The Influence of Affect on Risky Behavior: From the Lab to Real World Financial Behavior

Simon C Moore (simon.moore@warwick.ac.uk)
Nick Chater (n.chater@warwick.ac.uk)
Decision Technology Research Group, Department of Psychology, Warwick University
Coventry, CV4 7AL, UK

Abstract

There is some evidence indicating a relationship between variations in affect and risk aversion: under certain conditions the behavior observed suggests less risk aversion the more positive the affective state. The research presented in this paper examined how variations in everyday affective states influenced risk taking behavior in the laboratory using simple gambling tasks and then sought to corroborate findings in the laboratory using data on real world financial decision making. We observed a significant and positive relationship between affect and risky behavior in the laboratory that we replicated using structural equation modeling on real world financial data. It is argued that cognitive theories of affect and decision making might have real economic consequences.

Introduction

It is generally accepted that the working population across the industrialized world is not accumulating sufficient wealth to support their retirement. Although the causes and remedies to this crisis are many, one contributory feature of savings behavior is that individual portfolios are not sufficiently 'risky'. In general, funds invested in low return, but 'safe', savings instruments such as savings accounts under perform large diversified portfolios that contain greater 'risk'. Thus, cognitive research that improves our understanding of what influences risky behavior may contribute towards a better understanding of saving behavior and may help to ameliorate some of the problems surrounding the inadequacy of current savings strategies. The research presented in this paper addresses how affect influences risky behavior and we discuss the data with reference to cognitive models of risk and affect (e.g. Ashby, Isen, & Turken, 1999). Thus, this work provides an example of how cognitive science may have substantial real-world implications.

Individual Differences and Risk

An individual may exhibit variations in behavior over time. Risk preferences, for example, are found to co-vary with age, gender, marital status and occupation (Bromiley & Curley, 1992, p12). Specific to the research presented here, variations in affective state also appear to bias risky behavior in *hypothetical* investing scenarios (e.g. Arkes, Herren, & Isen, 1988; Isen & Patrick, 1983; Kahn & Isen, 1993). The research presented here sought to extend our understanding of how decisions that are made involving risky options are influenced by the affective state and further explored techniques that may offer researchers a means of testing cognitive models involving risk might be tested in real world environments.

Affect and Risk in the Laboratory

Research conducted by Isen and her colleagues (Arkes et al., 1988; Isen, Nygren, & Ashby, 1988; Isen & Patrick, 1983; Kahn & Isen, 1993) suggests a complex interaction between affect and risk in the laboratory. Under certain conditions a more positive affective state promotes risk taking, while other findings suggest greater risk aversion with an increase in positive affect. A full discussion of the possible reasons for these seemingly discrepant findings is beyond the remit of this paper. However, a key feature of this research is that affect has been artificially manipulated in the laboratory (usually through giving participants an unexpected gift to induce a positive state) and to date, there has been no systematic study of risk taking behavior where the affective state is a consequence of participants' natural environment (cf. Hockey, Maule, Clough, & Bdzola, 2000). Moreover, an important requirement of cognitive research is that behaviors exhibited in the laboratory are not isolated to the laboratory (e.g. Hutchins, 1996). Therefore, we examined risk taking behavior in the laboratory with reference to natural variations in participants' affective state. Second, we sought ecological validity through examining whether real risk taking behavior in financial decision making might also be modulated by the affective state.

In the first study presented here, we employed the Beck Depression Inventory (BDI; Beck & Steer, 1987) as a measure of overall affective state and assessed the

relationship between BDI score and proportion of risky options chosen on a gambling task (see below). The BDI has been used in cognitive research into decision making with good effect (e.g. Alloy & Abramson, 1979) and is generally regarded as measuring naturally occurring affective states that are similar to those affective states elicited through mood induction procedures (Mayberg et al., 1999) used in laboratory settings (Isen & Gorglione, 1983).

