investor risk tolerance could be country specific. As Australia shares a number of demographic and cultural similarities with other developed countries, we believe our results are relevant for these countries as well. For example, demographic similarities are apparent in the population pyramids depicted in Figure 1, with both Australia and the United States forecast to experience an increase in the elderly female segment of the population.

[FIGURE 1 ABOUT HERE]

From a somewhat different perspective, data from the U.S. Census Bureau reproduced in Panel A of Table 1 shows the impact of the baby boomers on the populations of developed countries outside Western Europe. Again, each country is forecast to experience significant increases in its elderly population, with the proportion of the population aged 65 and over increasing by, for example, 59 percent in the United States and 70 percent in Australia (from the year 2000 to 2030).

[TABLE 1 ABOUT HERE]

While the proportion of elderly in the population is increasing we also need to examine whether there are expected to be any significant changes in the gender composition of the population over 65. To do this we use a simple measure of gender composition, the sex ratio, defined by the U.S. Census Bureau as the number of men per 100 women in a given population or age category. In Panel B of Table 1 we can see that while each country listed is expected to experience some increase in the ratio over the period 2000 – 2030, the sex ratios peak at around 80. For the very old, those aged 80 and over, there is a similar pattern of increase although the ratios are much more in favor of women initially, ranging from 50-55 in 2000 to 61-66 in 2030.

The analysis undertaken in this paper proceeds as follows. We first give an overview of research into the determinants of financial risk tolerance and then turn our focus to research specifically relating to risk tolerance and gender. Regression analysis is used to examine the determinants of financial risk tolerance in our database and we find all of our demographic characteristics to be significant. The role of gender is then considered by focusing on the differential impact of gender on each of our demographic factors. Finally, a test for the presence of non-linearities in our relationships is undertaken.

2. The Determinants of Risk Tolerance

The last decade has seen an increase in research that has focused on the use of various demographic characteristics to predict investor risk tolerance.[2] The results of this research have not been uniform with respect to the identification of relevant demographic factors or the strength and direction of the identified relationships. Nevertheless, one of the most prominent factors that have been found to impact on financial risk tolerance is age. While the majority of the published research studies have found that risk tolerance decreases with age (Wallace and Kogan 1961; McInish 1982; Morin and Suarez 1983; Palsson 1996), some recent research fails to support or provides contrary evidence for this factor (Wang and Hanna 1997; Grable and Joo 1997; Grable and Lytton 1998, Grable 2000). Additionally, at least two studies have found the relationship to be negative but non-linear (Riley and Chow 1992; Bajtelsmit and VanDerhai 1997).

The marital status of a person has also been found to impact on risk tolerance. Roszkowski, Snelbecker and Leimberg, (1993) suggest that single people have higher financial risk tolerance than married individuals because they have less responsibilities than married people, particularly with respect to dependents. They also face less social risk (that is, potential loss of esteem) when undertaking risky investments. An alternative view suggests that married individuals have a greater capacity to weather financial vicissitudes and are therefore likely to have higher financial risk tolerance. Empirical research is equivocal on these competing hypotheses and a number of studies have failed to identify *any* significant relationship

[2] For a survey see Grable and Lytton (1998) and Grable and Joo (1999).

between marital status and financial risk tolerance (McInish, 1982; Masters, 1989; Haliassos and Bertaut, 1995). As such, the issue remains moot.

The impact of education and income on risk tolerance are found to be relatively uniform. Higher attained levels of education have been found to be positively related to higher financial risk tolerance (Baker and Haslem, 1974; Haliassis and Bertaut, 1995; Sung and Hanna, 1996). Similarly, research into the impacts of income and wealth uniformly support a positive relationship with levels of risk tolerance (Friedman 1974; Cohn, Lewellen, Lease and Schlarbaum 1975; Blume 1978; Riley and Chow 1992; Grable and Lytton 1999; Schooley and Worden 1996; Shaw 1996).

A final factor which is frequently tested in this context is gender and females typically show a lower preference for risk than males (for example, Bajtelsmit and Bernasek, 1996; Powell and Ansic, 1997; Grable, 2000, Grable and Joo, 2000). Although the research in this area is by no means uniform. For example, Grable and Joo (1999) found that gender was not significant in predicting financial risk tolerance and Ackert, Church and Englis (2002) also produced inconclusive results. The research in this area is explored in detail in the next section.

3. Gender and Risk Tolerance

Slovic (1966) documents what is considered to be the prevalent belief in western culture that men should, and do, take greater risks than women. Early psychological research on differences in decision-making generally was consistent with this belief. Eagly (1995) surveys research from the general psychology literature into gender differences relating to behavior, attitudes, cognitive ability, decision making and personality traits in the context of risk and decision-making and concluded that the bulk of the research suggests women are less aggressive, less confident, more cautious and possessing inferior leadership and problem solving abilities. However, these conclusions are not unanimous: Johnson and Powell (1994) reviewed earlier literature specifically on business decision-making and found the results to be ambiguous. For example, Powell (1990) found no significant differences in managers' decision-making style, and Masters and Meier (1988) were unable to differentiate between the risk-taking propensity of male and female entrepreneurs [although more recently Verheul, Risseeuw and Bartelse (2002) found gender differences in a range of other dimensions - in path traveled to entrepreneurship, strategy and type of leadership].

Schubert, Brown, Gysler and Brachinger's (1999) research suggests that gender-specific risk behavior is due more to contextual factors than a general trait, a finding consistent with Hudgens and Fatkin's (1985) experimental evidence that gender differences occur only in situations where the probability of success is low. In a similar vein, Siegrist, Cvetkovich and Gutscher (2002) examined biases in predicting the risk preferences of other people. While reporting that both women and men overestimated males' risks preferences, their research suggests that participants' predictions were influenced by knowledge about risk preferences incorporated in gender stereotypes and by their own feelings.

Another strand of research sought evidence of gender differences in financial literacy and attitudes towards money. Prince (1993) found that while both sexes saw money as closely linked with esteem and power, males were more prone to feel more involved and competent in money handling, and more prepared to take risks to build wealth. More recently, Chen and Volpe (2002) found statistically significant differences between male and female college students' financial literacy. Echoing Prince's (1993) findings, they found female students less interested and willing to learn about personal finance topics and less confident in dealing with these topics. Similarly, Stinerock, Stern and Solomon (1991) analyzed consumers use of professional financial advisers and found women had a higher degree of anxiety and lower risk preference when making financial decisions, and a stronger desire to use financial advisers. When examining both general and expert investors, Estes and Hosseini (1988) found females less confident in financial decision making, with gender the most important explanatory factor affecting confidence, ahead of age, experience, education, knowledge and asset holdings. Barber and Odean (2001) use gender as a proxy for overconfidence and find men trade more and perform worse than women.

In a related vein, Hawley and Fujii (1993) drew on data from the 1983 Survey of Consumer Finances which included questions asking respondents to state their preferences for taking financial risks. They found female heads of household were the most risk averse followed by single women. Interestingly, married women reported the lowest risk aversion.

Outside of the United States, Clark-Murphy and Gerrans (2001) examined survey responses from 2,399 Australian university staff and found women significantly more likely than men to consider themselves to have a lower level of knowledge, and more likely to seek advice from a financial advisor.

Turning to evidence of gender differences in financial decision making, there are a number of studies which examine the composition and risk profile of an individual's entire portfolio. Early research by Cohn, Lewellen, Lease and Schlarbaum (1975) and Lewellen, Stanley, Lease and Schlarbaum (1978) found that gender was significantly related to the proportion of risky assets held, and that female investors hold less risky portfolios. Riley and Chow (1992) analyzed asset allocation data provided by the Survey of Income and Participation and found some evidence that women are slightly more risk averse than men. The US Federal Reserve Board sponsored triennial Survey of Consumer Finances (SCF) has enabled a number of researchers to explore the issue of stated preference and revealed preference by examining the relationship between stated risk aversion, gender and asset allocation. For example, Schooley and Worden (1996) examined the 1989 SCF and compared household's reported willingness to take financial risk to the riskiness of their portfolios, measured as the proportion of risky assets to wealth. They found that overall households did allocate portfolio holdings consistent with their stated attitudes toward risk. They also found that the portfolios of households headed by females had significantly lower ratios of risky assets to wealth, although a coding procedure used in the creation of the data set meant that the extent of this gender difference could not be fully ascertained.

Jiankoplos and Bernasek (1998), using the same survey data found that as wealth increases, the proportion of wealth held as risky assets increased by a smaller amount for single women than for single men and married couples. Interestingly, they report that about 60% of female respondents and 40% of male respondents stated they were not prepared to accept *any* financial risk. Bajtelsmit, Bernasek and Jianakoplos (1999), again using the 1989 SCF, investigated pension allocations as part of the household's overall portfolio, finding significant gender differences in the overall allocation of wealth, with women exhibiting greater relative risk aversion in their allocation of wealth into defined contribution pension assets. Halek and Eisenhaeur (2001) used life insurance data to estimate relative risk aversion coefficients and then examined these in relation to demographic characteristics. They found men were less risk averse than women and that the difference in risk aversion across gender was highly significant.

