1-10-2013

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Keywords
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Disciplines
Economics

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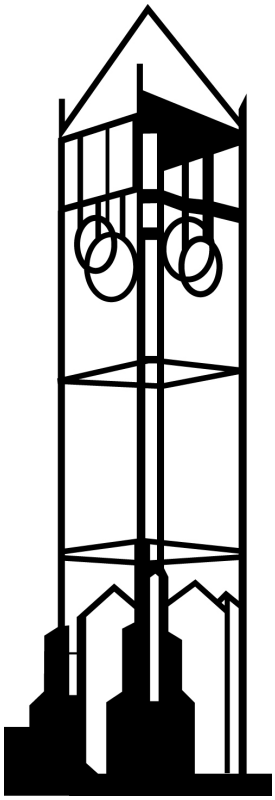

Working Paper No. 13002
January 2013

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Are Risk Attitudes Fixed Factors or Fleeting Feelings?

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We investigate the stability of measured risk attitudes over time, using a 13-year longitudinal sample of individuals in the NLSY79. We find that an individual's risk aversion changes systematically in response to personal economic circumstances. Risk aversion increases with lengthening spells of employment and time out of labor force, and decreases with lengthening unemployment spells. However, the most important result is that the majority of the variation in risk aversion is due to changes in measured individual tastes over time and not to variation across individuals. These findings that measured risk preferences are endogenous and subject to substantial measurement errors suggest caution in interpreting coefficients in models relying on contemporaneous, one-time measures of risk preferences.

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JEL: D81, C23

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Although the theory of economic decision under uncertainty typically presumes that individuals have time-invariant risk preferences, a series of empirical papers have raised doubts about the validity of the presumed stable risk preferences. More than two decades ago, Love and Robison (1984) examined the intertemporal stability of risk preferences using a data set including just 23 American farmers. Individual's risk preferences were elicited through choices between pairs of possible incomes at four different income levels in 1979 and again in 1981. They found that risk preferences were not stable over time, although they could not establish a firm pattern of change in risk preferences over two years. More recently, Andersen et al. (2008), using 97 Danish adults from experiments, found that an individual's risk attitudes change over a 17-month time period, but they also could not establish a definable pattern of either positive or negative change in risk preferences across time. While optimistic perceptions of personal financial security tend to reduce risk aversion, no other demographic characteristic was correlated with variation in risk attitudes across time. In both studies, relatively short time spans and few observations per individual made it difficult to draw any conclusions beyond the apparent instability of risk preferences. That leaves open the possibility that instability is due more to random measurement errors in risk measurement than to a behavioral response to changing economic circumstances.

Past studies have tried to establish how various economic or demographic attributes 'cause' attitudes toward risk using cross-sectional data. The evidence is uneven. Donkers et al. (2001) find that more educated and higher income individuals are less risk averse. Hartog et al. (2002) also find that wealthier individuals are less risk averse. However, Barsky et al. (1997) show that risk aversion increases with income and wealth for the lower half of their distributions. Donkers et al. (2001), Barsky et al. (1997), and Riley and Chow (1992) all find that risk aversion varies by age, but they disagree on the direction of the correlation. The most consistent finding is that women are more risk averse than men (Donkers et al. 2001; Hartog et al. 2002). Halek and Eisenhauer (2001) find that the

unemployed are less risk averse than job holders.

A more recent strand of the literature has begun to question whether measures of risk aversion depend on the risk elicitation method. Barseghyan et al. (2011) found that households tend to be more risk averse when facing hypothetical deductible decisions involving home insurance compared to auto insurance. Anderson and Mellor (2009) find that risk preferences obtained from experiments using real money prizes are not consistent with those inferred from surveys with hypothetical gambles. Binswanger (1980) observed that the distribution of measured risk aversion shifts to the right as proposed payoffs increase in a field experiment in India. Holt and Laury (2002) derive the same conclusion in a sample of American students.

Another strand of literature suggests that individual risk attitudes depend on feelings or emotions at the time risk is assessed. Raghunathan and Pham (1999) find that anxiety makes people more risk averse whereas sadness makes people less risk averse. Lerner and Keltner (2000) show that fearful people are more pessimistic and so they are less likely to take on risk. In a similar vein, but focusing on personal experience on stock market returns, Malmendier and Nagel (2011) find that people who experienced higher stock market returns show greater willingness to take risk.