In summary, an existing literature on the relationship between risk and affect would suggest participants in this study exhibiting lower scores on the BDI (i.e. less happy) will also exhibit behavior paradigmatic with relatively less risk aversion, than their more depressed counterparts, but only for low value gambles. For high value gambles we would expect the reverse. An alternative hypothesis has been developed by Moore (2003, forthcoming) who suggest that positive affect is in consequence of events unfolding in an unexpectedly beneficial manner. Positive affect, as an adaptive function, and elicited by unexpected positive events, serves to mediate greater exploratory, or risk taking, behavior. The rationale being that in an environment where events are unexpectedly good it makes good sense to take greater risks as this may lead to the discovery of previously unknown rewards.

Methodology

The purpose of this experiment was to assess the relationship between naturally occurring changes in affective state (measured by the BDI) and risk taking behavior.

Participants. 38 participants volunteered in return for payment (£5/hour) and were recruited from the Warwick University community.

Materials. Materials consisted of the Beck Depression Inventory (Beck & Steer, 1987) and four versions of a short choice-task consisting of 16 binary choice gambles of the form "choose between a.) £200 OR b.) a 60% chance of winning £300". For the '*p* chance of winning *y*' section of the choice, *p* values were set at 20%, 40%, 60% or 80%; *y* values were set at £100, £200, £300 or £400. The certain amount (A in the preceding example) was calculated from

$$x = y.p^{\frac{1}{g}} \qquad (1)$$

where *x* is the certainty equivalent (rounded to the nearest £1 for *x* < £20 and to the nearest £5 for *x* > £20 (cf. Baron, 2000, pp 238-243). Values of g, corresponding to different levels of risk aversion, were set at 0.35, 0.5, 0.65 or 0.8 giving 64 trials. Four tasks of 16 trials were developed in such a manner that each participant was exposed to all four values used to construct the stimuli.

Procedure. Participants first gave their full written informed consent. They then completed the BDI and then the choice-task. They were then debriefed, had all their questions regarding the task answered and were paid. The entire procedure did not take longer than 30 minutes.

Data Reduction and Analysis. The number of risky options (option B in the above example) chosen from the sixteen items in the choice task was taken as a measure of participants' riskiness. The BDI was scored according to guidelines (Beck & Steer, 1987) with a greater score indicating a more negative affective state and a median split divided participants into 'happy' and 'sad' affect groups. Analyses suggested that the 'happy' affect group selected a greater proportion of risky options than the 'sad' affect group (sad affect mean number of risky options chosen = 5.48, SD = 3.43, n = 21; high affect mean number of risky options chosen = 13.88, SD = 3.01, n = 17; Mann-Whitney U Test: $U = 102$, $Z = 2.25$, $p < 0.05$). Moreover, there was no evidence to suggest an interaction between the values of the risky options and affect group. The values of the risky options (*y* in equation 1) were set at £100, £200, £300 or £400. In order to determine whether happier participants opted for low value risky options but avoided high value risky options we classified gambles into 'High Value' (£300 and £400) and 'Low Value' (£100 and £200) and examined the risky options selected by BDI category and value of risky option ($Z < 1$ for each comparison; see Figure 1). These data present a simpler pattern than Isen's findings, discussed earlier.

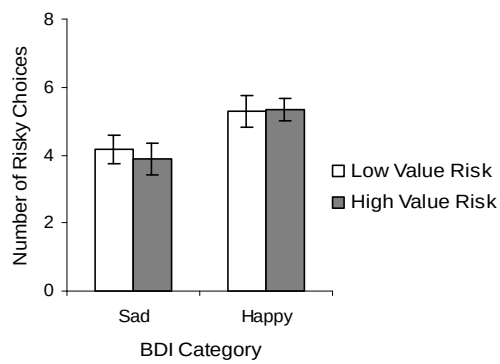

Figure 1: Affect and Risky Behavior. Average of proportion of risky options chosen by affect group (with standard error error bars of the mean) by value of risky option (high value options, *y* = £300 or £400; low value options, *y* = £100 or £200)

