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An empirical investigation of personal financial risk tolerance

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Abstract

We analyze a large database of psychometrically derived financial risk tolerance scores (RTS) and associated demographic information. We find that people's self-assessed risk tolerance generally accords with RTS. Furthermore, we find that gender, age, number of dependents, marital status, income, and wealth are significantly related to the RTS. Notably, the relationship between age and risk tolerance exhibits a significant nonlinear structure. © 2004 Academy of Financial Services. All rights reserved.

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1. Introduction

Risk tolerance, a person's attitude towards accepting risk, is an important concept that has implications for both financial service providers and consumers. For the latter, risk tolerance is one factor which may determine the appropriate composition of assets in a portfolio which is optimal in terms of risk and return relative to the needs of the individual (Droms, 1987). In fact, the well-documented home country bias of investors may be a manifestation of risk aversion on the part of investors (see Cooper & Kaplanis, 1994 and Simons, 1999). For fund managers, Jacobs and Levy (1996) argue that the inability to effectively determine investor

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risk tolerance may lead to homogeneity among investment funds. Furthermore, Schirripa and Tecotzky (2000) argue that the standard Markowitz portfolio optimization process can be optimized by pooling groups of investors together with different attitudes to risk into a single efficient portfolio that maintains the groups average risk tolerance.

Despite its importance in the financial services industry, there remain some unresolved questions with respect to the "determinants" of risk tolerance.[1] Although a number of factors have been proposed and tested, a brief survey of the results reveals a distinct lack of consensus. First, it is generally thought that risk tolerance decreases with age (see Wallach & Kogan, 1961; McInish, 1982; Morin & Suarez, 1983; Palsson, 1996), although this relationship may not necessarily be linear (see Riley & Chow, 1992; Bajtelsmit & VanDerhai, 1997). Intuitively, this result can be explained by the fact that younger investors have a greater (expected) number of years to recover from the losses that may be incurred with risky investments. Interestingly, there is some suggestion that biological changes in enzymes due to the aging process may be responsible (see Harlow & Brown, 1990). More recent research, however, reveals evidence of a positive relationship or fails to detect any impact of age on risk tolerance (see Wang & Hanna 1997; Grable & Joo, 1997; Grable & Lytton, 1998, Hanna, Gutter, & Fan, 1998; Grable 2000, Hariharan, Chapman, & Domian, 2000; Gollier & Zeckhauser, 2002).

A second demographic that is frequently argued to determine risk tolerance is gender, and Bajtelsmit & Bernasek (1996), Palsson (1996), Jianakoplos and Bernasek (1998), Bajtelsmit, Bernasek and Jianakoplos (1999), Powell and Ansic (1997), and Grable (2000) find support for the notion that females have a lower preference for risk than males. Grable and Joo (1999) and Hanna, Gutter, and Fan (1998), however, find that gender is not significant in predicting financial risk tolerance.

Education is a third factor that is thought to increase a person's capacity to evaluate risks inherent to the investment process and therefore endow them with a higher financial risk tolerance (see Baker & Haslem, 1974; Haliassos & Bertaut, 1995; Sung & Hanna, 1996). However, Shaw (1996) derives a model that suggests an element of circularity in this argument, as the relative risk aversion of an individual is shown to determine the rate of human capital acquisition.

Income and wealth are two related factors that are hypothesized to exert a positive relationship on the preferred level of risk (see Friedman, 1974; Cohn, Lewellen, Lease & Schlarbaum, 1975; Blume, 1978; Riley & Chow, 1992; Grable & Lytton, 1999; Schooley & Worden, 1996; Shaw, 1996; Bernheim et al., 2001). For the latter, however, the issue is not clear cut. On the one hand, wealthy individuals can more easily afford to incur the losses resulting from a risky investment and their accumulated wealth may even be a reflection of their preferred level of risk. Alternatively, wealthy people may be more conservative with their money while people with low levels of personal wealth may view risky investments as a form of lottery ticket and be more willing to bear the risk associated with such payoffs. This argument is analogous to Bowman's (1982) proposition that troubled firms prefer and seek risk.

Investigation of the investment decisions made by married individuals presents a unique challenge to researchers, as the investment portfolio of the couple may reflect the combined risk preferences of the couple (Bernasek & Shwiff, 2001). The available evidence suggests that single investors are more risk tolerant (Roszkowski, Snelbecker, & Leimberg, 1993) although some research has failed to identify any significant relationship (McInish, 1982; Masters, 1989; Haliassos and Bertaut, 1995).[2]

The purpose of the current article is to provide evidence as to the behavior and "determinants" of risk tolerance. In addition to an analysis of the relationship between risk tolerance and general demographics, special attention shall be given to issues surrounding age and marital status. To this end, a database has been compiled that consists of a psychometrically derived financial risk tolerance score (RTS) for over 20,000 surveyed individuals as well as each respondent's demographic characteristics. This data shall be analyzed to provide further empirical insights into the nature of financial risk tolerance.

The remainder of this article proceeds as follows. Section 2 details the risk tolerance database and sample used in this paper. Section 3 presents the results of econometric analysis into the determinants of risk tolerance as well as some observations as to the nature of risk tolerance. Section 4 summarizes our findings.

2. Sample description

Risk tolerance, reflecting a person's attitude towards taking on risk, is a complex psychological concept. Jackson, Hourany, and Vidmar (1972) contend that risk tolerance has four dimensions: financial, physical, social, and ethical. Moreover, they find that there appears to be consistency in decision-making within, but not across, each of these dimensions. Callan and Johnson (2003) note that it has long been accepted in the field of social psychology (see, for example, Secord & Backman, 1964) that attitudes have two components: a spoken component comprising a person's beliefs and an unspoken component reflecting a person's feelings and emotions. Consequently, the measurement of financial risk tolerance needs to capture both these aspects of the attitudinal construct.

The three main methods for measuring financial risk tolerance involve one or a combination of: assessing actual behavior (Schooley and Worden, 1996, for example, find that portfolio allocations may be used to infer attitudes to risk); assessing responses to hypothetical scenarios and/or investment choices (see Barsky et al., 1997 and Hey, 1999); and subjective questions (see Hanna, Gutter & Fan, 1998 for a survey of these different techniques).[3]

The use of the latter of these approaches—experimental questionnaire data—remains the primary method for assessing financial risk tolerance. However, because of the complexity of the attitudinal construct, a sophisticated psychological testing instrument is required to elucidate a person's attitude to financial risk.

Psychometrics is that area of psychology dealing with the design and analysis of measurements of human characteristics. Perhaps the most prominent example of psychometric testing is the Myers–Briggs Type Indicator, an attitudinal and personality test widely used in the recruitment and personnel areas. Callan and Johnson (2003) provide an overview of the issues involved in constructing an appropriate psychometric instrument to measure financial risk tolerance. A good attitudinal test will meet accepted psychological standards for both face validity (perceived relevance of the questions) and predictive validity (prediction of later performance or behavior), reliability (consistency in results for repeated tests of the same person), as well as having appropriate test norms so that subjects' test scores can be interpreted against an appropriate reference group.