Pension schemes that give the beneficiary some degree of control over asset allocation have enabled researchers to further explore the impact of gender. Bajtelsmit and Vanderhai (1997) examined the asset allocation decisions of a sample of nearly 17,000 management employees of a large United States employer. These employees were able to select from a choice of five investment alternatives offering different risk/return characteristics. It was found that women were significantly more likely to invest in fixed income securities and less likely to invest in employer stock. Hinz, McCarthy and Turner (1997) used data from the Thrift Savings Plan for United States Federal Government employees both found that women allocated a smaller proportion of their funds to equities than did men. Sunden and Surette (1998), using data from the 1992 and 1995 SCF, and after controlling for a range of demographic, financial and attitudinal characteristics, report that gender and marital status interact to significantly affect how individuals choose to allocate assets in defined-contribution plans: single women and married men were less likely than single men to choose the riskier portfolio option. Bernasek and Shwiff (2001) found that among university faculty, gender was the most significant factor in explaining the proportion of the pension invested in risky assets, with women more conservative investors than men. Interestingly, when interactive effects were added to the model, it was found that married and cohabiting women and men reacted in different ways to the attitudes towards risk of their partners: men were prepared to take on more risk than their partners while women were prepared to take less risk.

Barber and Odean (2001) examine the common stock portfolio holdings of men and women and find men invest in riskier positions than women when measured against four risk measures (portfolio volatility, individual stock volatility, beta and size). Dwyer, Gilkeson and List (2002) using data from a survey of 2000 randomly selected mutual fund investors, found that women exhibited less risk taking than men in their mutual fund investment decisions. Importantly, the impact of gender was significantly weakened when investor-specific financial investment knowledge was controlled for in the analysis, suggesting that the apparently lower risk tolerance of women is not an inalterable trait.

Researchers have also placed professional investors under the spotlight. Olsen and Cox (2001) investigate gender differences in attitudes towards risk for professionally trained investors. It was found that women investors weight risk attributes, such as possibility of loss and ambiguity, more heavily than their male colleagues. In addition, women tend to emphasize risk reduction more than men in portfolio construction. While gender differences appear to influence perceptions of risk and recommendations to clients, these differences tend to be the most significant for assets and portfolios at risk extremes. Bliss and Potter (2002) explore whether gender affects fund manager performance and/or behavior, in particular whether female fund managers are more risk-averse and less confident. Their exploration of whether equity mutual funds managed by women differed systematically in performance or operationally from those managed by men produced negative findings. Atkinson, Baird and Frye (2003) examined fixed income mutual fund managers and failed to find significant differences in terms of performance, risk or other fund characteristics. The difference appeared to be in the behavior of investors, with lower net asset flows into funds managed by women, suggesting gender stereotypes affect investor decision making.

4. Description of Survey Sample

Risk tolerance is an attitude and is therefore a complex psychological construct. Social psychology research going back at least 40 years (for example, Secord and Blackman, 1963) has identified two components of attitudes, known as the spoken component (that is, beliefs) and the unspoken component (that is, feelings and emotions). Attitude measurement therefore requires the use of a technique which can capture both these components.[3]

The ProQuest Personal Financial Profiling system is a proprietary, computer-based risk tolerance measurement tool. It has been available commercially to the Australian financial planning industry since 1998 and was introduced in the United States in 2002. It can be completed in hard-copy form or accessed through the Internet.[4] It is a psychometrically validated attitude test comprising 25 questions that generate a standardized Risk Tolerance Score (RTS) on a scale of 1 – 100, with higher scores indicating higher risk tolerance. Accompanying the risk tolerance test is a set of eight demographic questions dealing with age, gender, postcode, education,

[3] See Callan and Johnson (2003) for a discussion of risk tolerance measurement techniques and related issues.
[4] See www.ProQuest.com.au for further information about the ProQuest system.

income, marital status, dependents and net assets. In the case of education, income (individual and combined) and net assets; ordered categorical variables are created and the details of these are provided in Table 2.

The data sample comprised 20,353 Australian respondents who completed the survey in May 1999 – February 2002.[5] Approximately nine per cent of the respondents were identified as having completed the test in response to an invitation made to readers of Personal Investor magazine, 80 per cent of the respondents were identified as clients of financial advisers and the remainder was classified by ProQuest as non-specific. The Personal Investor readers completed the test by visiting the magazine's website where they could then access an internet link to the ProQuest website. Clients of financial advisers either completed the test online or completed a hard copy of the questionnaire sent to them in advance of meeting with their adviser.[6]

[TABLE 2 ABOUT HERE]

A summary of the demographic information for the investors captured in this database is presented in Table 3. Unfortunately, not all of the respondents who completed the survey and received an assessment of their financial risk tolerance also completed all of the demographic questions. As such, the number of observations for each demographic will be less than the total size of the RTS database. For example, 2726 respondents did not indicate their gender which reduced the sample to 17,627 comprising 11566 males (65.62%) and 6061 females (34.38%). More specifically, Panel A of Table 2 reveals that the majority of the survey respondents are married (76.82%). Panel B shows that proportionately more males (52.47%) than females (45.39%) had a university degree or higher qualification.

[TABLE 3 ABOUT HERE]

Panel C shows the breakdown of respondents' personal before-tax income. It is interesting to note that although 45.47% of total respondents reported incomes below $50,000, a much greater proportion of females (66.32%) than males (35.05%)

[5] Following consultation with ProQuest, respondents who recorded their age as less than 20 years or older than 80 years, and respondents who generated a RTS outside the range 20-95 were omitted from the analysis, as such responses were not considered plausible. A total of 356 respondents were excluded on these criteria.

[6] We recognize that the sample is not a representative cross-section of society, but argue that it represents those in society who are likely to seek professional investment and personal financial planning advice.

were in this category. As might be expected this disparity is reduced when combined incomes are considered: Panel D shows that 24.73% of females and 18.92% of males report combined family incomes of less than $50,000.

Finally, Panel E shows that 75.47% of males and 68.83% of females have more than $150,000 in net assets, with both groups recording their highest proportions in the $150,000 and $500,000 bracket. Taken in conjunction with the age information discussed earlier, this tends to suggest that the typical survey respondent is nearing or at retirement and is asset rich and income poor.

5. Empirical Framework

In order to test the determinants of risk tolerance, a number of different demographic factors may be considered. It is possible to quantify the effect of each of these demographic characteristics on the risk tolerance of an individual using statistical analysis. The model to be tested in this paper hypothesizes that the RTS for individual *i* is a function of each of these demographic characteristics, i.e.:

$$\begin{aligned} RTS = \alpha_0 + \alpha_1 DFEM + \alpha_2 DMARR + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU \\ + \alpha_6 INC + \alpha_7 \left(DMARR * CINC\right) + \alpha_8 NASS + \varepsilon \end{aligned} \tag{1}$$

where:

RTS is the financial risk tolerance score for each surveyed individual provided by ProQuest based on the answers to their Risk Tolerance Questionnaire and takes a value somewhere in the range between zero to 100 and;

DFEM is a dummy variable that signifies a respondent is female.

DMARR is a dummy variable that takes a value of unity if the respondent is married (legally or defacto).

NDEP is the number of people in the family whom are financially dependent on the respondent.

AGE is the age (in years) of the respondent.

EDU is an ordered categorical variable representing the educational background of respondents, 1 (4) representing the minimum (maximum) education level. Table 2 defines the four categories.

INC is an ordered categorical variable representing the income of respondents, 1 (5) representing the minimum (maximum) income level. Table 2 defines the five categories.

CINC is an ordered categorical variable representing the combined income of respondents (and their partner), 1 (5) representing the minimum (maximum) income level. Table 2 defines the five categories.

NASS is an ordered categorical variable representing the net assets of respondents, 1 (5) representing the minimum (maximum) income level. Table 2 defines the five categories.