While there appears to be consensus that measured risk preferences vary with elicitation mechanisms at a point in time, there is less evidence that measures of risk preferences using the same elicitation method are subject to change over time. Finding cross-sectional variation in risk preferences across individuals at one point in time does not prove that individual risk preferences are unstable. This chapter explores the long-term stability of measured risk preferences by exploiting a 13-year longitudinal sample of individuals in the National Longitudinal Survey of Youth 79 (NLSY79) over which risk attitudes were elicited on four different waves. The longer time series allows us to evaluate not just whether preferences are stable, but whether variation in preferences is dominated by

variation in risk preferences across individuals or by variation in individual risk preferences over time. Furthermore, the large sample size and long time frame allow us to identify some clear regularities in how risk attitudes change due to individual economic circumstances.

We find dramatic evidence that measured risk preferences for individuals are not stable: 57% of the total variance in measured risk aversion is attributable to changing individual risk attitudes over time and only 43% to variation across individuals. Even after controlling for plausible demographic and economic factors that might alter individual attitudes toward risk, the *within* variance due to unexplained changes in individual risk aversion over time dominates the *between* variance across individuals. To the extent that the *within* variation is an indication of measurement error, over half of the variation in measured risk preferences is noise, suggesting that there will be significant bias when such measures are included in regressions explaining economic behavior.

Although many cross-sectional studies found that demographic variables such as age, education, and marriage are correlated with variation in risk aversion, we find that changing personal economic circumstances have a greater impact on individual risk aversion than do changing demographics. Individuals become more risk averse as their incomes rise and as the duration of a current employment spell increases. Risk aversion also increases with duration of time spent out of the labor force and with accumulated work experience. In contrast, risk aversion decreases with length of a current unemployment spell. Because risk preferences respond to current economic circumstances, they cannot be viewed as causal factors in studies of contemporaneous economic decisions such as occupational choice, earnings, or entrepreneurship.

The rest of this paper is organized as follows. Section I reviews data and measures of risk aversion. Section II discusses empirical methodologies for testing the intertemporal stability of risk aversion. Empirical results that reject the stability of risk aversion are presented in section III. Section IV concludes.

I. Data and Measures of Risk Aversion

The data is drawn from the National Longitudinal Survey of Youth 79 (NLSY79). The NLSY79 offers a consistently designed lifetime income gamble questions to respondents in 1993, 2002, 2004, and 2006.

In the hypothetical gamble questions, the individual is asked to choose between a safe job paying a fixed current income and a risky job that will return a higher expected return but with a chance of income below the safe level. The risk questions are as follows:

(Q1) Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance that it will double your (family) income and a 50-50 chance that it will cut your (family) income by a third. Would you take the new job?

The individuals who answered 'yes' to this question were then asked: (Q2) suppose the chances were 50-50 that it would double your (family) income and 50-50 that it would cut it in half. Would you still take the new job? Those who answered 'no' to the first question (Q1) then asked: (Q3) suppose the changes were 50-50 that it would double your (family) income and 50-50 that it would cut it by 20 percent. Would you take the new job?

Responses to the series of gamble questions are used to elicit measures of risk aversion. Degree of risk aversion is measured by the degree to which the respondent is willing to accept downside risk, measured by the amount that could be reduced. We construct an ordered categorical risk aversion index ranging from 1 to 4 and so the risk index goes from the least to the most risk averse.

$$Risk\ aversion\ index = \begin{cases} 1\ if & accept\ 1/3\ cut\ \&\ accept\ 1/2\ cut\ ; the\ least\ risk\ averse \\ 2\ if & accept\ 1/3\ cut\ \&\ reject\ 1/2\ cut \\ 3\ if & reject\ 1/3\ cut\ \&\ accept\ 1/5\ cut \\ 4\ if & reject\ 1/3\ cut\ \&\ reject\ 1/5\ cut\ ; the\ most\ risk\ averse \end{cases}$$

Our sample includes all respondents who answered the risk questions in at least two years between 1993 and 2006. We drop households that report zero family income which excludes less than 1% of the sample. We also drop those who have incomplete information on demographics. Our conclusions are not sensitive to these sample inclusion criteria. The final sample is large: 5,197 respondents answered the risk questions in 1993; 5,424 in 2002; 5,387 in 2004; 5,698 in 2006, and 3,805 in all four years. The final analysis sample contains 21,706 person-year observations. Therefore, our study uses a much larger sample than the past longitudinal studies which had at most 300 observations.