Of the possible confounding factors associated with this analysis, gender is perhaps the most serious (Byrnes, Miller & Schafer, 1999). Gender differences are observed in normative BDI scores (Beck & Steer, 1987) and in risk taking behavior (Byrnes, Miller & Schafer, 1999). Women are generally found to report higher BDI scores and to be less risky. A multiple regression with BDI and gender (0, female; 1, male) as independent variables and number of risky options selected as the dependent variable suggested, however, that gender did not explain the observations made here ($R^2 = 0.33$, $p < 0.001$; see Table 1).

Table 1 Multiple regression results see text for further information

	Beta	Partial Correlation	t(35)	*p*
BDI	-0.394	-0.432	-2.830	<0.01
Gender	0.465	0.491	3.339	<0.01

The multiple regression analysis indicated that both gender and BDI score predicted risk behavior and did so independently of one another (the correlation between BDI and risk after partialling out the effect of gender still suggests a significant relationship).

Discussion

Building on earlier research, the preceding laboratory experiment examining the relationship between natural variations in affective state and risky behavior found relatively happier participants selected risky options more often than relatively less happy participants. As will be discussed, these data might contribute to current understandings on the relationship between affect and risk behavior.

As the affective state was not induced in the foregoing experiment, but a natural feature of the participant in the experimental setting, we circumvent some potential issues that surround the use of induction procedures in choice experiments. Specifically, research that has sought to manipulate a positive affective state in participants has, in some circumstances, achieved this through giving participants a surprise gift with control groups receiving nothing. The subjective value of this gift may have bearing on how much risk participants will take in risky choices. For example, and hypothetically, if a positive affective state was elicited through surprising participants with $500 and then those participants were asked to complete hypothetical gambles where the amounts were of the magnitude $1 one might be expected to see an effect of gift size that acts beyond the influence of affect. In other words, participants might exhibit greater risk taking for gambles that involve amounts less then their perceived recent subjective gain, but avoid risks on gambles that might serve to wipe out those current subjective gains. As earlier research has sought to manipulate the affective state with surprise gifts, the finding that positive affect participants are more risk averse for high value gambles and less risk averse for low value gambles may be a feature of the induction procedure but not the mood it elicits (cf. Tversky & Kahneman, 1981). Thus, considering naturally occurring affective states, as we have here, goes some way to circumvent potential confounds associate with inducing affective states and examining risk behavior.

If natural variations in affective state modulate degrees of risk aversion, does the same relationship hold for naturally occurring affective states in relation to real world financial decisions? The following analysis sought to address this question.

Risky Savings

There are very few studies that have explicitly sought to characterize what, if any, individual differences influence real world financial behavior (Blume & Friend, 1975; Cohn, Lewellen, Lease, & Schlarbaum, 1975). Blume and Friend (1975) examined a large sample of wealthy investors with respect to the level of diversification in their portfolios. Although diversification is an accepted means of *reducing* risk in a portfolio, diversification may also involve including more risky options to achieve that end. Blume and Friend (1975), although finding that diversification in their sample was generally low, presented data suggesting level of wealth was positively associated with greater diversification. Weaker positive associations with diversification were found with a male household head (as opposed to female) and a self-employed household head. More direct evidence for individual differences in financial risk taking are presented by Cohn, Lewellan, Lease and Schlarbaum (1975) who examined investing behavior in a sample drawn from customers of a brokerage firm. They classified assets as risky and non-risky and found income was strongly and positively associated with proportion of assets classified as risky. Weaker positive associations were found with age and being single. The preceding discussion suggests demographic information shows some relationship with risk preference. However, affect, and its fluctuation, is also an important feature of day to day life. We know of no published studies that examine how affect might influence risk taking behavior in the real world. The following analysis sought to explore techniques that might uncover whether any relationship between affect and risk found in the laboratory might be discernable in the

field, in real-world data on self-reported happiness and financial decisions.