ProQuest is an Australian company that uses such an approach to measure the preferred level of risk of an individual and have kindly provided the data to be analyzed in our study. The ProQuest Personal Financial Profiling system is a proprietary, commercially provided computer-based risk tolerance measurement tool. It is a psychometric attitude test comprising 25 questions that generate a standardized Risk Tolerance Score (RTS) on a scale of 1 – 100,[4] with higher scores indicating higher risk tolerance. The test, which has a univariate factor structure, has been subject to usability, reliability, and norming trials by the University of New South Wales and has been found to have reliability statistics in excess of international psychometric standards. The test has been normed against a reference group of 5000 Australians.[5] Accompanying the risk tolerance test is a set of eight demographic questions requesting information on year of birth, gender, postcode, education, income, marital status, number of dependents and net assets.

The ProQuest database consists of the RTS and associated demographics for respondents who have completed the test over the period from May 1999 to February 2002. The majority of these data are sourced from clients of personal financial planners who take this test as a first step in constructing a personalized financial plan. Access to the survey is online via the ProQuest website. A subset of the data (approximately 1900 observations) were respondents who completed the test in response to an invitation made to readers of Personal Investor magazine. 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.[6]

Following consultation with ProQuest, respondents who recorded their year of birth implying an age of less than 20 years or older than 80 years, and respondents who generated an RTS outside the range 20–95 were omitted from the analysis, as such responses were considered unreliable. After exclusions, our sample comprises a maximum of 20,415 observations.[7] Almost all respondents are Australian, with approximately only 0.5% giving an international home address.

A summary of the demographic information for the individuals captured in this database is presented in Table 1. 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.

More specifically, panel A of Table 1 reveals that males (70.75%) represent a higher proportion of the database compared to females (29.25%). Panel B shows that a relatively small number of respondents aged less than 30 years are represented in the database, while 25.49% are aged 51- 60.

The highest educational qualification attained for the respondents is summarized in panel C of Table 1, and just one half of the respondents who answered this demographic question had completed university. This result may be biased, as individuals who did not complete some form of tertiary education may not be inclined to answer. One interesting issue this demographic information raises is whether more educated individuals have more money and so they are more likely to need the services of a financial planner and hence undertake the ProQuest survey. This is an empirical issue, which will be considered later in this paper.

Table 1
Summary of the ProQuest dataset by demographics

	Number of Observations	% of Sample
A: Gender		
Males	14444	70.75
Females	5971	29.25
Total Responses	20415	
B: Age		
<30 years old	2359	13.67
30–40 years old	3957	22.93
41–50 years old	4012	23.25
51–60 years old	4399	25.49
>60 years old	2528	14.65
Total Responses	17255	
C: Education (highest qualification attained)		
Did not Complete High School	1369	8.00
High School	2878	16.81
Trade/Diploma	4292	25.07
University	8582	50.13
Total Responses	17121	
D: Marital status		
Married (incl. Defacto)	13217	77.66
Unmarried	3802	22.34
Total Responses	17019	
E: Income		
<$30,000	3454	20.53
$30,000–$50,000	3989	23.71
$50,000–$100,000	5340	31.74
$100,000–$200,000	3018	17.94
>$200,000	1025	6.09
Total Responses	16826	
F: Net assets		
<$50,000	2118	12.87
$50,000–$150,000	2349	14.27
$150,000–$500,000	5884	35.75
$500,000–$1,000,000	3481	21.15
>$1,000,000	2629	15.97
Total Responses	16461	

In panel D, we observe that the majority of the survey respondents are married (77.66%). Finally, panels E and F summarize the income and wealth composition of the database respectively. Almost half of the respondents answering this question earn $50,000 or less (44%), while 56% own assets of between $150,000 and $1,000,000.

3. Empirical analysis

Analysis of the dataset has two facets: investigating the relationship between subjective and objective estimates of risk tolerance (Section 3.1), and exploring the relationship between demographic variables and risk tolerance scores (Section 3.2).

3.1. Self-assessed risk tolerance

The ProQuest survey contains a question in which respondents are asked to estimate their RTS *ex ante*.[8] It is interesting to consider the relationship between their self-assessed risk tolerance (SRTS) and that estimated by the ProQuest survey. As a first step in our analysis, we can report that the average difference between the RTS and SRTS is 5.33 ($\sigma = 8.49$). This suggests that respondents typically underestimate their risk tolerance score by approximately 5 points.

Recall that the RTS is measured on a scale from 0 to 100 and so it appears that most peoples' assessment of their capacity to bear risk accords to their revealed preferences as indicated by their answers to the survey. This is not true of all respondents however, as the maximum difference was 74 points and the minimum difference was −63 points.[9] Furthermore, we can report that 803 respondents were "correct" in their estimation of their own RTS, 4691 respondents overestimated, and 14921 underestimated their RTS. Thus, for some individuals, their answers to the survey suggested a risk tolerance different from their own perception of their ability to absorb risk, and the majority tended to underestimate their risk tolerance to varying degrees.

Further insights to this relationship may be gained by estimating a regression equation between SRTS and the ProQuest RTS. The estimated regression output may be summarized as follows:

$$\text{SRTS} = 4.12 + 0.838\ \text{RTS}$$

t-statistics (15.19) (185.67)

$$R^2 = 0.628,\ F\ \text{statistic} = 34473.55\ (p\ \text{value}) = 0.000$$

The estimated coefficients verify the significant positive association between people's own perception of their risk tolerance and the RTS. On average, a respondents self-assessed RTS is approximately 4.12 points plus 83.8% of their actual RTS.