Distributions of measured risk aversion in the unbalanced panel sample over time are reported in Panel A of Table 1. Most respondents fall into the most risk averse category and the second largest portion into the least risk averse category. This suggests that there is considerable heterogeneity in risk attitudes across individuals. There is a tendency for increasing risk aversion with age: 46% were in the most risk averse category in 1993 but 57% in 2006. The largest decline is in the least risk averse group which falls from 25% to 17%. However, the progression to greater average risk aversion with age masks considerable variation in the patterns of changing risk aversion across individuals as shown in Panel B of Table 1. Panel B focuses on the balanced panel of 3,805 individuals who answered the risk aversion question all four years. We show the distribution of 2006 risk aversion measures by 1993 measured risk aversion. Only 43% remained in the same risk aversion category over 13 years. Only 2% stayed in the same risk aversion category all four years.

As in Panel B, there is a movement toward greater average risk aversion as age

increases: 46% of those in the least risk averse category in 1993 were in the most risk averse category in 2006. However, 33% of those in the most risk averse category in 1993 became less risk averse in 2006. The changes in measured aversion are not of modest size as 35% moved at least 2 risk categories between the two periods. These intertemporal changes cannot be explained as just reflecting an aging cohort of respondents.

II. Testing for the stability of risk aversion over time

In order to test the presumption that risk aversion is stable over time, we first incorporate analysis of variance (ANOVA). We measure the relative stability of risk aversion by assessing how much of the variance in measured risk aversion is attributable to variation across individuals and how much is due to due to variation in individual risk aversion over time. ANOVA allows us to decompose the total variance in response to the income gamble question into '*between*' individual and '*within*' individual components. The *between* variance is due to deviations of individual mean risk aversion from the sample mean. The *within* variance is due to changes in measured risk aversion within an individual over time.

With *n* individuals in the sample and 4 temporally separated measures of risk aversion for each individual *i*, the total sum of square (TSS) partitioned into sum of squared errors (SSE) and sum of squares of treatments (SST) can be written as:

$$TSS = SSE + SST$$

$$(1) \qquad \sum_{i=1}^{n}\sum_{t=1}^{4}(\theta_{it}-\bar{\theta})^2 = \underbrace{\sum_{i=1}^{n}\sum_{t=1}^{4}(\theta_{it}-\bar{\theta}_{i0})^2}_{within} + \underbrace{\sum_{i=1}^{n}4(\bar{\theta}_{i0}-\bar{\theta})^2}_{between}$$

$$(2) \qquad = n\times\sigma_{\theta}^2$$

where θ_{it} is an individual *i*'s risk aversion measured at time *t*; $\bar{\theta}_{i0}=\frac{1}{4}\sum_{t=1}^{4}\theta_{it}$ represents an

individual's average measured risk aversion over 4 years; $\bar{\theta} = \frac{1}{n}\sum_{i=1}^{n}\bar{\theta}_{i0}$ denotes the sample mean of measured risk aversion across individuals in the sample; and σ_{θ}^{2} is variance of measured risk aversion.[1]

The SSE corresponding to the first term of equation (1) measures the *within* variance due to changes in individuals measured risk aversion, while the second term measures the *between* variance due to differences in mean risk preferences across individuals. The TSS can be alternatively estimated by the sum of the two variance components or by equation (2).

We report the variance decomposition in Panel A of table 2. Surprisingly, 57% of the total variance comes from the *within* individual component and only 43% is due to the *between* variance. The majority of the variance in risk aversion is due to changing individual risk preferences over time and not to different risk preferences across individuals. Nor is this result due to some regular pattern of evolving risk preferences as individuals age.

Panel B reports the *within* and *between* variation in risk aversion after controlling for a vector X_{it} of demographic attributes that could explain why individual risk attitudes might change over time: age, marriage, education, and number of kids. If risk preferences change as these demographic attributes change over the sample period, they will reduce the *within* component. However, after removing the variance attributable to these non-economic variables, the *within* variance falls only to 54% from 57%, and so the *within* component is still larger than the variation across individuals.

Since the sizeable *within* component is not due to non-economic factors, it is potentially influenced by changing economic circumstances. We take on that question next.