The correlations between all these potential independent variables are reported in Table 4. As might be expected, the strongest correlation (0.7940) is found between the respondent’s income and the respondent’s combined family income. The relationships between the respondent’s net assets and age (0.5422) and net assets and combined family income (0.4012) exhibit moderate positive associations while weaker positive correlations are observed between marriage and the number of dependents (0.3576), marriage and combined family income (0.3461) and marriage and the respondents net assets (0.3627). Similarly weaker positive correlations are observed between the respondent’s income and net assets (0.3433) and income and education (0.3358). Focusing on the dummy variable for gender (DFEM), all the correlation coefficients between this variable and the other independent variables (with the exception of the dummy variable for marriage (DMARR)) indicate weak negative relationships. Interestingly, the relationship between the respondent’s gender and their income displays the strongest negative correlation (-0.3210), indicating a tendency for female respondents to have lower income. Table 4 provides some comfort that multicollinearity is unlikely to affect the estimation of the coefficients in the regression equations.[7]

[TABLE 4 ABOUT HERE]

Model (1) can easily be modified to consider a range of special cases, for example:

The general model for males is (i.e. DFEM = 0):

$$\begin{aligned} RTS = {} & \alpha_0 + \alpha_2 DMARR + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU \\ & + \alpha_6 INC + \alpha_7 (DMARR * CINC) + \alpha_8 NASS + \varepsilon \end{aligned} \tag{1a}$$

The general model for females is (i.e. DFEM = 1):

$$\begin{aligned} RTS = {} & \alpha_0 + \alpha_1 + \alpha_2 DMARR + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU \\ & + \alpha_6 INC + \alpha_7 (DMARR * CINC) + \alpha_8 NASS + \varepsilon \end{aligned} \tag{1b}$$

The model for married males is (i.e. DFEM = 0 and DMARR = 1):

$$\begin{aligned} RTS = {} & \alpha_0 + \alpha_2 + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU \\ & + \alpha_6 INC + \alpha_7 CINC + \alpha_8 NASS + \varepsilon \end{aligned} \tag{1c}$$

The model for unmarried males is (i.e. DFEM = 0 and DMARR = 0):

$$RTS = \alpha_0 + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU + \alpha_6 INC + \alpha_8 NASS + \varepsilon \tag{1d}$$

The model for married females is (i.e. DFEM = 1 and DMARR = 1):

$$\begin{aligned} RTS = {} & \alpha_0 + \alpha_1 + \alpha_2 + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU \\ & + \alpha_6 INC + \alpha_7 CINC + \alpha_8 NASS + \varepsilon \end{aligned} \tag{1e}$$

The model for unmarried females is (i.e. DFEM = 1 and DMARR = 0):

[7] The strongest correlation coefficient (0.7940), between the respondent's income and the respondent's combined family income, is insufficiently high to indicate severe collinearity between these two independent variables. In any case these two variables do not enter the regression together as such – referring to equation (1) we see that CINC is included interactively with DMARR. Additionally, the absence of high R^2 values in company with low t-statistic values for the regression results also supports this conclusion. Notwithstanding this, we cannot categorically rule out the possibility that three or more of the variables are collinear but no two taken alone display evidence of this.

$$RTS = \alpha_0 + \alpha_1 + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU + \alpha_6 INC + \alpha_8 NASS + \varepsilon \qquad (1f)$$

6. Basic Regression Results

Estimation results for the model specified in equation (1) are reported in Table 5. All of the demographic characteristics tested in equation (1) were found to be significant at the 1% level for our sample group. The constant term in this model, 65.79, represents a baseline risk tolerance score which will be adjusted up or down according to the characteristics of the individual respondent. The coefficients for the independent variables indicate the direction and magnitude of the effect on risk tolerance. For example, gender is the most significant of the specified determinants of risk tolerance and a female will exhibit a RTS 5.87 points less than a demographically equivalent male. Marriage is also an important determinant, reducing the RTS by 2.29 points. The results also support the view held by many in the investment industry that investors become more risk averse with age: the RTS decreases by 3.24 points for each decade of birthdays.

[TABLE 5 ABOUT HERE]

On the other hand, RTS is positively related to both income and education, with the former increasing the RTS by 1.70 points per category (as defined in Table 2) and the latter by 1.10 points per category. Risk tolerance is also positively related to the respondent's net assets, although this variable has less influence than income and education per category: the RTS increases 0.87 points per category. The interactive variable, DMARR*CINC, captures the impact of the combined income effect associated with marriage (or defacto relationships) and shows that RTS increases by 0.59 points per combined income category.

Overall, our results, based on the responses of a large-sample of investors, indicate that all of the demographic characteristics are significant in explaining financial risk tolerance. From a statistical significance point of view it seems that the most influential demographics are: Age, Gender, Education and Income.

7. Exploring the Role of Gender

Good reason exists to believe that males and females behave differently with regard to risk tolerance and this can be explored further in the context of model (1) by extending it into the following dummy variable enhanced regression specification:

$$
\begin{aligned}
RTS = {} & \delta_0 + \delta_1 DMARR + \delta_2 NDEP + \delta_3 AGE + \delta_4 EDU + \delta_5 INC + \delta_6 (DMARR * CINC) + \delta_7 NASS \\
& + \delta_{0\Delta} DFEM + \delta_{1\Delta} DFEM * DMARR + \delta_{2\Delta} DFEM * NDEP + \delta_{3\Delta} DFEM * AGE \\
& + \delta_{4\Delta} DFEM * EDU + \delta_{5\Delta} DFEM * INC + \delta_{6\Delta} DFEM * (DMARR * CINC) \\
& + \delta_{7\Delta} DFEM * NASS + \varepsilon
\end{aligned} \tag{2}
$$

In this form the model can test the increment in each coefficient derived from being female relative to the base case of being male, and thereby provide deeper insight into the impact of gender on risk tolerance.

Model (2) can be easily converted into a range of special cases, for example:

The general model for males is (i.e. DFEM = 0):

$$
RTS = \delta_0 + \delta_1 DMARR + \delta_2 NDEP + \delta_3 AGE + \delta_4 EDU + \delta_5 INC + \delta_6 (DMARR * CINC) + \delta_7 NASS + \varepsilon \tag{2a}
$$

The general model for females is (i.e. DFEM = 1):

$$
\begin{aligned}
RTS = {} & \delta_0 + \delta_{0\Delta} + (\delta_1 + \delta_{1\Delta}) DMARR + (\delta_2 + \delta_{2\Delta}) NDEP + (\delta_3 + \delta_{3\Delta}) AGE + (\delta_4 + \delta_{4\Delta}) EDU \\
& + (\delta_5 + \delta_{5\Delta}) INC + (\delta_6 + \delta_{6\Delta})(DMARR * CINC) + (\delta_7 + \delta_{7\Delta}) NASS + \varepsilon
\end{aligned} \tag{2b}
$$

Estimation results for the model specified in equation (2) are reported in Table 6. Table 6 is partitioned with the upper panel showing a baseline case for males and the lower panel showing the incremental effect of gender. In other words, the lower panel shows the incremental effect for each coefficient of being female relative to the base case of being male, and thereby identifies those characteristics that are differentially important for females.

[TABLE 6 ABOUT HERE]

First, we notice that the fixed (constant) component of RTS is lower for females by 9.6 points. However, the magnitude of this impact is generally tempered once the other demographic characteristics are taken into account. Most noticeably, marriage is a differentially important characteristic, having a less negative impact on risk tolerance for females than the negative impact found for males. That is, for males, being married reduces RTS by 3.63 points, whereas for females, being married reduces RTS by about 1 point (i.e. 3.63- 2.66). Similarly, the number of dependents is positively related to risk tolerance for females but negatively related for males, although in each case the magnitude of the impact is relatively small. Interestingly, while age reduces risk tolerance by 3.39 points per decade for males, its differential impact for females is positive but negligible, being associated with a decrease of 2.91 points per decade (i.e. 0.48 points lower in magnitude).

On the other hand, the combined income effect derived from marriage and the level of net assets of the respondent, which have a positive impacts of 1.02 and 1.03 points per category respectively for males, have correspondingly incremental negative impacts of –0.78 and –0.48 points for females.

Education was not found to be a significant differentiating variable in explaining the RTS of females. While important for both males and females in the sense that it is associated with an increase by 1.09 points per education category, the results show that no more or less importance is attached to it by females.

As an example, a 40 year old, university educated, married female with one dependent, earning \$50,000 - \$100,000, a combined income of \$100,000 - \$200,000 and net assets of \$150,000 - \$500,000 would have a risk tolerance of: 59.1.[8] This compares to the demographically equivalent male with a risk tolerance of 65.1.

The combined model reported in Table 5 somewhat obscures the direct effects of the demographic variables on female RTS. Accordingly, as noted above, the general model for evaluating the determinants of RTS [equation (1)] can be converted to a general model for females [Equation (1b)]:

$$\begin{aligned} RTS = \alpha_0 + \alpha_1 + \alpha_2 DMARR + \alpha_3 NDEP + \alpha_4 AGE + \alpha_5 EDU \\ + \alpha_6 INC + \alpha_7 (DMARR * CINC) + \alpha_8 NASS + \varepsilon \end{aligned} \quad (1b)$$

[8] This is calculated as: 67.304 + (- 9.6019) + (-3.6307 + 2.6589) + (-0.2876 + 0.4096) + (40*-0.3390 + 40*0.0485) + (4*1.0883 +4*0.0515) + (3*1.2486+ 3*0.9786) + (4*1.0236 + 4*-0.7822) + (3*1.0374 + 3*-0.4823) = 59.10

Section 3.1 reported the basic regression results for the general model and established that all the demographic characteristics were important determinants of an individual's attitude to risk. When the general model for females was tested on the data, it was found that the respondent's age, education, income and net assets were the most important determinants of risk tolerance. To investigate further the influence of these factors on the RTS, a parsimonious version of equation (1b) may be estimated in which only the most important components of equation (1b) are retained. The parsimonious model that focuses on these determinants may be specified as:

$$RTS = \chi_0 + \chi_1 AGE + \chi_2 EDU + \chi_3 INC + \chi_4 NASS + \varepsilon \qquad (3)$$

The estimated output for equation 3 is presented in Table 7. All of the estimated coefficients are significant at the 1% level. Here the constant term of 57.59 represents the baseline for females. The impact of the respondent's age, education, income and net assets can be estimated by examining the sign and magnitude of the estimated coefficients for these variables. For example, we can see that a female's RTS declines by 2.98 points with each passing decade but increased levels of education, income and net assets (as defined by the categories in Table 2) will increase her RTS by 1.16, 2.30 and 0.62 points per category, respectively.