Another way in which the consistency between individuals expressed and revealed risk preferences may be established is to cross reference their RTS with their answer to a question from the ProQuest survey in which respondents were asked to choose the most appealing portfolio from a selection each of which is composed of a different mix of high, medium and low risk/return assets:[10]

Portfolio	Risk/Return		
	High	Medium	Low
1	0%	0%	100%
2	0%	30%	70%
3	10%	40%	50%
4	30%	40%	30%
5	50%	40%	10%
6	70%	30%	0%
7	100%	0%	0%

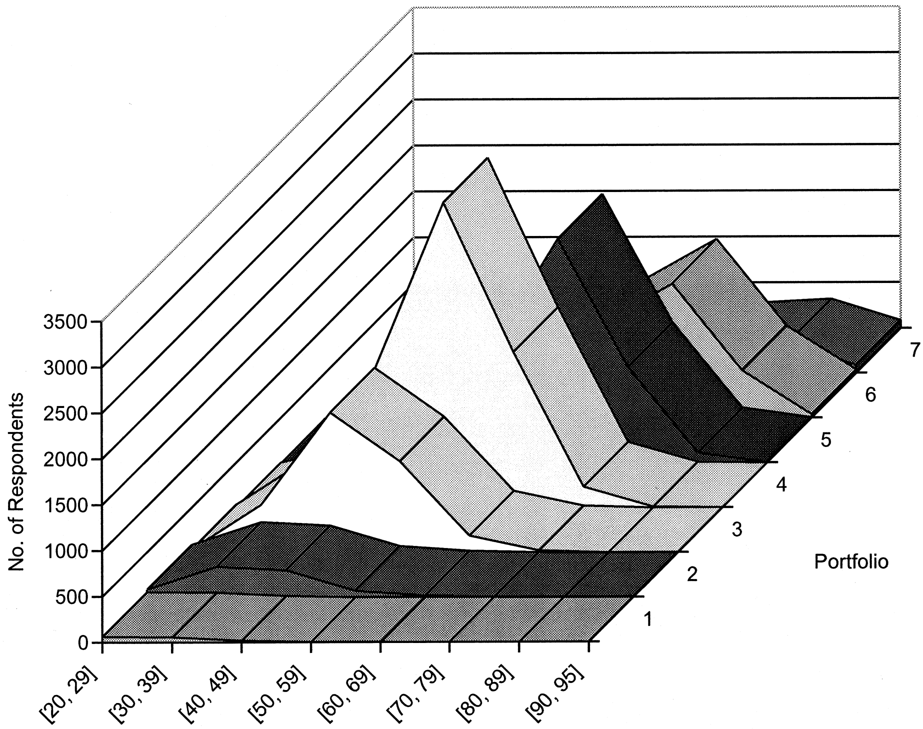

Fig. 1. Investor risk tolerance and portfolio composition. This figure presents information as to the number of respondents (Y-axis) selecting one of seven portfolios (Z-axis) grouped by RTS (X-axis). Each portfolio contains a different mix of low/medium/high risk assets with successively higher numbered portfolios weighted more toward the high risk/return asset.

Fig. 1 presents information as to the number of respondents (Y-axis) selecting each of the seven portfolios (Z-axis) grouped by RTS (X-axis). Portfolio 4, which contains the most even mix of the three asset classes, is the most popular choice among respondents (6986 or 34% of the observations). The RTS of respondents selecting this portfolio ranged from 20 to 90; however, the majority (3327 observations) possessed a RTS of between 50 and 59. The second most popular portfolio was number five, which was a more aggressive portfolio with a relatively higher weighting of high risk/high return assets (4981 observations). Portfolios three and six were preferred by a similar number of respondents (3309 and 3284, respectively) while relatively few individuals chose portfolios one, two or seven (160, 834, and 807, respectively). Thus, the responses of individuals are logically consistent as the "average" investor (in terms of RTS) most commonly selected the "average" portfolio (in terms of the most even mix of assets).

Given the increasing risk associated with each successively higher numbered portfolio, logic suggests that the average RTS of investors preferring each portfolio should also increase. This would be consistent with the peak of the surface for each portfolio occurring at a higher RTS. It is not easy to distinguish these peaks from Fig. 1 due to the different number of observations in each portfolio. Accordingly, in an unreported version of the figure, the Y-axis is expressed as a percentage of the total number of respondents choosing each portfolio. Portfolio 1 contains the low risk/return spread of investments and it was most frequently selected (40%) by individuals with an RTS of between 20 and 29. For higher portfolios, which exhibit a higher level of risk/return, the most frequently observed RTS of individuals selecting that portfolio successively increases which is consistent with our expectations. This highest risk/return portfolio (portfolio 7) was most commonly selected by respondents with a RTS of 80 – 90 (40%). These results suggest that people tend to choose a portfolio which is consistent with their inherent propensity to bear risk.

In general, our results serve to confirm the rationality of individual's choices. Investors' responses to individual questions, which represent their expressed preferences, are broadly consistent with their overall level of risk tolerance, that is, their revealed preference. While we acknowledge there is an element of endogeneity to this analysis, as the answers to these two questions are used to generate the ProQuest estimate of RTS, we believe it is an interesting outcome nonetheless.

3.2. The role of demographic factors

The ProQuest database contains information on a number of different demographic factors for each respondent, namely, age, number of dependents, gender, marital status, education, personal income, combined family income and net assets. As discussed in Section 1, past research involving these variables has provided conflicting results. Accordingly, an hierarchical regression analysis was employed to assess which of the variables make a significant contribution to the prediction of risk tolerance. The hierarchical regression was structured with the interval-level variables for the demographic characteristics of age and the number of dependents constituting the base-case regression. In light of the results of Riley and Chow (1992) and Bajtelsmit and VanDerhai (1997), a test for the presence of nonlinearities in the relationship between age and risk tolerance was included in the form of a quadratic age term. The remaining demographic characteristics, that is, gender, marital status, education, income, combined income and net assets, which enter the ProQuest database as ordinal-level variables, were dummy coded and entered sequentially as separate sets of predictors, judged in order of importance having reference to past research.

The results of estimating this model are presented in Table 2. The incremental change in the reported R^2 values indicates the contribution toward prediction of each of the ordinal-level independent variables. Consistent with the bulk of prior research, the greatest change in the R^2 values above the base-case is associated with the introduction of the first variable, gender, as an explanatory variable. Interestingly, the subsequent addition of marital status fails to increase the explanatory power of the regression. The increments to the R^2 values generated by the sequential introduction of the remaining variables show a pattern of monotonic increase, confirming that these variables make a significant contribution to the prediction of risk tolerance scores.

The final hierarchical regression model contains the full set of predictors and provides a quantification of the relationship between each of the demographic characteristics and RTS according to the following specification:

Table 2
Heirarchical regression of financial risk tolerance on demographic variables