Methodology

The hypothesis we sought to explore in the following analysis is relatively simple: that the happier a person is over their life, the more likely they are to invest their wealth in relatively more risky options. However, and to the authors' knowledge, no survey has been specifically designed to assess this hypothesis. Therefore, to determine if a relationship existed between affective state and financial risk taking we used data from Wave 10 of The British Household Panel Survey (BHPS; Taylor, Brice, Buck, & Prentice-Lane, 2002). The BHPS is a multi-purpose study that follows the same representative sample of 10,300 individuals, drawn from 250 different regions of Great Britain, over a period of years (the survey is now in its 10th year). The range of information collected from each respondent is broad, including details on income, savings strategy, happiness, leisure, etc., and is therefore well suited to the current objectives of this research.

From the BHPS we selected variables that closely matched the variables of interest in this study. The BHPS contains information on respondents' savings strategies across a range of options (e.g. questions asked include: 'do you save money in a bank account?', 'do you invest money in a bank account?'). Respondents answer 'yes' or 'no' to each. Of these options variable JNVESTE (Money in shares: UK or foreign; 'Financial Risk' hereafter) represented the riskiest savings option respondents were asked about. We therefore used this variable as an indication of whether respondents had any of their wealth invested in a risky instrument. The BHPS also contains information on respondents self reported feelings. From the 12 variables describing various aspects of each respondent's subjective state researchers concerned with the construction of the BHPS have derived an overall index of subjective well-being (JHLGHQ1; Taylor et al., 2002; 'Affect' hereafter). We used this variable as a proxy to the BDI employed in the earlier experiment and as an indication of overall affective state.

From the preceding discussion, it was apparent that wealth has a strong association with proportion of wealth invested in risky options (Blume & Friend, 1975). Moreover, there is evidence from the economic literature that associates an increase in wealth with an increase in subjective happiness (Blanchflower & Oswald, 2000; Gardner & Oswald, 2001; Oswald, 1997). We therefore included JFIHHMN (level of household income; 'HH Income' hereafter) as a measure of respondents' wealth in subsequent analyses.

The hypothesis we sought to explore concerned the possible relationship between happiness and risk taking. As income is associated with both we used structural equation modeling (SEM) to ascertain whether happiness might play a role in how income affects greater risky behavior in the financial domain.

Data Reduction and Analysis.

Data from the BHPS was trimmed to include respondents aged between 31 and 50 years of age and to those who had invested money in at least one investment vehicle (number of observations entered into the analysis = 2,664, see Table 2 for descriptive statistics).

Table 2 Descriptive statistics for the sample examined

	Mean	Min	Max
Affect	11.44	0.00	36.00
HH Income	3009.21	£0.00	£38,766
Financial Risk	0.28	0	1
AGE (years)	39.73	31.00	50.00

Consistent with Blume and Friend's (1975) observations, we found a significant linear association between HH Income and likelihood of investing in the stock market (n = 2,664, $R^2 = 0.038$, $p < 0.0001$).

In order to assess the hypothesis that affect may play a role in the amount of risk respondents take with their investments we used SEM with an asymptotically distribution free Gramian discrepancy function and a Golden Section line search method on the correlation matrix derived from the three variables of interest (see Table 3).

Table 3 Correlation matrix used in the SEM

	Affect	HH Income	Financial Risk
Affect	1.000		
HH Income	-0.073	1.000	
Financial Risk	-0.049	0.195	1.000

The SEM found a solution that had a reasonable fit with the data (χ^2 goodness-of-fit = 84.83, RMS Standardized Residual = 0.10; see Figure 2 and Table 3). Other indices of fit suggest this parsimonious model fits the data reasonably well (Joreskog GFI = 0.976, Browne-Cudeck Cross Validation Index = 0.036).