[TABLE 7 ABOUT HERE]

Figures 2 and 3 illustrate some cases that are derived from the results reported in Tables 6 and 7.[9] In Figure 2 we have chosen male and female examples from each end of the socio-economic spectrum to observe how the risk tolerance score varies with age. In each case the negative and monotonic relationship between age and risk tolerance can be clearly seen and the impact of socio-economic factors is readily apparent.

[FIGURES 2 AND 3 ABOUT HERE]

[9] The top panel of Table 6 represents the parsimonious model for males and Table 7 the comparable model for females.

In Figure 3 we have chosen a young (20 year old) male and a matching young female and an elderly (70 year old) male and a matching elderly female, each with high school education, to illustrate how the risk tolerance score varies with changes in the income and wealth positions for each. Age and gender differences are clearly evident and are maintained as income and wealth increase.

8. The Presence of Non-linearities in the Model

An interesting extension of our research is to test the robustness of the linearity assumption implicit in the specification of the model. Indeed, previous research by Riley and Chow (1992) and Bajtelsmit and VanDerhai (1997) pointed to non-linearities in the relationship between age and risk tolerance, and non-linearities are plausible also for: NDEP; INC; CINC and NASS.[10] A simple test for the presence of non-linearities is to introduce quadratic versions of the independent variables. Accordingly, the non-linear model takes the form:

$$RTS = \gamma_0 + \gamma_1 DFEM + \gamma_2 DMARR + \gamma_3 NDEP + \gamma_4 NDEP^2 + \gamma_5 AGE + \gamma_6 AGE^2 + \gamma_7 EDU + \gamma_8 INC + \gamma_9 INC^2 + \gamma_{10} DMARR * CINC + \gamma_{11} DMARR * CINC^2 + \gamma_{12} NASS + \varepsilon \quad (4)$$

[TABLE 8 ABOUT HERE]

The estimated regression results are presented in Table 8. The significance of all of the estimated coefficients provides clear evidence of nonlinear effects in the relationship between RTS and NDEP, AGE, INC and CINC. Specifically, we see RTS decreasing at a decreasing rate as the number of dependents increases and decreasing at an increasing rate as reported age increases. On the other hand, RTS increases at a decreasing rate as income and combined income increase. A more insightful impression of this nonlinearity may be obtained using the estimated coefficients of the parsimonious model specified in equation (4) and plotting the predicted RTS for a collection of characterized cases. Figure 4 presents a plot of the predicted RTS for a young (20 year old) male and a similar female and an elderly (70 year old) male and a similar female who, in each case, are married, have one dependent family member and have completed high school. Similar to the counterpart plots given in Figure 3, age and gender differences are clearly evident and are maintained as income and wealth increase. Compared to Figure 3, the non-linear model provides lower RTS estimates on a case by case basis, suggesting that ignoring non-linearities may induce overestimation of RTS (at least for these types of individuals).

[FIGURE 4 ABOUT HERE]

9. Conclusion

Attitudes towards risk and their impact on asset allocation decisions will be an important determinant of financial well-being in retirement. Our analysis, of a very large database of psychometrically-derived risk profiles of Australians aged between 20 and 80 years, provides evidence that women differ from men in their attitude to financial risk taking. Our examination of a large Australian database also provides a response to the observation made by Jiankoplos and Bernasek (1998) that most of the risk tolerance research uses United States data and consequently the results could be country specific.

Regression analysis of risk tolerance scores (RTS) on the demographic characteristics of gender, marital status, number of dependents, age, education, income, combined income and net assets revealed each of these characteristics to be significant at the 1% level, with the first four characteristics having a negative relationship with RTS. The impact of gender was explored through dummy variable enhanced regression analysis constructed to test the increment in each demographic coefficient derived from being female relative to the base case of being male. While we found the fixed component of the RTS to be 9.6 points lower for females, the magnitude of this impact is reduced once the other demographic characteristics are taken into account. Marriage and number of dependents were found to be differentially important characteristics, with marriage having a less negative impact on risk tolerance for females than the negative impact found for males. Age reduces risk tolerance by 3.39 points per decade for males, and its differential impact for females is positive but negligible, being associated with a decrease of 2.91 points per decade (i.e. 0.48 points lower in magnitude).

[10] The non-linear effect in NASS is dropped due to insignificant results.

On the other hand, the combined income effect derived from marriage and the level of net assets of the respondent, which have positive impacts per category for males, have correspondingly incremental negative impacts for females. Education was not found to be a significant differentiating variable in explaining the RTS of females. While important for both males and females in the sense that it is associated with an increase in RTS per education category, the results show that no more or less importance is attached to it by females. Finally, we found evidence of nonlinear effects in the relationship between RTS and the number of dependents, age and income and combined income.

So, in the context of an aging and increasingly female world, what are the key implications of our findings? The implications are most apparent in the managed funds industry over a medium to longer term timeframe (looking at 2030 and beyond): as the baby boomer bulge moves through the age profile, the gender composition will shift further in favor of women. The extent to which women do have more conservative risk profiles and the extent to which this conservatism is exacerbated with age, we expect to see asset allocation decisions leading to an overall shift to less risky investment portfolios. Importantly, the existence of a positive equity premium means that such a shift in overall asset allocation has the potential to lead to lower levels of wealth for women in their retirement years. At a macro level, in the absence of countervailing forces at play, it may lead to lower levels of 'speculative' capital being available for venture capital and other extreme risk projects that currently attract funding.

References

Ackert, Lucy F, Bryan K Church, and Basil Englis, 2002, The Asset Allocation Decision and Investor Heterogeneity: A Puzzle? *Journal of Economic Behavior and Organisation* 47, 423-433.

Aguilar, Leticia, 2001, Women, Business and Finances: A Look to the Future., Los Angeles Business Journal, 8 October, 4.

Atkinson, Stanley M, Samantha Boyce Baird, and Melissa B Frye, 2003, Do Female Mutual Fund Manages Manage Differently?, *Journal of Financial Research* 26, 1-18.

Bajtelsmit, Vickie L, and Alexandra Bernasek, 1996, Why Do Women Invest Differently to Men?, *Financial Counselling and Planning* 7, 1-9.

Bajtelsmit, Vickie L, and Jack L VanDerhei, 1997, Risk Aversion and Pension Investment Choices, in Olivier S Mitchell, ed.: *Positioning Pensions for the Year 2000* (University of Pennsylvania Press, Philadelphia).

Bajtelsmit, Vickie L, Alexandra Bernasek, and Nancy A Jianakoplos, 1999, Gender Differences in Defined Contribution Pension Decisions, *Financial Services Review* 8, 1-10.

Baker, H K, and J A Haslem, 1974, The Impact of Investor Socioeconomic Characteristics on Risk and Return Preferences, *Journal of Business Research* 2, 469-476.

Barber, Brad M, and Terrance Odean, 2001, Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment, *Quarterly Journal of Economics* 116, 261-292.

Barsky, Robert B, F.Thomas Juster, Miles S Kimball, and Matthew D Shapiro, 1997, Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Study, *Quarterly Journal of Economics* 112, 537-579.

Bernasek, A, and S Shwiff, 2001, Gender, Risk and Retirement, *Journal of Economic Issues* 35, 345-356.

Bernheim, B Douglas, Jonathan Skinner, and Steven Weinberg, 2001, What Accounts for the Variation in Retirement Wealth Among U.S. Households, *American Economic Review* 91, 832-.

Bliss, Richard T, and Mark E Potter, 2002, Mutual Fund Managers: Does Gender Matter?, *Journal of Business and Economic Studies* 8, 1-15.

Blume, M, 1978, *The Changing Role of the Individual Investor* (John Wiley and Sons, New York).

Burton, Dawn, 1995, Women and Financial Services: Some Directions for Future Research, *International Journal of Bank Marketing* 13, 21-29.

Callan, V J and M Johnson, 2003, Some Guidelines for Financial Planners in Measuring and Advising Clients About Their Levels of Risk Tolerance, *Journal of Personal Finance* 1, 31-44.

Chen, Haiyang, and Ronald P Volpe, 2002, Gender Difference in Personal Financial Literacy among College Students, *Financial Services Review* 11, 289-307.