Model	Statistics
$RTS_i = \alpha_0 + \alpha_1 \mathrm{AGE_i} + \alpha_2 \mathrm{AGE_i}^2 + \alpha_3\ \mathrm{NDEP_i} + \varepsilon_i$	$R^2 = 0.114$
$RTS_i = \alpha_0 + \alpha_1 \mathrm{AGE_i} + \alpha_2 \mathrm{AGE_i}^2 + \alpha_3\ \mathrm{NDEP_i} + \alpha_4\ D_{i,FEM} + \varepsilon_i$	$R^2 = 0.187$ F stat = 946.53 P value = 0.000
$RTS_i = \alpha_0 + \alpha_1 \mathrm{AGE_i} + \alpha_2 \mathrm{AGE_i}^2 + \alpha_3\ \mathrm{NDEP_i} + \alpha_4 D_{i,FEM} + \alpha_5\ D_{i,MARRIED} + \varepsilon_i$	$R^2 = 0.187$ F stat = 757.56 P value = 0.000
$RTS_i = \alpha_0 + \alpha_1 \mathrm{AGE_i} + \alpha_2 \mathrm{AGE_i}^2 + \alpha_3\ \mathrm{NDEP_i} + \alpha_4 D_{i,FEM} + \alpha_5 D_{i,MARRIED} + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \varepsilon_i$	$R^2 = 0.208$ F stat = 538.41 P value = 0.000
$RTS_i = \alpha_0 + \alpha_1 \mathrm{AGE_i} + \alpha_2 \mathrm{AGE_i}^2 + \alpha_3\ \mathrm{NDEP_i} + \alpha_4 D_{i,FEM} + \alpha_5 D_{i,MARRIED} + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \varepsilon_i$	$R^2 = 0.229$ F stat = 405.94 P value = 0.000
$RTS_i = \alpha_0 + \alpha_1 \mathrm{AGE_i} + \alpha_2 \mathrm{AGE_i}^2 + \alpha_3\ \mathrm{NDEP_i} + \alpha_4 D_{i,FEM} + \alpha_5 D_{i,MARRIED} + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \sum_{j=CINC_2}^{CINC_5} \alpha_j D_{i,j} + \varepsilon_i$	$R^2 = 0.233$ F stat = 312.15 P value = 0.000
$RTS_i = \alpha_0 + \alpha_1 \mathrm{AGE_i} + \alpha_2 \mathrm{AGE_i}^2 + \alpha_3\ \mathrm{NDEP_i} + \alpha_4 D_{i,FEM} + \alpha_5 D_{i,MARRIED} + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \sum_{j=CINC_2}^{CINC_5} \alpha_j D_{i,j} + \sum_{k=NASS_2}^{NASS_5} \alpha_k D_{i,k} + \varepsilon_i$	$R^2 = 0.238$ F stat = 257.53 P value = 0.000

$$RTS_i = \alpha_0 + \alpha_1 D_{i,FEM} + \alpha_2 AGE_i + \alpha_3 AGE_i^2 + \alpha_4 NDEP_i + \alpha_5 D_{i,MARRIED} + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \sum_{j=CINC_2}^{CINC_5} \alpha_j D_{i,j} + \sum_{k=NASS_2}^{NASS_5} \alpha_k D_{i,k} + \varepsilon_i \quad (1)$$

where RTS_i is the financial risk tolerance score for respondent i provided by ProQuest based on the answers to their Risk Tolerance Questionnaire and takes a possible value between 0 and 100 and:

- D_{FEM} is a dummy variable that signifies a respondent is female;
- AGE is the age of the respondent;
- AGE^2 is a quadratic age term
- NDEP is the number of people in the family whom are financially dependent on the respondent;
- $D_{MARRIED}$ is a dummy variable that takes a value of unity if the respondent is married (legally or defacto);
- D_{EDU} captures the completed level of education of the respondent and includes the cases: did not complete high school (D_{EDU1}), completed high school (D_{EDU2}), trade/ diploma (D_{EDU3}), or university (D_{EDU4}) level of education;

- D_{INC} shows the respondent's income as < \$30,000 (D_{INC1}), \$30,000-\$50,000 (D_{INC2}), \$50,000-\$100,000 (D_{INC3}), \$100,000-\$200,000 (D_{INC4}), or > \$200,000 (D_{INC5});
- D_{CINC} indicates if the respondent's combined family income is <\$30,000 (D_{CINC1}), \$30,000 - \$50,000 (D_{CINC2}), \$50,000-\$100,000 (D_{CINC3}), \$100,000-\$200,000 (D_{CINC4}), or > \$200,000 (D_{CINC5});
- D_{NASS} takes a value of unity if the respondent's net assets are <\$50,000 (D_{NASS1}), \$50,000 - \$150,000 (D_{NASS2}), \$150,000-\$500,000 (D_{NASS3}), \$500,000-\$1,000,000 (D_{NASS4}), or > \$1,000,000 (D_{NASS5}).

The result of estimating this model is presented in Table 3. The constant term in this model of 62.39 represents an unqualified unmarried male with no dependents and having a personal and family income of less than \$30,000 and net assets of less than \$50,000. The RTS for respondents who differ from this case can be assessed by considering the significance and sign of the estimated coefficients in the model. Gender is a significant determinant of risk tolerance and a female will exhibit an RTS of 6.20 points less compared to a demographically equivalent male. Similarly, age (squared) and marital status are found to be significant determinants of the RTS. While marriage simply decreases the RTS by two points, the relationship between age and RTS is revealed as more complex: the regression output shows that the linear age variable is nonsignificant, while the nonlinear age term is highly significant. This provides clear evidence as to the presence of nonlinear effects in the relationship between age and RTS: the negative sign of the coefficient on the quadratic age variable (α_3) indicates that risk tolerance declines at an increasing rate as age increases.

As the constant term in the model is based on an age of zero, the RTS for a representative individual aged, for example, 20 years becomes 60.91 ($62.39 + 400^* - 0.0037$). Fig. 2 provides a comparative plot of the relationship between age and RTS in the linear (as given by an unreported estimation of Eq. (1) minus the quadratic term) and nonlinear (as given by Eq. (1) above) cases. The nonlinear nature of this relationship can clearly be seen and reveals the extent to which the change in RTS for a change in age increases the older the respondent concerned.

The series of dummy variables capturing the level of income of a respondent (D_{INC}) were all individually significant and positive as were the net asset (D_{NASS}) dummy variables. The estimated results indicate that the RTS of a respondent generally increases as income and assets increase. A Wald test of coefficient equality rejects the null hypothesis of coefficient equality for the income, combined income and net asset dummy variables, respectively. This positive relationship between income, assets and risk tolerance does not appear to be uniform. Specifically, higher levels of income are found to be associated with successively higher RTS except for the top income bracket. Although the increment to the RTS over the base case is still positive ($D_{INC5} = 2.75$), it is less than that found for the income bracket preceding it ($D_{INC4} = 3.55$). A Wald test of coefficient equality however, between D_{INC4} and D_{INC5} generates a *p* value of 0.130, which suggests this difference is not statistically significant. Furthermore, the number of dependents was found to be significantly associated with RTS for our sample group, although the negative impact on RTS is small in magnitude.

