A MEASURE OF ENTREPRENEURIAL RISK PREFERENCE AND OPTIMISM USING FIELD EXPERIMENTS

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ABSTRACT

Previous studies have underscored the economic importance of the role of the entrepreneur, and empirical studies testing the nature of the entrepreneur are notably lacking. This study directly addresses this issue by examining newly gathered field data which captures the decision making and risk behaviors for a group of high-technology entrepreneurs. Two decision making tasks were used to elicit risk aversion measures and to test for any 'joy of winning' or judgmental errors, possibly in the form of over optimistic behavior. These elicitations were made with the use of multiple price formats and winner's curse experiments.

62 responses were collected from subjects at the 2004 national Small Business Innovation Research (SBIR) conference in Atlanta, March 2004. From these 62 responses a subject pool of 33 entrepreneurs and 29 non-entrepreneurs were identified. Statistical methods were employed to assign risk aversion measures and identify any 'joy of winning' or judgmental errors for the entrepreneur (treatment) group compared with the non-entrepreneur (control) group. Findings show that entrepreneurs exhibit less risk aversion, but show no statistically meaningful difference in judgmental errors compared to their non-entrepreneur counterparts. However, there is evidence to support the claim that both entrepreneurs and non-entrepreneurs exhibit a 'joy of winning', and that the size of the effect is larger for entrepreneurs.

I wish to dedicate this manuscript to my family: To my brother for always being my best friend. You have always challenged me to look at life a little bit differently, and in the process made me laugh a little bit harder. To my father for setting an example of how hard work and dedication are the only ingredients needed to lead a successful life; and finally, my mother for giving me the morals and the values that I lead my life with today. Thank you and I love you all!

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CHAPTER ONE: INTRODUCTION

While many previous studies have underscored the economic importance of the role of the entrepreneur, empirical studies testing the nature of the entrepreneurs are notably lacking. Lazear (2002; p. 1) for example states that "The entrepreneur is the single most important player in a modern economy", while Goeffee and Scase (1987; p.1) suggest that "They [entrepreneurs] are seen as risk-takers and innovators…Indeed, according to many, economic recovery…is largely dependent upon their ambitions and efforts." This study will directly address this issue by examining newly gathered field data which captures the decision making and risk behaviors for a group of largely high-technology entrepreneurs.

The Oxford English Dictionary dates the word's use back to 1828, originally used to denote the *director or manager of a public musical institution or one who 'gets up' entertainments*. However, in 1852 the semantic definition began to include *one who undertakes an enterprise; one who owns and manages a business; a person who takes the risk of profit or loss*. This study will use the last definition.

Perhaps the easiest type of entrepreneur to identify is the individual who is self-employed - the initial owner and operator of a firm. There is recent survey evidence that suggests, in industrialized countries, many individuals who are currently employed in another firm would actually prefer to be self-employed. Although hardly conclusive, this evidence is suggestive that there may be restrictions imposed on the supply of entrepreneurs. For example in the International Social Survey Programme – Work Orientations II Survey of 1997, respondents from 26 countries were asked: "Suppose you were working and could choose between different kinds of jobs. Which of the following would you personally choose? I would choose (i) being

an employee, (ii) being self-employed, (iii) Can't choose." Large numbers of survey participants answered (ii), stating that they would prefer to be self-employed. Examining choices by country, 61.8 percent of the US respondents indicated their preference for self-employment over working in another firm, in contrast to 39.4 percent from Great Britain and 47.7 percent for Germany. In reality however, only about 15 percent of the U.S. and Great Britain's workforces, and 10 percent of Germany's workforce are actually self employed.[1] These differences raise an interesting question: Why don't more of these individuals, desirous to be self-employed, actually become self-employed?

In this study I explore possible answers to this question using established methodologies from the social sciences and include findings from the disciplines of psychology, economics, and management. I will also present new findings on entrepreneurial risk preferences and optimism to better characterize and define the entrepreneur; where risk is defined as *the chance that is accepted in economic enterprise and considered the source of (an entrepreneur's) profit*. Using lottery choice and biding experiments performed on entrepreneurs and non-entrepreneurs in the field, rather than college students in the lab, my study attempts a direct elicitation of risk aversion and judgmental bias stemming from optimism for the entrepreneur. This study tries to provide a clearer picture as to why certain individuals self-select into the role of an entrepreneur while others do not.

The hypotheses tested in this study are: (i) entrepreneurs are less risk averse than non-entrepreneurs; (ii) entrepreneurs will experience a 'joy of winning' compared to non-

[1] http://www.za.uni-koeln.de/data/en/issp/codebooks/s3090cdb.pdf German statistics are obtained using a weighted average of the aggregates given for D-W and D-E.

entrepreneurs; and (iii) entrepreneurs will suffer from judgmental bias, possibly in the form of over-optimism, more than non-entrepreneurs.

The organization of the thesis is as follows: Chapter II, the literature review, explores the self-employment choice of individuals and motivates the use of experimental methods; Chapter III, describes the experimental design and specific methodology used for measuring risk aversion and optimism; Chapter IV, presents empirical results; and finally, Chapter V provides conclusions of the study and identifies important areas for future research.