Clark-Murphy, Marilyn, and Paul Gerrans, 2001, Consultation and Resource Usage in Retirement Savings Decisions: Australian Evidence of Systematic Gender Differences, *Financial Services Review* 10, 273-290.

Cohn, Ronald A, Wilbur G Lewellen, Ronald C Lease, and Gary G Schlarbaum, 1975, Individual Investor Risk Aversion and Investment Portfolio Composition, *Journal of Finance* 30, 605-620.

Davey, Geoff, 2000, Risk Tolerance, Risk Profiling and the Financial Planning Process, (ProQuest).

Dwyer, Peggy D, James H Gilkeson, and John A List, 2002, Gender Differences in Revealed Risk Taking: Evidence from Mutual Fund Investors, *Economics Letters* 76, 151-158.

Eagly, A, 1995, The Science and Politics of Comparing Women and Men, *American Psychologist* 50, 145-158.

Estes, Ralph, and Jinoos Hosseini, 1988, The Gender Gap on Wall Street: An Empirical Analysis of Confidence in Investment Decision Making, *Journal of Psychology* 122, 577-590.

Friedman, B., 1974, Risk Aversion and the Consumer Choice of Health Insurance Option, *Review of Economics and Statistics* 56, 209-214.

Grable, John E, 2000, Financial Risk Tolerance and Additional Factors that Affect Risk Taking in Everyday Money Matters, *Journal of Business and Psychology* 14, 625-630.

Grable, J E, and S Joo, 1997, Determinants of Risk Preference: Implication for the Family and Consumer Science Professionals, *Family Economics and Resource Management Biennial* 2, 19-24.

Grable, J E, and S Joo, 1999, Factors Related to Risk Tolerance: A Further Examination, *Consumer Interests Annual* 45, 53-58.

Grable, John E, and So-Hun Joo, 2000, A Cross-Disciplinary Examination of Financial Risk Tolerance, *Consumer Interests Annual* 46.

Grable, John E, and Ruth H Lytton, 1998, Investor Risk Tolerance: Testing the Efficacy of Demographics as Differentiating and Classifying Factors, *Financial Counseling and Planning* 9, 61-73.

Grable, J E , and Lytton, R H, 1999, Assessing Financial Risk Tolerance: Do Demographic, Socioeconomic and Attitudinal Factors Work?, *Family Relations and Human Development/Family Economics and Resource Management Biennial*, 80-88.

Halek, Martin, and Joseph G Eisenhauer, 2001, Demography of Risk Aversion, *Journal of Risk and Insurance* 68, 1-24.

Haliassos, M, and C Bertaut, C, 1995, Why Do so Few Hold Stocks?, *Economic Journal* 105, 1110-1129.

Hariharan, Govind, Kenneth S Chapman, and Dale L Domian, 2000, Risk Tolerance and Asset Allocation for Investors Nearing Retirement, *Financial Services Review* 9, 159-170.

Hawley, Clifford B, and Edwin T Fujii, 1993-94, An Empirical Analysis of Preferences for Financial Risk: Further Evidence on the Friedman-Savage Model, *Journal of Post-Keynesian Economics* 16, 197-.

Hinz, Richard P, David D McCarthy, and John A Turner, 1997, Are Women Conservative Investors, in Olivier S Mitchell, ed.: *Positioning Pensions for the Year 2000* (University of Pennsylvania Press, Philadelphia).

Hudgens, Gerard A, and Linda T Fatkin, 1985, Sex Differences in Risk-Taking: Repeated Sessions on a Computer-Simulated Task, *Journal of Psychology* 119, 197-206.

Jianakoplos, Nancy Ammon, and Alexandra Bernasek, 1998, Are Women More Risk Averse, *Economic Inquiry* 36, 620-630.

Johnson, J, and P Powell, 1994, Decision Making, Risk and Gender: Are Managers Different?, *British Journal of Management* 5, 123-138.

Kinsella, Kevin, and Yvonne J Gist, 1998, International Brief - Mortality and Health,

Series IB/92-2 Gender and Aging (U.S. Census Bureau, Washington, DC).
Kover, Amy, 1999, Okay, Women Really Could Use Special Advice about Investing but why Does it have to be so Brainless? Fortune, 139, 6, 129-132.
Lewellen, Wilbur G, K L Stanley, Ronald C Lease, and Gary G Schlarbaum, 1978, Some Direct Evidence on the Dividend Clientele Phenomenon, *Journal of Finance* 33, 1385-1399.
Masters, Robert, and Robert Meier, 1988, Sex Differences and Risk-taking Propensity of Entrepreneurs, *Journal of Small Business Management* 31-35.
Masters, R., 1989, Study examines investors' risk-taking propensities, *Journal of Financial Planning* 151-155.
McInish, T H, 1982, Individual Investors and Risk-taking, *Journal of Economic Psychology* 2, 125-136.
Morin, R A, and A F Suarez, 1983, Risk Aversion Revisited, *Journal of Finance* 38, 1201-1216.
Olsen, Robert A, and Constance M Cox, 2001, The Influence of Gender on the Perception and Response to Investment Risk: The Case of Professional Investors, *Journal of Psychology and Financial Markets* 2.
Palsson, A-M., 1996, Does the Degree of Relative Risk Aversion Vary with Household Characteristics?, *Journal of Economic Psychology* 17, 771-787.
Powell, G, 1990, One More Time: Do Male and Female Managers Differ?, *Academy of Management Executive* 4, 68-75.
Powell, Melanie, and David Ansic, 1997, Gender Difference in Risk Behavior in Financial Decision-making: An Experimental Analysis, *Journal of Economic Psychology* 18, 605-628.
Prince, Melvin, 1992, Women, Men and Money Styles, *Journal of Economic Psychology* 14, 175-182.
Riley, William B, and K Victor Chow, 1992, Asset Allocation and Individual Risk Aversion, *Financial Analysts Journal* 48, 32-37.
Roszkowski, M J, G E Snelbecker, and S R Leimberg, 1993, Risk Tolerance and Risk Aversion, in S R Leimberg, M J Satinsky, and R T Leclair, eds.: *The Tools and Techniques of Financial Planning* (National Underwriter, Cincinnati, OH.).
Schooley, Diane K, and Debra Drecnik Wordon, 1996, Risk Aversion Measures: Comparing Attitudes and Asset Allocation, *Financial Services Review* 5, 87-99.
Schubert, Renate, Martin Brown, Matthias Gysler, and Hans Wolfgang Brachinger, 1999, Financial Decions-Making: Are Women Really More Risk-Averse, *AEA Papers and Proceedings* 89, 381-385.
Secord, P F and Backman, C W, 1964, *Social Psychology*, New York: McGraw-Hill.
Shaw, K L, 1996, An Empirical Analysis of Risk Aversion and Income Growth, *Journal of Labor Economics* 14, 626-653.
Siegrist, Michael, George Cvetkovich, and Heinz Gutscher, 2002, Risk Preference Predictions and Gender Stereotypes, *Organizational Behavior and Human Decision Processes* 87, 91-102.
Slovic, P, 1966, Risk-taking in Children: Age and Sex Differences, *Child Development* 37, 169-176.
Stinerock, Robert, Barbara B Stern, and Michael R Solomon, 1991, Sex and Money: Gender Differences in the Use of Surrogate Consumers for Financial Decision Making, *Journal of Professional Services Marketing* 7, 167-182.
Sunden, Annika E, and Brian J Surette, 1998, Gender Differences in the Allocation of Assets in Retirement Savings Plans, *AEA Papers and Proceedings* 207-211.
Sung, J., and S. Hanna, 1996, Factors related to risk tolerance, *Financial Counsel and*

Planning 7, 11-2.
Verheul, Ingrid, Peter Risseeuw, and Gaby Bartelse, 2002, Gender Differences in Strategy and Human Resource Management: The Case of Dutch Real Estate Brokerage, *International Small Business Journal* 20, 443-476.
Wallach, M M, and N Kogan, 1961, Aspects of Judgment and Decision Making: Interrelationships and Changes with Age, *Behavioral Science* 6, 23-26.
Wang, H, and S Hanna, 1997, Does Risk Tolerance Decrease with Age?, *Financial Counseling and Planning* 8, 27-32.

Table 1: Aging Population Projections for United States, Australia, Canada and New Zealand

	Over 65 Years of Age			Over 80 Years of Age		
Country	2000	2015	2030	2000	2015	2030
Panel A: Percent of Population						
United States	12.6	14.7	20.0	3.3	3.8	5.3
Australia	12.4	15.8	21.1	3.0	4.1	6.0
Canada	12.7	16.1	22.9	3.1	4.3	6.2
New Zealand	11.5	13.7	17.8	2.9	3.5	5.0
Panel B: Sex Ratio of Population[a]						
United States	71	79	80	50	66	61
Australia	78	82	81	55	62	66
Canada	74	77	79	52	56	61
New Zealand	77	79	79	53	60	62

Source: U.S. Census Bureau 2000
[a] Sex ratio is defined as the number of men per 100 women in a given population or age category.