A. *What personal economic circumstances affect risk aversion over time?*

To explore the transitory economic factors that alter measured risk attitudes, we first

[1] See Appendix 1 for full derivation of equation (1).

must control for any underlying differences in tastes for risk across individuals. That suggests using a fixed-effects regression that will control for unobservable individual tastes and all other time-invariant factors u_i. We also add the time-varying elements of the vector of demographic factors, X_{it}, including age and its square, education, marital status, and number of children. We then add a vector of time-varying labor market factors, M_{it} to a regression explaining changes in measured risk preferences over time. The linear regression model with fixed effects is

$$\theta_{it} = X_{it}\beta_X + M_{it}\beta_M + u_i + \varepsilon_{it},\ \varepsilon_{it} \sim N(0, \sigma^2) \quad (3)$$

As before, θ_{it} is an ordered categorical risk aversion index variable ranging from the least risk averse to the most risk averse for an individual *i* at time *t*. The vector M_{it} contains time-varying measures that reflect individual household and local labor market economic status: the net family income and its square, years of previous labor market experience, the duration of recent employment, unemployment, and out of labor force spells, and the local unemployment rate. Gender, race, and other factors that do not change over the sample period are absorbed by the individual fixed effects.

It is possible that measures of degree of risk aversion are nonlinear. Thus, alternatively we estimate an ordered probit model. More specifically, random effect ordered probit model and an ordered probit model clustering the standard errors on the level of the individual are incorporated to show our results are robust to the alternative specifications.

B. *Measures of key independent variables*

Weekly labor force information and interview date are available in the NLSY79. Accordingly, we were able to identify each individual's labor force status—employed, unemployed, or out of labor force—at the time individual risk aversion was measured. Unemployed individuals and those out of labor force differ in that the unemployed are actively looking for a job while those out of labor force are neither working nor looking for

work. Hence, the unemployed are constrained from their presumed preferred time allocation (employment) while those out of the labor force are in control of their time allocation. The employed are also nominally meeting their time allocation objectives. Our measure is the length of the current time allocation spell since the last interview and so the maximum length of the current spell is 2 years.

Previous labor market experience is measured by cumulative years spent at work since the first survey year, 1979. Net family income variable is created by NLSY79 at each wave. The descriptive statistics of variables are summarized in Appendix 2.

III. Results

Table 3 reports estimation results using various model specifications. The first four columns are fixed effects estimates of the linear model. In the first column, age and age-squared are the only regressors. Age has a significant effect on changes in measured risk aversion over time. Risk aversion increases until age 52 and then decreases.[2] The R-squared statistic is the ratio of the *between* variance to the total variance and so the *within* and *between* variances can be inferred by the R-squared statistic. As 57% of the total variance was due to the within-individual component without controlling for any cofactors, removing only the variation in age lowers the *within* component to 54%. When we add the other time-varying non-economic variables—education, marriage, and number of kids—the proportion of total variance attributable to the *within* component remains 54%.

When we include only time-varying economic variables in the third column, the *within* component is also 54%. We then let the non-economic and economic variables compete with one another in column 4. The *within* variance remains at 54%. However, we

[2] In the study of Barsky et. al (1997) using older cohorts (age between 50 and 70) from Health and Retired Study (HRS), risk aversion starts to decrease at age 60 without controlling for any factors.

can no longer reject the null hypothesis that the effect of the demographic factors on risk preferences is jointly zero ($F_{5,n-5}$=1.72, p>0.1).[3] On the other hand, the effect of the economic factors are jointly significant ($F_{7,n-7}$=5.49, p=0.00). Hence, economic circumstances rather than demographic variation are the more important observable source of changing risk attitudes over time. Nevertheless, the dominant source of variation in risk preferences remains the *within* component, even after controlling for economic and demographic variables.

When economic variables are added, the relationship between age and risk aversion weakens. Peak risk aversion now occurs at age 43 and decreasing thereafter. The weakening effect of age on risk preferences is due to the correlation between age and risking income and job security, both of which raise risk aversion. This nonlinear effect of age on risk aversion conflicts with findings from single cross-sectional studies that risk aversion rises monotonically with age (Riley and Chow 1992; Donkers et al. 2001; Dohmen et al. 2006) but is similar to results reported by Barsky et al. (1997). Unlike earlier conclusions based on studies using a single cross-section, changes in education do not affect measured risk aversion. And changes in marital status have only small effects that are statistically significant only at the 10% level.

Changing economic circumstances do influence risk preferences by statistically significant but numerically small amounts. Risk aversion increases with net family income at a decreasing rate with peak risk aversion at $307 thousand. In other words, household become increasingly risk averse as income rises for virtually the entire range of household income. Because age and income are positively correlated, conclusions regarding the pattern of risk preferences by age in previous studies may have been clouded by the underlying correlation between age and household economic status. Our results that risk

[3] Marital status, fertility behavior and education may be a consequence of risk preferences rather than a causal factor. However, none of our results are sensitive to the inclusion or exclusion of these factors, and so we include them for completeness.

preferences rise with income are consistent with Barsky et al. (1997) and Bellemare and Brown (2010).