Not all of the demographic characteristics tested in Eq. (1) were found to be significant. In terms of the level of education of an individual, at least a trade/diploma level of education

Table 3
Regression of financial risk tolerance on demographic variables

Variable	Coefficient	Std. Error	*T* statistic	*p* value
α_0	62.3874	1.1413	54.66	0.000
D_{FEM}	−6.2031	0.2032	−30.53	0.000
AGE	0.0344	0.0528	0.65	0.515
AGE^2	−0.0037	0.0006	−6.68	0.000
NDEP	−0.1921	0.0734	−2.62	0.009
$D_{MARRIED}$	−2.2212	0.3972	−5.59	0.000
D_{EDU2}	0.6674	0.3750	1.78	0.075
D_{EDU3}	2.0019	0.3561	5.62	0.000
D_{EDU4}	3.2289	0.3479	9.28	0.000
D_{INC2}	0.9968	0.2766	3.60	0.000
D_{INC3}	2.9354	0.2911	10.08	0.000
D_{INC4}	3.5479	0.3405	10.42	0.000
D_{INC5}	2.7522	0.5851	4.70	0.000
D_{CINC2}	0.7248	0.4198	1.73	0.084
D_{CINC3}	1.7483	0.3915	4.47	0.000
D_{CINC4}	2.8219	0.4220	6.69	0.000
D_{CINC5}	3.0323	0.5578	5.44	0.000
D_{NASS2}	1.6275	0.3556	4.58	0.000
D_{NASS3}	1.4132	0.3437	4.11	0.000
D_{NASS4}	3.1242	0.3867	8.08	0.000
D_{NASS5}	3.9484	0.4289	9.21	0.000
Adjusted *R* squared = 0.2384		*F* stat = 257.53 (*P* value = 0.000)		
Wald Tests of Coefficient Equality: ($D_{INC2} = D_{INC3} = D_{INC4} = D_{INC5}$)			*P* value = 0.000	
($D_{INC4} = D_{INC5}$)			*P* value = 0.130	
($D_{CINC2} = D_{CINC3} = D_{CINC4} = D_{CINC5}$)			*P* value = 0.000	
($D_{NASS2} = D_{NASS3} = D_{NASS4} = D_{NASS5}$)			*P* value = 0.000	
($D_{NASS4} = D_{NASS5}$)			*P* value = 0.006	

This table presents a summary of the estimated regression output for the equation:

$$RTS_i = \alpha_0 + \alpha_1 D_{i,FEM} + \alpha_2 AGE_i + \alpha_3 AGE_i^2 + \alpha_4 NDEP_i + \alpha_5 D_{i,MARRIED} + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \sum_{j=CINC_2}^{CINC_5} \alpha_j D_{i,j} + \sum_{k=NASS_2}^{NASS_5} \alpha_k D_{i,k} + \varepsilon_i$$

where RTS_i is the ProQuest RTS for respondent *i,* Age is the age expressed in years, NDEP is the number of financial dependents, D are dummy variables for gender (FEM), marital status (MARRIED), education (EDU), income (INC) and combined income (CINC), and α are the coefficients to be estimated.

was required before a significant increase (at the 5% level) in RTS was observed. Similarly, a combined income of at least $50,000 is required before RTS is positively influenced.

Overall, these results suggest that gender, age, the number of dependents, marital status, tertiary education, income, and wealth are all related to risk tolerance. The results for gender, education, and income are consistent with the earlier literature. However, the positive relationship for wealth and RTS contrasts with the results of Bernheim et al., (2001) who found no relationship between risk tolerance and wealth.

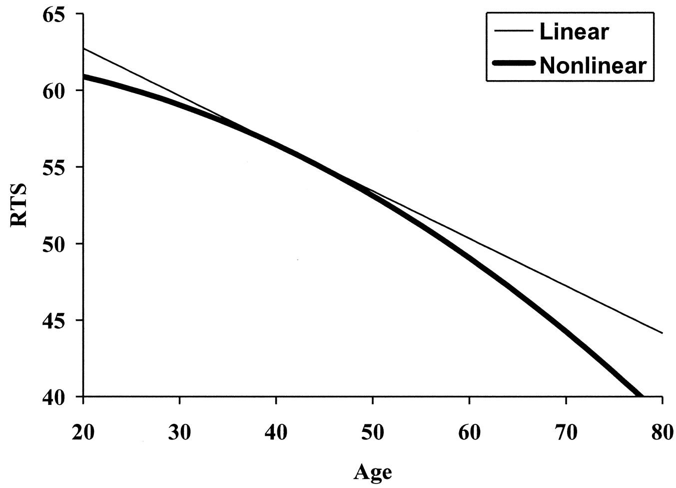

Fig. 2. Forecast RTS using a linear and nonlinear age variable. This diagram forecasts the risk tolerance score for different aged investors. The nonlinear forecast represents the base case individual of Table 3 plus an adjustment for age as given by the quadratic age coefficient in that table. The linear forecast represents the base case individual of Table 3 where the model is estimated excluding the quadratic age coefficient.

3.3. Age and risk tolerance

The negative relationship between age-squared and RTS discussed in the previous section, is a particularly interesting result and conflicts with much of the current literature which has found that a positive or no relationship between age and risk tolerance exists (see Wang & Hanna, 1997; Grable & Joo, 1997; Grable & Lytton, 1998, Hanna, Gutter, & Fan, 1998; Grable, 2000, Hariharan, Chapman, & Domian, 2000; Gollier & Zeckhauser, 2002), although the presence of nonlinearity is consistent in that regard with the findings of Riley and Chow (1992) and Bajtelsmit and VanDerhai (1997).

Further insights on the relationship between age and RTS may be gained by focusing our analysis on those respondents who recorded their age as over 60. Table 4, provides a summary of RTS scores for this group of retired and semiretired individuals. The overall RTS of 51.02 is the lowest generated by the age-based subgroups of the full sample and exhibited the smallest variation of scores (compared to unreported results for similar analysis of the full dataset). This is not to suggest that this age group do not exhibit a diversity of risk profiles. Indeed, the 60+ individuals are a very heterogenous group with a wide distribution of RTS ranging from extremely conservative to highly risk tolerant. This result may provide some insights as to why there is a no clear consensus on the impact of age on risk tolerance. Given that there is such a wide range of RTS to be found within this age group, the results could be sample dependent and a sufficiently large sample may be necessary to avoid bias.