Table 2: Summary of Ordered Categorical Variables

Ordered Categorical Variable Value	Education (EDU)[a]	Income (INC)[b]	Combined Income (CINC)[c]	Net Assets (NASS)[d]
1	Did not complete high school	Under $30,000	Under $30,000	Under $50,000
2	Completed high school	$30,000 - $50,000	$30,000 - $50,000	$50,000 - $150,000
3	Trade or diploma qualification	$50,000 - $100,000	$50,000 - $100,000	$150,000 - $500,000
4	University degree or higher qualification	$100,000 - $200,000	$100,000 - $200,000	$500,000 - $1,000,000
5	na[e]	Over $200,000	Over $200,000	Over $1,000,000

[a] The highest education level attained, or the closest equivalent.
[b] The income bracket for the respondent's personal before-tax income (having in mind income from all sources – work, investment, family and government).
[c] If married (or defacto), the income bracket for the respondent's combined before-tax income.
[d] The respondent's own net assets, including the family home and other personal-use assets, minus any amounts owed (if married or de facto, the respondent includes their share of jointly owned assets).
[e] 'not applicable'

Table 3: Dataset Partitioning Summary – Observation Counts

	Males						Females						Grand Total
	Age (years)					Total	Age (years)					Total	
	<=30	31-40	41-50	51-60	>60		<=30	31-40	41-50	51-60	>60		
Panel A: Marital Status													
Unmarried	997	470	325	254	162	2208	597	291	328	327	234	1777	3985
Married	728	1937	2327	2667	1471	9130	536	922	1070	1099	451	4078	13208
Total	1725	2407	2652	2921	1633	11338	1133	1213	1398	1426	685	5855	17193
Panel B: Education[a]													
Edu1	31	110	154	238	254	787	29	70	111	214	156	580	1367
Edu2	200	254	330	476	252	1512	148	207	338	402	223	1318	2830
Edu3	276	599	726	897	525	3023	159	290	316	329	156	1250	4273
Edu4	1210	1417	1404	1275	569	5875	790	629	607	457	134	2617	8492
Total	1717	2380	2614	2886	1600	11197	1126	1196	1372	1402	669	5765	16962
Panel C: Income[b]													
Inc1	307	116	131	356	543	1453	287	310	386	575	380	1938	3391
Inc2	527	377	403	600	429	2336	436	300	421	342	143	1642	3978
Inc3	577	969	1068	1023	371	4008	279	344	348	281	73	1325	5333
Inc4	175	600	636	547	144	2102	39	134	115	77	15	380	2482
Inc5	30	228	326	264	63	911	6	34	37	29	7	113	1024
Total	1616	2290	2564	2790	1550	10810	1047	1122	1307	1304	618	5398	16208

Table 3 cont.

	Males						Females						Grand Total
	Age (years)					Total	Age (years)					Total	
	<=30	31-40	41-50	51-60	>60		<=30	31-40	41-50	51-60	>60		
Panel D: Combined Income[c]													
Cinc1	47	42	45	155	326	615	41	24	33	161	177	436	1051
Cinc2	90	149	152	361	377	1129	71	78	110	215	126	600	1729
Cinc3	369	678	832	966	460	3305	255	347	420	394	119	1535	4840
Cinc4	262	790	880	825	203	2960	170	324	361	249	39	1143	4103
Cinc5	52	307	420	350	81	1210	44	156	159	96	20	475	1685
Total	820	1966	2329	2657	1447	9219	581	929	1083	1115	481	4189	13408
Panel E: Net Assets[d]													
Nass1	856	237	69	32	11	1205	610	140	46	30	11	837	2042
Nass2	466	499	254	144	96	1459	262	265	179	112	62	880	2339
Nass3	291	1004	1067	878	551	3791	183	492	585	542	284	2086	5877
Nass4	35	378	688	870	454	2425	24	158	310	391	171	1054	3479
Nass5	24	194	474	857	430	1979	13	81	197	253	107	651	2630
Total	1672	2312	2552	2781	1542	10859	1092	1136	1317	1328	635	5508	16367

[a] Education groups are classified as follows: 'Edu1': did not complete high school; 'Edu2': completed high school; 'Edu3': trade or diploma qualification; 'Edu4': university education.

[b] Income groups are classified as follows: 'Inc1': under $30,000; 'Inc2': $30,000 - $50,000; 'Inc3': $50,000 - $100,000; 'Inc4': $100,000 - $200,000; 'Inc5': over $200,000.

[c] Combined income groups are classified as follows: 'Cinc1': under $30,000; 'Cinc2': $30,000 - $50,000; 'Cinc3': $50,000 - $100,000; 'Cinc4': $100,000 - $200,000; 'Cinc5': over $200,000.

[d] Net asset groups are classified as follows: 'Nass1': under $50,000; 'Nass2': $50,000 - $150,000; 'Nass3': $150,000 - $500,000; 'Nass4': $500,000 - $1,000,000; 'Nass5': over $1,000,000.

Table 4: Correlation between Independent Variables

	DFEM	DMARR	NDEP	AGE	EDU	INC	CINC	NASS
DFEM	1	-	-	-	-	-	-	-
DMARR	0.0502	1	-	-	-	-	-	-
NDEP	-0.2054	**0.3576**	1	-	-	-	-	-
AGE	-0.0552	0.2771	-0.0213	1	-	-	-	-
EDU	-0.1097	-0.0602	0.0751	-0.2556	1	-	-	-
INC	**-0.3210**	0.1229	0.2739	-0.0772	**0.3358**	1	-	-
CINC	-0.1127	**0.3461**	0.2609	-0.0770	0.2981	**0.7940**	1	-
NASS	-0.1032	**0.3627**	0.2017	**0.5422**	-0.0030	**0.3433**	**0.4012**	1

DFEM is a dummy variable taking the value of unity if the respondent is female and zero for males. DMARR is a dummy variable taking the value of unity if the respondent is married and zero if unmarried. NDEP is a variable measuring the number of family dependents. AGE is the respondent's age in years. Ordered categorical variables for education (EDU); income (INC); combined income (CINC) and net assets (NASS) as defined in Table 2.

Table 5: Basic Aggregate Regression Results

Variable	Coefficient	Std. error	t-statistic	p-value
Constant	65.794**	0.587	112.06	0.000
DFEM	-5.8687**	0.210	-28.01	0.000
DMARR	-2.2940**	0.511	-4.49	0.000
NDEP	-0.1989**	0.073	-2.73	0.006
AGE	-0.3240**	0.009	-34.74	0.000
EDU	1.0997**	0.103	10.73	0.000
INC	1.7050**	0.120	14.21	0.000
DMARR*CINC	0.5855**	0.137	4.28	0.000
NASS	0.8651**	0.105	8.23	0.000
Adjusted R-squared	= 0.242			
Number of observations	= 15,916			

This table reports regression results in which the dependent variable is the respondent's risk tolerance score (created by ProQuest) and the independent variables are: DFEM, a dummy variable taking the value of unity if the respondent is female and zero for males; DMARR, a dummy variable taking the value of unity if the respondent is married and zero if unmarried; NDEP, a variable measuring the number of family dependents; AGE, the respondent's age in years; EDU, an ordered categorical variable measuring education level; INC, an ordered categorical variable measuring income; DMARR*CINC, an interactive variable created by the product of DMARR and CINC, where CINC is an ordered categorical variable measuring combined income and NASS, an ordered categorical variable measuring net assets. The ordered categorical variables for education (EDU); income (INC); combined income (CINC) and net assets (NASS) are defined in Table 2. White Heteroskedasticity-Consistent Standard Errors and Covariance are used.

* Significant at the 5% level

** Significant at the 1% level

Table 6: Dummy Variable Regression Results – Conditioned on Gender

Variable	Coefficient	Std. error	t-statistic	p-value
Constant	67.304**	0.733	91.77	0.000
DMARR	-3.6307**	0.730	-4.98	0.000
NDEP	-0.2876**	0.088	-3.27	0.001
AGE	-0.3390**	0.012	-28.31	0.000
EDU	1.0883**	0.131	8.30	0.000
INC	1.2486**	0.176	7.09	0.000
DMARR*CINC	1.0236**	0.200	5.12	0.000
NASS	1.0374**	0.133	7.78	0.000
DFEM	-9.6019**	1.178	-8.15	0.000
DFEM*DMARR	2.6589*	1.030	2.58	0.010
DFEM*NDEP	0.4096*	0.163	2.52	0.012
DFEM*AGE	0.0485*	0.019	2.49	0.013
DFEM*EDU	0.0515	0.212	0.24	0.808
DFEM*INC	0.9786**	0.251	3.89	0.000
DFEM*DMARR*CINC	-0.7822**	0.279	-2.81	0.005
DFEM*NASS	-0.4823*	0.218	-2.22	0.027
Adjusted R-squared	= 0.244			
Number of observations	= 15,916			

This table reports regression results in which the dependent variable is respondent's risk tolerance score (created by ProQuest) and the independent variables are combinations of: DFEM, a dummy variable taking the value of unity if the respondent is female and zero for males; DMARR, a dummy variable taking the value of unity if the respondent is married and zero if unmarried; NDEP, a variable measuring the number of family dependents; AGE, the respondent's age in years. Ordered categorical variables for education (EDU); income (INC); combined income (CINC) and net assets (NASS) are defined in Table 2. White Heteroskedasticity-Consistent Standard Errors and Covariance are used.