Previous studies argued that more risk-averse job seekers exit unemployment faster (Stephenson 1976; Feinberg 1977) or that the employed are more risk averse than the unemployed (Halek and Eisenhauer 2001). However, the direction of causality is uncertain when based solely on cross-sectional data. The longitudinal data used in this study allows us to investigate whether the duration of employment, unemployment, or out of labor force spells affect risk preferences. We find that among those who are currently employed, risk aversion increases with the duration of employment spell. Risk aversion also increases with the duration of time spent out of the labor force. To the extent that employment or out of labor force are the desired state, these results suggest that risk aversion increases with persistence in success at time allocation decisions. In contrast, risk aversion decreases with length of current unemployment spell or persistent lack of success in time allocation. A one standard deviation increase in weeks of a current employment spell raises risk aversion by 1.6%, evaluated at sample means. A one standard deviation increase in time out of the labor force increases risk aversion by 1.4%. On the other hand, a one standard deviation increase in unemployment spell lowers risk aversion by 0.5%.

These effects are quite small. It takes a consistent spell of 1-2 years to move measured risk preferences up or down by one point. Nevertheless, individuals are more responsive to current spells than accumulated labor market experience. A 52 week current employment spell raises risk aversion 3 times more than one year of accumulated work experience.

The last two columns remove the fixed effects and allow nonlinearities in the measured risk aversion using an ordered probit specification. These estimates allow us to show that some of the demographic effects are captured by the individual fixed effects as marital status and education do not change for large fractions of the sample. In addition,

males are significantly less risk averse than women. However, the signs and significance of the economic variables remain intact.

Regardless of specification, we easily reject the hypothesis that risk preferences do not respond to current and accumulated household economic circumstances.[4] The implication is that risk preferences are endogenous to economic success. One cannot use contemporaneously measured risk preferences to 'explain' labor market decisions regarding search, employment, or labor force participation. With extended periods of unemployment or employment, risk preferences can change substantially. Recent work of Malmendier and Nagel (2011) also suggests that personal economic experiences of macroeconomic shocks explain individual risk preferences. They show that experiences of high stock market returns makes individuals less risk averse and so risk preferences are indeed endogenous to personal economic experiences, which is consistent with our conclusion.

The main story from section II remains. Variation in measured risk preferences are dominated by changes in individual risk preferences that are uncorrelated with demographics or changing economic circumstances. These apparent random measurement errors in risk preferences suggest that one should use considerable caution in using measured risk preferences to test theoretical propositions regarding how risk attitudes influence economic choices.

IV. Conclusion

Risk aversion plays an important role in economic decisions. Economists often use measured risk aversion as a fixed taste that explains why individuals with the same opportunities make different choices under uncertainty. This paper examines whether the

[4] Expanding the sample to include individuals with on partial information on demographic or economic variables does not change our conclusions. See Appendix 3.

measured risk aversion is indeed fixed or if it varies over time. Utilizing panel data from the NLSY79 over a 13-year span, we find that measured risk aversion varies to a much greater extent than assumed in past empirical studies where risk aversion is treated as an exogenous factor in individual decisions. Individual risk aversion changes systematically in response to changing personal economic circumstances. While previous cross-sectional studies have found evidence that risk aversion is correlated with economic variables, we show that measured risk aversion responds to an individual's recent employment and earnings success. Risk aversion increases with lengthening spells of employment and time out of labor force, presumably planned time allocations. Risk aversion decreases with lengthening unemployment spells, time allocations that are at least partially outside the individual's control. Risk aversion rises with income until very high levels and rises with age until age 43. The finding that measured risk aversion is endogenous means that one cannot use contemporaneously measured risk aversion as an explanatory variable shaping decisions under uncertainty.

More surprisingly, individual measured risk aversion changes dramatically over time for unobserved reasons as well. Fifty-eight percent of the least risk averse individuals at the start of our period are in the most risk averse category 13 years later while 12 percent of the most risk averse are in the least risk averse group by the end of the sample period. As a result, over half of the variance in risk aversion in the population is due to changing individual measured tastes and not to differences in risk aversion across individuals. This seemingly random variation in measured risk aversion suggests that these measures are subject to large noise to signal ratios, compromising any interpretation of their measured impacts on economic behavior.