A comparison of the RTS for these predominantly retired individuals to that of the whole sample reveals that their risk tolerance is lower across all demographic groupings. Beyond this general observation, the same patterns are observed in terms of gender, education, and income as were found across the entire database. Two notable exceptions are: first, the RTS

Table 4
Risk tolerance score summary for respondents aged over 60

A: Risk tolerance score for all 60+ individuals by sample, gender and marital status

	All	Males	Females	Married	Unmarried
Mean	51.02	53.20	45.74	51.61	48.03
Median	51.00	53.00	45.00	51.00	47.00
Maximum	91.00	91.00	81.00	91.00	90.00
Minimum	20.00	20.00	21.00	20.00	21.00
Std. Dev.	11.64	11.34	10.60	11.50	11.86

B: Risk tolerance score by education-based subgroups

Education	DNC*	High Sch.	Trade/Dip	University
Mean	47.34	47.97	51.20	54.96
Median	46.00	48.00	50.00	55.00
Maximum	83.00	82.00	90.00	91.00
Minimum	20.00	21.00	22.00	21.00
Std. Dev.	11.51	11.16	11.45	11.01

C: Risk tolerance score by income-based subgroups

Income Band	<$30,000	$30,000–$50,000	$50,000–$100,000	$100,000–$200,000	>$200,000
Mean	47.11	51.37	55.85	57.70	56.17
Median	47.00	52.00	55.00	58.00	56.00
Maximum	82.00	83.00	90.00	91.00	83.00
Minimum	20.00	20.00	25.00	26.00	31.00
Std. Dev.	10.67	10.63	11.47	12.02	10.95

D: Risk tolerance score by net asset-based subgroups

Net Asset Band	<$50,000	$50,000–$150,000	$150,000–$500,000	$500,000–$1,000,000	>$1,000,000
Mean	50.70	45.64	47.66	52.03	56.72
Median	49.00	45.00	47.00	51.00	56.00
Maximum	82.00	85.00	89.00	88.00	91.00
Minimum	28.00	25.00	20.00	22.00	22.00
Std. Dev.	13.25	10.94	11.57	10.68	10.62

Note: * DNC, did not complete high school.

of the married 60+ group is higher than those who are unmarried which is the opposite of the trend identified in the full sample; and second, the U-Shaped trend in the RTS across asset based subgroupings is asymmetric in this case. Panel D of Table 4 reveals that RTS falls and then increases as assets levels rise, which is consistent with the trend identified in (unreported results for) the full dataset. The asymmetry exists in that the RTS increases to 56.72 in the case of respondents with assets of >$1,000,000, which is statistically higher than (at the 5% level of significance) the RTS of those individuals in the lowest asset grouping (50.70). Across the whole sample, these two average RTS values were closer in value and statistically indistinguishable (61.34 and 60.56 for the lowest and highest groupings, respectively). There are sufficient observations to suggest that this anomaly is not a function of sample size, but no obvious reason exists for this outcome.

The impact of the various demographic variables on RTS for respondents aged over 60

Table 5
Regression of financial risk tolerance on demographic variables for respondents aged over 60

Variable	Coefficient	Std. Error	*t* statistic	*P* value
α_0	158.3557	43.6252	3.63	0.000
D_{FEM}	−5.5949	0.5319	10.52	0.000
AGE	−2.9099	1.2817	2.27	0.023
AGE^2	0.0195	0.0094	2.08	0.038
NDEP	−0.2446	0.3004	0.81	0.416
$D_{MARRIED}$	−1.6558	0.7951	2.08	0.037
D_{EDU2}	0.0725	0.6957	0.10	0.917
D_{EDU3}	1.2995	0.6495	2.00	0.046
D_{EDU4}	3.1827	0.6753	4.71	0.000
D_{INC2}	0.2839	0.6466	0.44	0.661
D_{INC3}	2.0641	0.8119	2.54	0.011
D_{INC4}	2.4833	1.1817	2.10	0.036
D_{INC5}	−0.7106	1.9988	0.36	0.722
D_{CINC2}	2.6323	0.7208	3.65	0.000
D_{CINC3}	3.1202	0.8134	3.84	0.000
D_{CINC4}	2.7465	1.0883	2.52	0.012
D_{CINC5}	4.0693	1.7557	2.32	0.021
D_{NASS2}	−3.9618	1.4806	2.68	0.008
D_{NASS3}	−3.3609	1.2862	2.61	0.009
D_{NASS4}	−0.9039	1.3103	0.69	0.490
D_{NASS5}	1.8870	1.351	1.40	0.163
Adjusted *R* squared = 0.2128		*F* stat = 33.25 (*P* value = 0.000)		
Wald Tests of Coefficient Equality: ($D_{INC2} = D_{INC3} = D_{INC4} = D_{INC5}$)			*P* value = 0.032	
($D_{INC4} = D_{INC5}$)			*P* value = 0.091	
($D_{CINC2} = D_{CINC3} = D_{CINC4} = D_{CINC5}$)			*P* value = 0.767	
($D_{NASS2} = D_{NASS3} = D_{NASS4} = D_{NASS5}$)			*P* value = 0.000	
($D_{NASS4} = D_{NASS5}$)			*P* value = 0.000	

This table presents a summary of the estimated regression output for the equation fitted to a restricted dataset of respondents aged 60+:

$$RTS_i = \alpha_0 + \alpha_1 D_{i,FEM} + \alpha_2 AGE_i + \alpha_3 AGE^2 + \alpha_4 NDEP_i + \alpha_5 D_{i,MARRIED} + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \sum_{j=CINC_2}^{CINC_5} \alpha_j D_{i,j} + \sum_{k=NASS_2}^{NASS_5} \alpha_k D_{i,k} + \varepsilon_i$$

where RTS_i is the ProQuest RTS for respondent *i,* Age is the age expressed in years, NDEP is the number of financial dependents, D are dummy variables for gender (FEM), marital status (MARRIED), education (EDU), income (INC) and combined income (CINC), and α are the coefficients to be estimated.

may be formally assessed by estimating Eq. (1) for this subgroup of our data. The regression output is summarized in Table 5 and the coefficients relating to the gender, number of dependents, and marital status are substantively unchanged to those observed in Table 3. A notable feature of the data are the relationship between RTS and age: in contrast to the results for the full dataset, the coefficient for the age variable (α_2) is negative and significant and the coefficient for the quadratic age variable (α_3) is positive and significant, indicating that RTS for this group decreases at a decreasing rate rather than the increasing rate which charac-

Table 6
Risk tolerance score summary for married respondents

A: Risk tolerance score by marital status and gender

	Married	Unmarried	Married Males	Unmarried Males	Married Females	Unmarried Females
Mean	58.83	60.29	61.00	64.01	53.97	55.72
Median	59.00	60.00	61.00	64.00	54.00	56.00
Maximum	95.00	95.00	95.00	95.00	93.00	91.00
Minimum	20.00	21.00	20.00	23.00	20.00	21.00
Std. Dev.	12.65	13.43	12.26	12.83	12.15	12.73

B: Risk tolerance score by marital status and education-based subgroups

	Married				Unmarried			
Education	DNC*	High Sch.	Trade/Dip	University	DNC*	High Sch.	Trade/Dip	University
Mean	52.43	55.03	58.13	61.71	50.41	55.76	59.33	63.06
Median	52.00	55.00	58.00	62.00	48.00	56.00	59.00	63.00
Maximum	91.00	92.00	95.00	95.00	89.00	92.00	94.00	95.00
Minimum	20.00	21.00	20.00	24.00	21.00	21.00	25.00	21.00
Std. Dev.	13.02	12.46	12.77	11.72	13.36	13.85	13.57	12.34