* Significant at the 5% level

** Significant at the 1% level

Table 7: Parsimonious Model for Female Respondents

Variable	Coefficient	Std. error	t-statistic	p-value
Constant	57.588**	0.881	65.37	0.000
AGE	-0.2982**	0.014	-20.78	0.000
EDU	1.1591**	0.164	7.05	0.000
INC	2.2987**	0.167	13.78	0.000
NASS	0.6240**	0.156	4.01	0.000
Adjusted R-squared	= 0.187			
Number of observations	= 5,323			

This table reports regression results in which the dependent variable is respondent's risk tolerance score (created by ProQuest) and the independent variables are: AGE, the respondent's age in years. Ordered categorical variables for education (EDU); income (INC); and net assets (NASS) are defined in Table 2. White Heteroskedasticity-Consistent Standard Errors and Covariance are used.

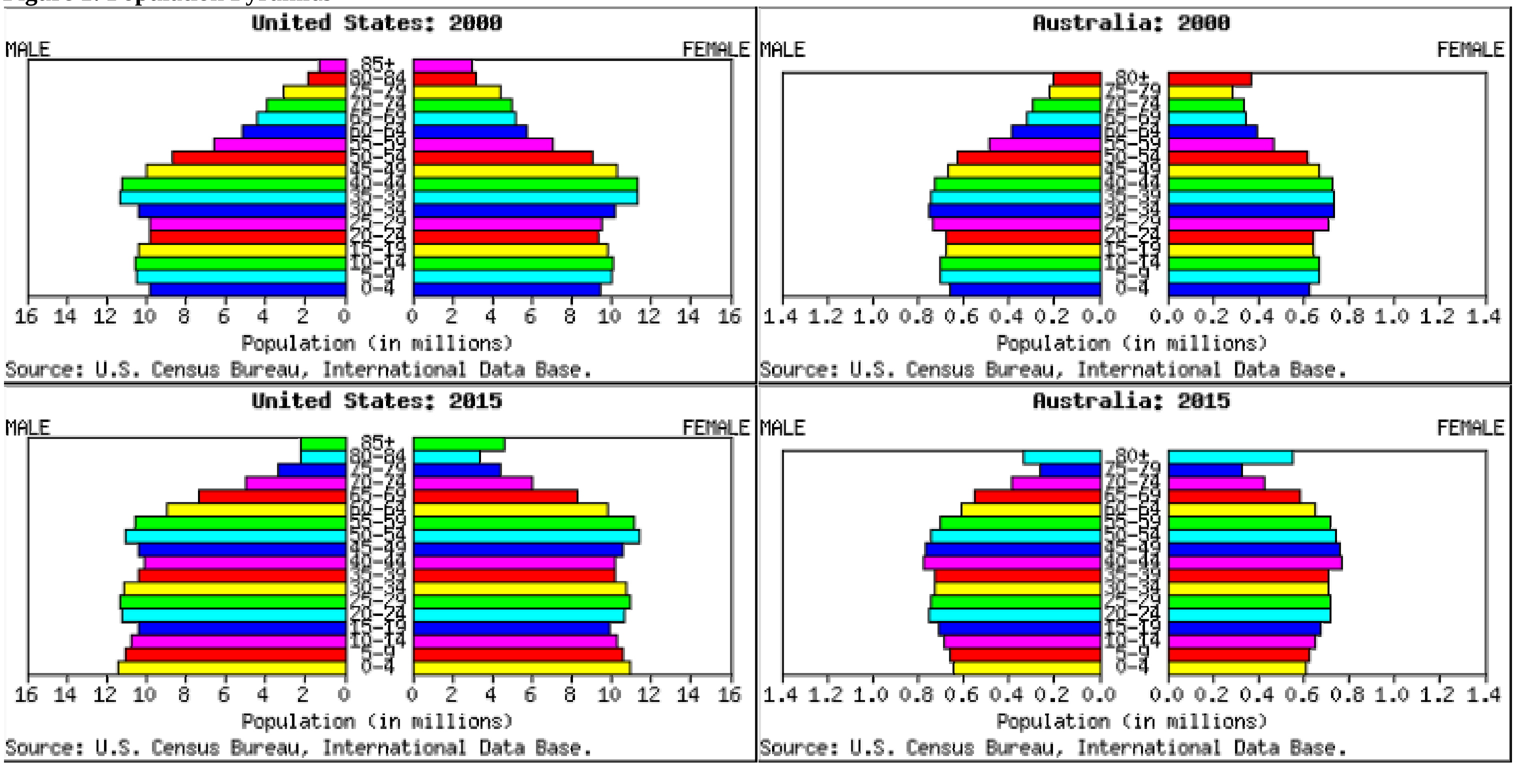
* Significant at the 5% level ** Significant at the 1% level

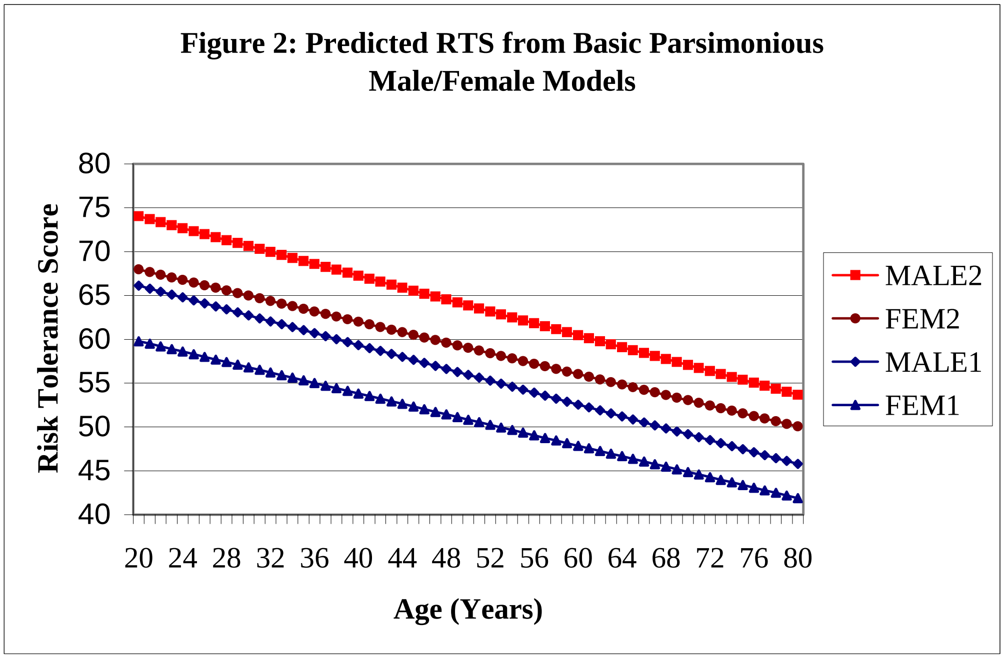
Table 8: Non-Linear Regression Results

Variable	Coefficient	Std. error	t-statistic	P-value
Constant	59.192**	1.191	49.70	0.000
DFEM	-5.9086**	0.212	-27.93	0.000
DMARR	-4.4117**	0.852	-5.18	0.000
NDEP	-0.6373**	0.188	-3.38	0.001
$NDEP^2$	0.0893*	0.042	2.12	0.034
AGE	-0.0964	0.052	-1.86	0.063
AGE^2	-0.0024**	0.001	-4.40	0.000
EDU	1.1006**	0.103	10.68	0.000
INC	3.5264**	0.413	8.53	0.000
INC^2	-0.3430**	0.076	-4.54	0.000
DMARR*CINC	2.0101**	0.538	3.74	0.000
$DMARR*CINC^2$	-0.2260**	0.087	-2.61	0.009
NASS	0.8837**	0.106	8.32	0.000
Adjusted R-squared	= 0.247			
Number of observations	15,916			