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Table 1—Distribution of categorical responses to income gamble questions over time

Panel A: Unbalanced panel

Risk aversion index	1993	2002	2004	2006
1: the least risk averse	23.9%	18.0%	16.6%	17.2%
2	17.1%	16.3%	13.9%	14.9%
3	12.9%	10.7%	16.1%	11.2%
4: the most risk averse	46.1%	55.0%	53.4%	56.7%
Total Observation	5,300	5,583	5,540	5,949
	(100%)	(100%)	(100%)	(100%)

Panel B: Balanced panel subset

Risk aversion index 1993	Risk aversion index 2006				
	1	2	3	4	Total
1: the least risk averse	6.2%	4.0%	2.8%	10.9%	23.8%
	(26.0%)	(17.0%)	(12.0%)	(46.0%)	(100%)
2	2.9%	3.5%	2.0%	8.7%	17.1%
	(16.8%)	(20.6%)	(11.8%)	(50.8%)	(100%)
3	1.8%	1.9%	2.5%	7.0%	13.3%
	(13.8)	(14.6%)	(18.9%)	(52.7%)	(100%)
4: the most risk averse	5.3%	5.3%	4.7%	30.6%	45.8%
	(11.5%)	(11.5%)	(10.3%)	(66.7%)	(100%)
Total	16.1%	14.7%	12.0%	57.1%	100.0%

Note: Top number is the percentage of all observations. Number in parentheses is the related row proportion.

Table 2—Variance Decomposition of measured risk aversion (θ)

	Within variance (SSE)	Between variance (SST)	Total variance (TSS)
Panel A			
	$\sum_{i=1}^{n}\sum_{t=1}^{T_i}(\theta_{it}-\bar{\theta}_{i0})^2$	$\sum_{i=1}^{n}T_i(\bar{\theta}_{i0}-\bar{\theta})^2$	$n\times\sigma_\theta^2$
Variance (%)	17,601 (57%)	13,448 (43%)	31,049 (100%)
Observations (n)			21,706
Standard error (σ_θ)			1.196
	Within variance (SSE)	Between variance (SST)	Total variance (TSS)
Panel B			
	$\sum_{i=1}^{n}\sum_{t=1}^{T_i}\left\{(\theta_{it}-\bar{\theta}_{i0})-(X_{it}-\bar{X}_{i0})\hat{\beta}_X\right\}^2$	$\sum_{i=1}^{n}T_i\left\{(\bar{\theta}_{i0}-\bar{\theta})-(\bar{X}_{i0}-\bar{X})\hat{\beta}_X\right\}^2$	$n\times\sigma_\theta^2$
Variance after controlling for individual demographics	16,673 (54%)	14,376 (46%)	31,049 (100%)
Observations (n)			21,706

Note: $\bar{\theta}_{i0}=\frac{1}{T_i}\sum_{t=1}^{T_i}\theta_{it}$, $\bar{X}_{i0}=\frac{1}{T_i}\sum_{t=1}^{T_i}X_{it}$, $\bar{\theta}=\frac{1}{n}\sum_{i=1}^{n}\bar{\theta}_{i0}$, and $\bar{X}=\frac{1}{n}\sum_{i=1}^{n}\bar{X}_{i0}$.

Table 3—Effects of economic factors on change in risk aversion over time

	Linear Regression					Ordered Probit	
	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Beta[a]	Random effects	Clustering
Time-varying economic factors							
Family income/100,000			0.172***	0.135**	0.069	0.117**	0.088**
			(3.34)	(2.46)		(2.46)	(2.06)
(Family income/100,000)^2			-0.029**	-0.022*	-0.043	-0.031***	-0.029***
			(2.52)	(1.86)		(2.91)	(3.04)
Recent weeks employed			0.001***	0.001***	0.045	0.002***	0.002***
			(3.99)	(3.83)		(6.23)	(6.43)
Recent weeks unemployed			-0.001**	-0.001**	-0.015	-0.002***	-0.002***
			(2.12)	(2.03)		(3.46)	(3.71)
Recent weeks out of labor force			0.002***	0.002***	0.037	0.002***	0.002***
			(3.87)	(3.33)		(5.14)	(5.49)
Labor market experience (in years)			0.016***	0.012**	0.069	0.014***	0.012***
			(6.00)	(1.98)		(5.68)	(5.42)
State unemployment rate			0.003	0.0002	0.004	0.0003	0.0003
			(0.54)	(0.38)		(0.56)	(0.65)
Non-economic controls							
Age	0.074***	0.072***		0.042*	0.192	0.035	0.029
	(3.61)	(3.40)		(1.96)		(1.53)	(1.36)
Age^2	-0.001***	-0.001**		-0.0005*	-0.171	-0.0004	-0.0003
	(2.60)	(2.39)		(1.74)		(1.33)	(1.16)
Education (in years)		-0.027		-0.026	-0.054	-0.010*	-0.007*
		(1.31)		(1.27)		(1.94)	(1.66)