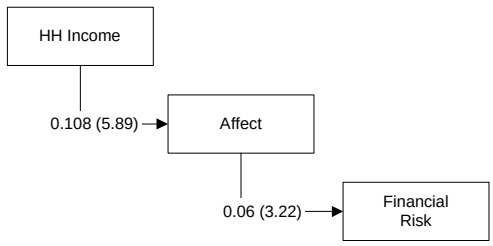

Figure 2 SEM model of the relationship between income, affect and financial risk taking with parameter estimates (t values in brackets, $p < 0.001$ for each).

Discussion

The SEM analysis appears to support the conjecture that financial risk taking behavior may be associated with overall affective state. Those respondents reporting generally higher levels of subjective happiness were also more likely to invest in the stock market. However, although the model presented is both parsimonious and significant, it should be stressed that it cannot represent the only relationship between income and likelihood of investing in the stock market. Clearly factors such as sound financial advice will play an important role. The SEM analysis was designed to allow any relationship between affect, risk taking and income to become apparent assuming that potential confounds were normatively distributed across the variables of interest. Furthermore, a respondent's decision to invest in the stock market may have been taken at times far removed from the administration of the BHPS and therefore the measure of affect recorded may not be a good representation of the level of affect while that decision was made. These drawbacks are methodological and cannot be addressed using existing data sources of the scale offered by the BHPS. Future research should seek to design data collection methods that measure affect levels while these decisions are made and might serve to validate laboratory based research in real world settings.

Despite unavoidable drawbacks in the design of this second experiment, the analyses broadly support the notion that affect may play a role in how people decide to invest their money and risk taking behavior generally. Importantly, this represents an extension of cognitive research from a carefully controlled environment to real world choices. As such, we regard the analysis presented as indicating a potentially important direction for future research.

General Discussion

To extrapolate from past experiences and current observations to predict what comes next is enormously valuable: it allows us to avoid harm and manage our environment. However, the world is an uncertain place and despite our predictive abilities we are regularly exposed to surprising events (cf. Kagan, 2002). It is generally held that emotion is elicited at the juncture where things do go wrong, or surprisingly better than expected (e.g. Oatley & Johnson-Laird, 2002; Scitovsky, 1976) with better than expected events eliciting happiness and worse than expected events eliciting unhappiness (Lazarus, 1966). One means, therefore, of conceptualizing how the affective state modulates consequent behavior is that it serves to reduce exposure to uncertainty and biases the organism to take less risk. The rationale being that choice options that are more certain will hold no further surprises and reduce exposure to further risk (in the case of negative affect). Alternatively, positive affect may serve to promote risky behavior if the environment appears to offer previously unknown rewards. Affect may therefore have an adaptive function that is closely related to risk taking behavior and the data presented here may support this notion. Moreover, given the ecological validity provided, cognitive models derived from observing the modulation of behavior by affect might play an important role in understanding real world economic behavior in future research.

The proposed modulatory influence of affect on cognition may be associated with the function of mesocortical dopamine (DA). For example, Ashby draws together many studies showing how affect modulates cognition and argues DA (realized as modulating the gain parameter in network models of cognition) mediates the observed changes in behavior (Ashby et al., 1999). Moreover, DA appears to play a role in decision making and learning (Montague & Berns, 2002) and plays an important role modulating behaviors that are similar to those observed in the research presented here. Thus, the dopaminergic system may play a central role in how affect modulates behavior. If this is the case then future research into the role of affect in real world financial behavior offers the opportunity to draw together observations made on real world decision making with cognitive and neuroanatomical models of behavior. In particular, there appear to be notable individual differences in the function of the DA system (e.g. in receptor density; Kandel, Schwartz & Jessell, 1995) which might suggest a more complex interaction between affect, individual differences and financial decisions with respect to risk. In particular, if the nature of these individual differences proves to be stable and predictable, models of financial behavior might gain considerably through attending to them. In this paper we have suggested that affect biases individual preferences for risk. If more risky investments offer a higher return than more

conservative options then feeling happy might also improve one's financial standing, in the long-term.

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