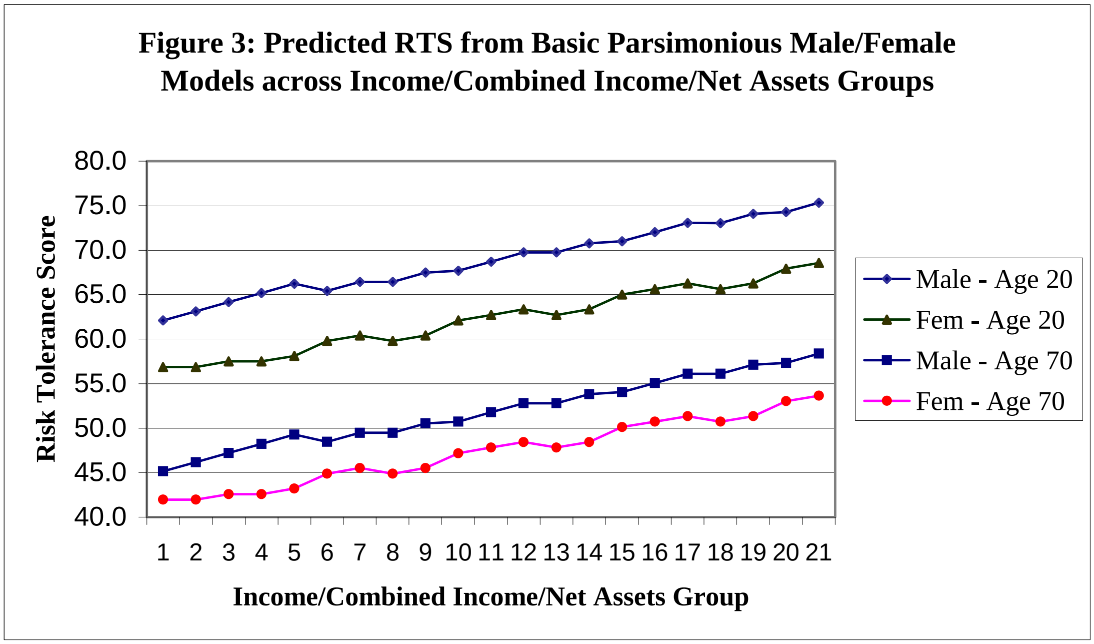
This table reports regression results in which the dependent variable is respondent's risk tolerance score (created by ProQuest) and the independent variables involve linear and/or quadratic versions of: DFEM, a dummy variable taking the value of unity if the respondent is female and zero for males; DMARR, a dummy variable taking the value of unity if the respondent is married and zero if unmarried; NDEP, a variable measuring the number of family dependents; AGE, the respondent's age in years. Ordered categorical variables for education (EDU); income (INC); combined income (CINC) and net assets (NASS) are defined in Table 2. White Heteroskedasticity-Consistent Standard Errors & Covariance are used.
* Significant at the 5% level ** Significant at the 1% level

Figure 1: Population Pyramids





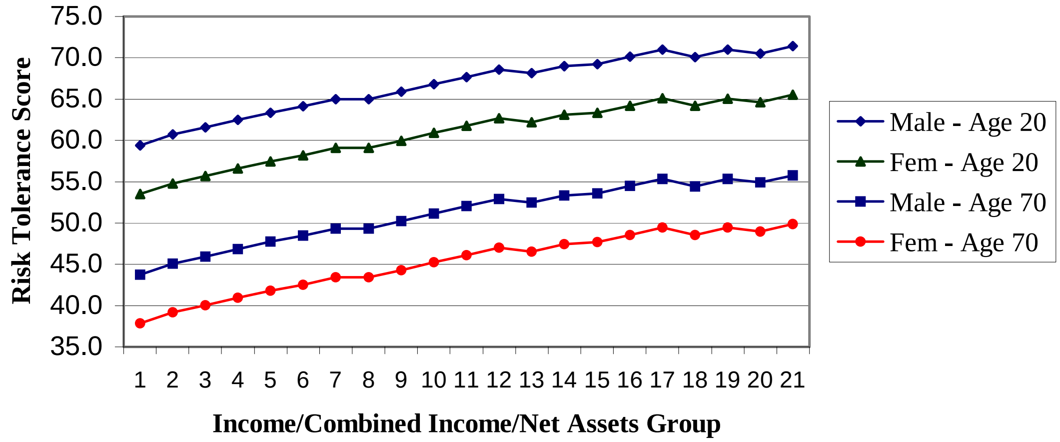
Note: This Figure displays four illustrative cases from the regression equations estimated for Tables 6 and 7. All cases represent unmarried respondents. 'FEM1' and 'MALE1' represent a female and male pair that habitate the lower end of the socio-economic spectrum. Specifically, 'FEM1' represents female respondents who have any number of family dependents; have completed a high school education only; have an income in the range $30,000 - $50,000; and have net assets in the range $50,000 - $150,000. 'MALE1' represents male respondents who have four family dependents; have completed a high school education only; have an income in the range $30,000 - $50,000; and have net assets in the range $50,000 - $150,000. In contrast, 'FEM2' and 'MALE2' represent a female and male pair that habitate the upper end of the socio-economic spectrum. Specifically, 'FEM2' represents female respondents who have any number of family dependents; have university qualifications; have an income in the range $100,000 - $200,000; and have net assets in the range $500,000 - $1,000,000. 'MALE2' represents male respondents who have no family dependents; have university qualifications; have an income in the range $100,000 - $200,000; and have net assets in the range $500,000 - $1,000,000.



Note: This Figure displays four illustrative cases from the regression equation estimated for Tables 6 and 7. All four cases are based on (a) one dependent family member; and (b) high school as the highest educational qualification. Males are married, whereas females may be married or unmarried. The Income / Combined Income / Net Asset groups are defined as follows:

I/CI/NA Group	Income	Combined Income	Net Assets
1	< $30,000	< $30,000	< $50,000
2	< $30,000	$30,000 - $50,000	< $50,000
3	< $30,000	$30,000 - $50,000	$50,000 - $150,000
4	< $30,000	$50,000 - $100,000	$50,000 - $150,000
5	< $30,000	$50,000 - $100,000	$150,000 - $500,000
6	$30,000 - $50,000	$30,000 - $50,000	$50,000 - $150,000
7	$30,000 - $50,000	$30,000 - $50,000	$150,000 - $500,000
8	$30,000 - $50,000	$50,000 - $100,000	$50,000 - $150,000
9	$30,000 - $50,000	$50,000 - $100,000	$150,000 - $500,000
10	$50,000 - $100,000	$50,000 - $100,000	$50,000 - $150,000
11	$50,000 - $100,000	$50,000 - $100,000	$150,000 - $500,000
12	$50,000 - $100,000	$50,000 - $100,000	$500,000 - $1,000,000
13	$50,000 - $100,000	$100,000 - $200,000	$150,000 - $500,000
14	$50,000 - $100,000	$100,000 - $200,000	$500,000 - $1,000,000
15	$100,000 - $200,000	$100,000 - $200,000	$150,000 - $500,000
16	$100,000 - $200,000	$100,000 - $200,000	$500,000 - $1,000,000
17	$100,000 - $200,000	$100,000 - $200,000	> $1,000,000
18	$100,000 - $200,000	> $200,000	$500,000 - $1,000,000
19	$100,000 - $200,000	> $200,000	> $1,000,000
20	> $200,000	> $200,000	$500,000 - $1,000,000
21	> $200,000	> $200,000	> $1,000,000

Figure 4: Predicted RTS from Non-Linear Model across Income/Combined Income/Net Asset Groups



Note: This Figure displays four illustrative cases from the regression equation estimated for Table 8. All four cases are based on (a) a married respondent; (b) one dependent family member; and (c) high school as the highest educational qualification. The Income / Combined Income / Net Asset groups are defined as follows:

I/CI/NA Group	Income	Combined Income	Net Assets
1	< $30,000	< $30,000	< $50,000
2	< $30,000	$30,000 - $50,000	< $50,000
3	< $30,000	$30,000 - $50,000	$50,000 - $150,000
4	< $30,000	$50,000 - $100,000	$50,000 - $150,000
5	< $30,000	$50,000 - $100,000	$150,000 - $500,000
6	$30,000 - $50,000	$30,000 - $50,000	$50,000 - $150,000
7	$30,000 - $50,000	$30,000 - $50,000	$150,000 - $500,000
8	$30,000 - $50,000	$50,000 - $100,000	$50,000 - $150,000
9	$30,000 - $50,000	$50,000 - $100,000	$150,000 - $500,000
10	$50,000 - $100,000	$50,000 - $100,000	$50,000 - $150,000
11	$50,000 - $100,000	$50,000 - $100,000	$150,000 - $500,000
12	$50,000 - $100,000	$50,000 - $100,000	$500,000 - $1,000,000
13	$50,000 - $100,000	$100,000 - $200,000	$150,000 - $500,000
14	$50,000 - $100,000	$100,000 - $200,000	$500,000 - $1,000,000
15	$100,000 - $200,000	$100,000 - $200,000	$150,000 - $500,000
16	$100,000 - $200,000	$100,000 - $200,000	$500,000 - $1,000,000
17	$100,000 - $200,000	$100,000 - $200,000	> $1,000,000
18	$100,000 - $200,000	> $200,000	$500,000 - $1,000,000
19	$100,000 - $200,000	> $200,000	> $1,000,000
20	> $200,000	> $200,000	$500,000 - $1,000,000
21	> $200,000	> $200,000	> $1,000,000