Number of children		0.004		-0.0001	0.0001	0.011	0.010
		(0.30)		(0.01)		(1.24)	(1.26)
Married		0.084**		0.056*	0.023	0.100***	0.099***
		(2.74)		(1.73)		(3.88)	(4.23)
Male						-0.216***	-0.187***
						(8.88)	(9.12)
White						0.027	0.022
						(1.05)	(0.98)
Constant	0.184	0.522	1.517***	2.043***			
	(0.48)	(1.14)	(24.27)	(4.36)			
R^2	0.46	0.46	0.46	0.46			
1-R^2 (within variance %)	54%	54%	54%	54%			
Total observation (n)	21,706	21,706	21,706	21,706		21,706	21,706
Cut1						0.016	0.028
						[0.438]	[0.395]
Cut2						0.603	0.522
						[0.438]	[0.395]
Cut3						1.003	0.858
						[0.438]	[0.395]

Note: [a] Fully standardized coefficients. *t*-statistics are in parentheses. Standard errors are in brackets. */**/*** significant at 10%/5%/1.

Appendix 1

With *n* individuals in the sample and 4 temporally separated measures of risk aversion for each individual *i*, the total sum of square (TSS) is given by

$$TSS = \sum_{i=1}^{n}\sum_{t=1}^{4}(\theta_{it} - \bar{\theta})^2$$

$$= \sum_{i=1}^{n}\sum_{t=1}^{4}(\theta_{it} - \bar{\theta}_{i0} + \bar{\theta}_{i0} - \bar{\theta})^2$$

$$= \sum_{i=1}^{n}\sum_{t=1}^{4}\{(\theta_{it} - \bar{\theta}_{i0}) + (\bar{\theta}_{i0} - \bar{\theta})\}^2$$

$$= \sum_{i=1}^{n}\sum_{t=1}^{4}\{(\theta_{it} - \bar{\theta}_{i0})^2 + 2(\theta_{it} - \bar{\theta}_{i0})(\bar{\theta}_{i0} - \bar{\theta}) + (\bar{\theta}_{i0} - \bar{\theta})^2\}$$

where $\bar{\theta} = \frac{1}{n}\sum_{i=1}^{n}\bar{\theta}_{i0}$ and $\bar{\theta}_{i0} = \frac{1}{4}\sum_{t=1}^{4}\theta_{it}$.

Summing over the first *t* yields

$$TSS = \sum_{i=1}^{n}\left\{\sum_{t=1}^{4}(\theta_{it} - \bar{\theta}_{i0})^2 + 2(\bar{\theta}_{i0} - \bar{\theta})\sum_{t=1}^{4}(\theta_{it} - \bar{\theta}_{i0}) + 4(\bar{\theta}_{i0} - \bar{\theta})^2\right\}$$

$$= \sum_{i=1}^{n}\left\{\sum_{t=1}^{4}(\theta_{it} - \bar{\theta}_{i0})^2 + 2(\bar{\theta}_{i0} - \bar{\theta})(4\bar{\theta}_{i0} - 4\bar{\theta}_{i0}) + 4(\bar{\theta}_{i0} - \bar{\theta})^2\right\}$$

$$= \sum_{i=1}^{n}\sum_{t=1}^{4}(\theta_{it} - \bar{\theta}_{i0})^2 + \sum_{i=1}^{n}4(\bar{\theta}_{i0} - \bar{\theta})^2$$