C: Risk tolerance score by marital status and income-based subgroups

	Married					Unmarried				
Income Band	<$30,000	$30,000–$50,000	$50,000–$100,000	$100,000–$200,000	>$200,000	<$30,000	$30,000–$50,000	$50,000–$100,000	$100,000–$200,000	>$200,000
Mean	51.23	56.58	61.13	64.71	63.79	55.55	59.36	63.62	62.35	65.11
Median	51.00	56.00	61.00	65.00	63.50	55.00	59.00	63.00	63.00	66.00
Maximum	93.00	93.00	94.00	95.00	95.00	92.00	93.00	95.00	95.00	95.00
Minimum	20.00	20.00	20.00	26.00	27.00	21.00	22.00	23.00	26.00	31.00
Std. Dev.	11.67	12.06	11.86	11.50	10.98	13.34	13.43	12.22	11.92	13.92

DNC, did not complete high school.

terized the full dataset. Furthermore, a significant negative relationship between two of the net asset dummy variables and RTS is found in contrast to the positive relationship estimated for the entire sample.

3.4. Marital status and risk tolerance

Marital status is a potentially important demographic that impacts on the preferred level of risk in the investment process. The available evidence suggests that single investors are more risk tolerant, although some research has failed to identify any significant relationship (McInish, 1982; Masters, 1989; Haliassos & Bertaut, 1995). Our evidence, provided in Table 3 and discussed in Section 3.2, supports the former view and suggests marriage is a significant determinant of RTS. It is worthwhile considering this result in more detail using an extended analysis of the ProQuest database. Table 6 presents a summary of the RTS by marital status and various demographics. Panel A presents a summary of our data classified by marital status and gender. Married respondents are found to exhibit a lower RTS and gender does not impact on this trend. Panel B considers the RTS of respondents by marital

Table 7
Regression of financial risk tolerance on demographic variables for married respondents

Variable	Coefficient	Std. Error	t statistic	P value
α_0	64.0951	1.5159	42.28	0.000
D_{FEM}	−6.1047	0.2433	−25.08	0.000
AGE	−0.1107	0.0658	−1.68	0.092
AGE^2	−0.0021	0.0006	−3.13	0.001
NDEP	−0.1225	0.0780	−1.56	0.116
D_{EDU2}	0.3445	0.4100	0.84	0.400
D_{EDU3}	1.4212	0.3854	3.68	0.000
D_{EDU4}	2.3884	0.3805	6.27	0.000
D_{INC2}	1.0598	0.3342	3.17	0.001
D_{INC3}	2.8119	0.3593	7.82	0.000
D_{INC4}	4.3958	0.4460	9.85	0.000
D_{INC5}	2.8315	0.6789	4.17	0.000
D_{CINC2}	1.1273	0.4694	2.40	0.016
D_{CINC3}	2.4067	0.4552	5.28	0.000
D_{CINC4}	3.3554	0.5013	6.69	0.000
D_{CINC5}	3.7085	0.6417	5.77	0.000
D_{NASS2}	0.6225	0.4675	1.33	0.183
D_{NASS3}	0.3661	0.4338	0.84	0.398
D_{NASS4}	2.0632	0.4719	4.37	0.000
D_{NASS5}	2.8158	0.5118	5.50	0.000
Adjusted R squared = 0.2420		F stat = 215.89 (P value = 0.000)		

This table presents a summary of the estimated regression output for the equation fitted to a restricted dataset of married respondents:

$$RTS_i = \alpha_0 + \alpha_1 D_{i,FEM} + \alpha_2 AGE_i + \alpha_3 AGE^2 + \alpha_4 NDEP_i + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \sum_{j=CINC_2}^{CINC_5} \alpha_j D_{i,j} + \sum_{k=NASS_2}^{NASS_5} \alpha_k D_{i,k} + \varepsilon_i$$

where RTS_i is the ProQuest RTS for respondent i, Age is the age expressed in years, NDEP is the number of financial dependents, D are dummy variables for gender (FEM), marital status (MARRIED), education (EDU), income (INC) and combined income (CINC), and α are the coefficients to be estimated.

status and education, and panel C presents information on the RTS classified by marital status and income. Notably, pairings of all of the reported RTS scores across these various demographics are significantly different from each other, except the RTS for married and unmarried respondents with income greater than $200,000 (panel C).

As a final step in investigating whether marriage impacts on RTS, Tables 7 and 8 present the estimation output of our regression based model of the determinants of RTS (Eq. (1)) applied to married survey respondents and unmarried survey respondents, respectively. Comparing the estimated coefficients of the two samples some notable differences are apparent. Firstly, all levels of education of the unmarried respondents are associated with a significant monotonic increase in RTS, whereas the results for married individuals indicate that a trade/diploma level of education was required before a significant positive relationship was observed. A similar monotonic relationship between the range of net asset categories and

Table 8
Regression of financial risk tolerance on demographic variables for unmarried respondents

Variable	Coefficient	Std. Error	t statistic	P value
α_0	57.4524	2.0176	28.47	0.000
D_{FEM}	−6.3104	0.4093	15.42	0.000
AGE	0.1844	0.0972	1.90	0.058
AGE^2	−0.0054	0.0011	5.06	0.000
NDEP	−0.3780	0.2311	1.64	0.102
D_{EDU2}	2.2355	0.9188	2.43	0.015
D_{EDU3}	4.1150	0.9149	4.50	0.000
D_{EDU4}	5.9265	0.8663	6.84	0.000
D_{INC2}	0.7175	0.5338	1.34	0.179
D_{INC3}	3.4654	0.5775	6.00	0.000
D_{INC4}	1.5450	0.5723	2.70	0.007
D_{INC5}	3.9942	1.3852	2.88	0.004
D_{CINC2}	0.6850	1.2189	0.56	0.574
D_{CINC3}	−0.2572	1.3063	0.20	0.844
D_{CINC4}	1.7019	1.6748	1.02	0.310
D_{CINC5}	−0.4819	2.6974	0.18	0.858
D_{NASS2}	1.7736	0.6025	2.94	0.003
D_{NASS3}	2.2670	0.6451	3.51	0.000
D_{NASS4}	3.9164	0.8287	4.73	0.000
D_{NASS5}	5.0402	1.0066	5.01	0.000
Adjusted R squared = 0.2363		F stat = 58.350 (P value = 0.000)		

This table presents a summary of the estimated regression output for the equation fitted to a restricted dataset of unmarried respondents:

$$RTS_i = \alpha_0 + \alpha_1 D_{i,FEM} + \alpha_2 AGE_i + \alpha_3 AGE^2 + \alpha_4 NDEP_i + \sum_{g=EDU_2}^{EDU_4} \alpha_g D_{i,g} + \sum_{h=INC_2}^{INC_5} \alpha_h D_{i,h} + \sum_{j=CINC_2}^{CINC_5} \alpha_j D_{i,j} + \sum_{g=NASS_2}^{NASS_5} \alpha_k D_{i,k} + \varepsilon_i$$

where RTS_i is the ProQuest RTS for respondent i, Age is the age expressed in years, NDEP is the number of financial dependents, D are dummy variables for gender (FEM), marital status (MARRIED), education (EDU), income (INC) and combined income (CINC), and α are the coefficients to be estimated.