Appendix 2—Descriptive statistics

Variables	Definition	Mean (Std) 1993	2002	2004	2006
Risk aversion index	Ordered categorical variable (1-4) 1 = the least risk averse 4 = the most risk averse	2.81 (1.24)	3.03 (1.19)	3.07 (1.15)	3.09 (1.18)
Net Family income		39,251 (31,314)	63,011 (58,545)	68,002 (65,670)	74,707 (75,604)
Recent length of employment	Weeks employed in past 2 years if currently employed	34.17 (21.55)	75.14 (39.42)	74.09 (39.66)	75.97 (38.52)
Recent length of unemployment	Weeks unemployed in past 2 years if currently unemployed	1.61 (10.35)	1.84 (12.69)	5.71 (23.10)	6.01 (23.44)
Recent length of out of labor force	Weeks out of labor force in past 2 years if currently out of labor force	6.54 (17.53)	10.20 (28.74)	14.60 (34.35)	12.07 (31.56)
Work experience	Previously labor market experience (in years)	10.35 (3.92)	17.56 (5.67)	19.08 (6.10)	20.65 (6.37)
Unemployment rate	Local unemployment rate	7.49 (2.57)	6.68 (2.41)	5.71 (1.51)	5.02 (1.49)
Age	Age (in years)	31.58 (2.25)	40.55 (2.25)	42.55 (2.25)	44.55 (2.26)
Education (in year)	Years in schooling	13.16 (2.42)	13.36 (2.48)	13.39 (2.49)	13.42 (2.50)
Number of kids	Number of kids in household	1.37 (1.28)	1.44 (1.29)	1.34 (1.25)	1.25 (1.22)
Married	= 1 if married	0.59 (0.49)	0.59 (0.49)	0.59 (0.49)	0.59 (0.49)
Male	= 1 if male	0.46 (0.50)	0.48 (0.50)	0.48 (0.50)	0.48 (0.50)
White	= 1 if female	0.68 (0.47)	0.67 (0.47)	0.66 (0.47)	0.64 (0.47)
Total observation (*n*)		5,197	5,424	5,387	5,698

Note: Standard deviations are in parentheses.

Appendix 3—Effects of economic factors on change in risk aversion over time with different total observations

	Linear Regression					Ordered Probit	
	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Beta[a]	Random effects	Clustering
Time-varying economic factors							
Family income/100,000			0.173***	0.136**	0.072	0.113**	0.093**
			(3.35)	(2.48)		(2.43)	(2.20)
(Family income/100,000)^2			-0.029**	-0.022*	-0.044	-0.030***	-0.030***
			(2.53)	(1.87)		(2.84)	(3.15)
Recent weeks employed			0.001***	0.001***	0.052	0.002***	0.002***
			(3.99)	(3.84)		(5.98)	(6.33)
Recent weeks unemployed			-0.001***	-0.001**	-0.008	-0.002	-0.002***
			(2.12)	(2.03)		(3.28)	(3.54)
Recent weeks out of labor force			0.002***	0.002***	0.045	0.002	0.002***
			(3.87)	(3.33))		(5.20)	(5.57)
Labor market experience (in years)			0.016***	0.012**	0.081	0.015***	0.012***
			(6.00)	(1.98)		(6.15)	(5.63)
State unemployment rate			0.0003	0.0002	0.003	0.0002	0.0003
			(0.53)	(0.37)		(0.55)	(0.61)
Non-economic controls							
Age	0.067***	0.064***		0.042*	0.157	0.037	0.030
	(3.65)	(3.37)		(1.93)		(1.61)	(1.45)
Age^2	-0.001***	-0.001**		-0.0004*	-0.149	-0.0004	-0.0003
	(2.51)	(2.24)		(1.73)		(1.43)	(1.25)
Education (in years)		-0.024		-0.026	-0.039	-0.012**	-0.008*
		(1.35)		(1.27)		(2.42)	(1.90)

Number of children		0.007		0.0000	0.001	0.013	0.011
		(0.64)		(0.00)		(1.46)	(1.40)
Married		0.066**		0.056*	.020	0.103***	0.095***
		(2.40)		(1.73)		(4.06)	(4.10)
Male						-0.207***	-0.184
						(8.71)	(9.07)
White						0.029	0.022
						(1.13)	(1.02)
Constant	1.300***	1.631***	2.516***	2.046***			
	(3.79)	(4.02)	(40.33)	(4.37)			
R^2	0.47	0.47	0.47	0.47			
1-R^2 (within variance %)	53%	53%	53%	53%			
Observations (*n*)	25,784	25,783	22,042	22,042	22,042	22,042	22,042
Cut1						-0.007	0.048
						[0.428]	[0.390]
Cut2						0.577	0.540
						[0.428]	[0.390]
Cut3						0.972	0.874
						[0.428]	[0.390]