RTS is observed for unmarried respondents; however, married individuals must record a level of net assets of at least $500,000 before a significant relationship with RTS is observed. On the other hand, while all income categories were individually significant and positive for married individuals, unmarried respondents needed an income of at least $30,000 before a significant relationship was observed. Interestingly, the $100,000-$200,000 category is associated with the largest significant increase in RTS (4.4 points) for married respondents but with the smallest increase (1.6 points) in RTS for unmarried respondents.

Thus, while our data provides support for the notion that single investors are more risk tolerant, it contrasts with the existing body of evidence (McInish, 1982; Masters, 1989; Haliassos & Bertaut, 1995) which finds that marital status has no material impact on investment decisions.

Table 9
Cross tabulation of net assets and education for respondents aged over 60

Net Asset Band	<$50,000	$50,000–$150,000	$150,000–$500,000	$500,000–$1,000,000	>$1,000,000
A: No. of Observations					
DNC	4	57	209	90	55
High Sch.	11	39	199	147	84
Trade/Dip	5	46	280	205	171
University	3	23	199	241	293
B: Percentage of responses					
DNC*	17.39	34.55	23.56	13.18	9.12
High Sch.	47.83	23.64	22.44	21.52	13.93
Trade/Dip	21.74	27.88	31.57	30.01	28.36
University	13.04	13.94	22.44	35.29	48.59

* DNC, did not complete high school.

3.5. *Education and wealth*

One interesting issue that our data allows us to explore is the relationship between education and wealth. For this generation, a university degree was far less common compared to current trends and at the time, the general perception was that a tertiary education would secure a financial future. Our data enables us to explore the relationship between respondents' answers to their level of assets and completed education. A cross tabulation summary of our data are presented in Table 9 and reveals that as expected, almost half (48.59%) of elderly millionaires are university educated and only a small fraction did not complete high school (9.12%). Of those respondents that fall into the lowest asset subgrouping, the majority did not complete any education beyond high school. A trend is apparent across the three middle asset subgroupings as a higher level of education is associated with a higher level of net assets, that is, 34.55% of those with assets of $50,000-$100,000 did not complete high school, 31.57% of those with assets of $150,000-$500,000 completed trade school or a diploma, and 35.29% of those with assets of $500,000-$1,000,000 completed university. Thus, our evidence suggests that the level of eduction of retiring-age respondents reflects their wealth.

4. Summary and conclusion

The aim of this paper is to investigate the relationship between demographic factors and financial risk tolerance. We employ a large database which contains a psychometrically derived risk tolerance score (RTS) measured by ProQuest. While we find that peoples self-assessed risk tolerance and ProQuest RTS generally accord, there is considerable variation with a tendency for respondents to underestimate their risk tolerance. This suggests that financial planners who rely largely on subjective assessments of risk tolerance run the risk of suggesting inappropriate, and in the majority of cases overly conservative, investment strategies for their clients.

Our analysis of the relationship between participant demographics and risk tolerance reveals that gender, income, and wealth are significantly associated with financial risk tolerance. A detailed investigation of the relationship between risk tolerance and age as well as marital status was also performed. Our results suggest that a negative relationship between age and risk tolerance exists which, while in line with generally held industry beliefs, contradicts some of the more recent research findings. Furthermore, we found that the relationship between age and risk tolerance exhibits a significant nonlinear structure. Finally, a negative relationship between marital status and risk tolerance was found.

As suggested above, assessment of an investor's risk profile is a highly influential factor in the construction of an appropriate investment portfolio. Our research, in providing support for the widely held view that women have lower risk tolerance than men and that, at least in a cross-sectional sense, age has an inverse, though nonlinear, relationship with risk tolerance, has important implications for the funds management industry: as the baby boomer cohort ages and moves into retirement we could expect to see demand shift away from the relatively more risky growth asset classes towards the less risky income asset classes, reflecting the decline in risk tolerance associated which increasing age. Moreover, this effect would be compounded by the greater life expectancy of women: as the population ages the gender composition will shift in favor of women, who on average have lower risk tolerance. Thus, the changing age and gender demographics of the population will provide a duel force for change in the composition of the overall demand for investment products.

Acknowledgments

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Notes

1. While we use the term "determinants" here, we really have in mind the identification of factors/variables that reveal a strong and systematic association with risk tolerance.
2. Other factors that have been found to impact on risk tolerance and are not included in this study are: race (see Leigh, 1986; Jianakoplos & Bernasek, 1998; Xiao et al., 2000) the desire to leave an estate and expectations about the adequacy of pension income (see Schooley & Worden, 1996).
3. An interesting alternative involves the use of insurance contracts to measure risk tolerance (Dreze, 1987).
4. The scale is normally distributed with a mean of 50 and a standard deviation of 10.
5. This information is available on the ProQuest web site: www.risk-profiling.com.
6. The Personal Investor data does not substantially differ from the main database.
7. Application of the age filter resulted in the exclusion of 129 observations, while the RTS boundary condition excluded an additional 66 responses. In unreported anal-

ysis, the major thrust of our analysis is revealed to be unaffected by this relatively minor data truncation.

8. This is the final question in the set of 25 questions comprising the ProQuest survey. The actual question reads: "This questionnaire is scored on a scale of 0 to 100. In practice, however, the scores range from around 20 to around 80, with the average being 50. When the scores are graphed they follow the familiar bell-shaped curve of the Normal Distribution (diagram provided). About two-thirds of all scores are within 10 points of the average. What do you think your score will be?". It is also noteworthy that respondents do not get to see their ProQuest RTS prior to answering this question and completing the survey.
9. These extreme values are not the norm and 99% of the differences fell in the range of ±25 points. ProQuest consider approximately ±20 points to be within the bounds of possibility.
10. The actual question reads: "Most investment portfolios have a spread of investments—some of the investments may have high expected returns but with high risk, some may have medium expected returns and medium risk, and some may be low risk/low return (for example, shares and property would be high risk/high return, whereas cash and term deposits would be low risk/low return). Which spread of investments do you find the most appealing? Would you prefer all low risk/low return, all high risk/high return or somewhere in between?" (table presented)

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