CHAPTER TWO: LITERATURE REVIEW

Social Science Approach to Entrepreneurs

Social science researchers have attempted to characterize and define what makes an entrepreneur by interviewing individuals that self-selected into becoming an entrepreneur and look for causal relationships in their socio-demographic profile that could account for this. Davidsson's Researching Entrepreneurship (2004; p.37) contains a chart of possible determinants of entrepreneurship gathered from "reading a large number of empirically based studies." Among those cited were education level, need for achievement (nAch), taxes, risk taking, firm size, business cycle stage, firm age, age, sex, shoe size, business education, locus-of-control, networking, optimism, location, management experience, industry growth rate, labor market legislation, industry structure, role models, industry experience, and regional characteristics, but even this is only a partial list of the actual attributes which characterize and define the entrepreneur.

It is beyond the scope of this study to provide a background into every determinant of entrepreneurship studied thus far; however, limited attention will given to those socio-demographic variables that are mentioned in much of the current research. These variables include the existence of a parent or close relative entrepreneur (Jacobowitz & Vidler, 1982; Scherer, Brodzinski & Wiebe, 1991; Hisrich, 1990), educational attainment (Evans & Leighton, 1989; Brockhaus, 1982; Hisrich, 1990), locus of control (Rotter, 1966, Jacobowitz & Vidler, 1982) and optimism (de Meza & Southey, 1996; Evans & Leighton, 1989).

Existence of parent entrepreneur

Jacobowitz and Vidler (1982) administered a questionnaire which focused on educational and social background, perceived satisfaction, and personality attributes of 430 small business owners in central New Jersey and eastern Pennsylvania. These entrepreneurs shared certain characteristics, despite their particular industry of operation. Most (72 percent) came from homes where their parents or close relatives either owned a small business or were independent professionals. According to the authors (p.254) the rationale was that "…such a background created a climate where entrepreneurial qualities were established as standards and gave tacit approval to similar behaviors displayed by the entrepreneurs in their early years. The role models they were exposed to in their youth set the tone for their attachment to entrepreneurial values and attitudes." In addition, Hisrich (1990; p.211) states, "To see someone else do something and succeed makes it easier to picture oneself doing a similar, and of course, better, activity." One could reason this behavior would be particularly likely in a household where a close family member is an entrepreneur. These studies suggest that the existence of a parent or close relative entrepreneur would increase the chances of an individual becoming an entrepreneur; however these studies do not examine how risk aversion or optimism might be passed on to family members.

Educational Attainment

Evans and Leighton (1989) examined determinants of earnings for self-employed individuals using data from the National Longitudinal Survey of Young Men for 1966-1981 and

the Current Population Surveys for 1968-1987. Using these data sets, they ran regression analyses for the role of education using probit and log-earnings functions. The probit regressions estimated the probability that an individual would be self-employed for the year 1981. Results indicated that, ceteris paribus, the probability of being self employed increased by 4.7 percent per additional year of education. The log-earnings regression estimated wage differences (as a percentage) between self-employed individuals and wage workers. The estimations revealed that, ceteris paribus, returns per additional year of education were higher for self-employed individuals, averaging 10.3 percent per year, compared with wage workers average of 7.1 percent per year.[2] These studies suggest that the more education an individual has, the greater the likelihood that individual will be self-employed, and that they will be self-employed at a higher wage then they could get as a wage earning worker. One could reason that an individual with this information would realize that their expected utility under self-employment would exceed their expected utility as a wage worker; however, this statement would assume that all individuals display similar risk aversion preferences.

Additionally, Hisrich (1990; p.212) states "Both male and female entrepreneurs have cited educational needs in the areas of finance, planning, marketing (particularly distribution), and management." It is plausible to think that each additional year of education an individual acquires would lead to an increased chance of exposure to core business functions, such as those cited by Hisrich. With exposure to these functions an individual would presumably have a foundation of principles to draw from when starting a business, thus creating a sense of certainty

[2] Evans and Leighton (p.530) reports results that are statistically significant even after controlling for individuals in professional occupations.

when putting these principles into practice. Indeed, education of core business functions would allow individuals to cope with problems as they arise and allow for the correction of deficiencies before it would have put them out of business.

Locus of control

Much of the current literatures on entrepreneurs refer to a psychological assessment test, designed by Julian Rotter (1966), known as locus of control (LOC). LOC provides a measure of the extent to which an individual believes the occurrence of good or bad circumstances in their life is conditional on their own behavior. This measure is defined using Rotter's Internal-External (I-E) scale. Individuals are classified along a continuum from 0 (very internal) to 23 (very external): 'Internals' view positive or negative events as being related to one's own actions and thereby under one's own personal control; conversely, 'externals' view positive or negative events as being unrelated to one's own behavior in certain situations and thereby beyond personal control.

'Internals' are viewed as being apt to be more self-reliant, independent, wanting greater autonomy, and hold a view that change in the world comes from within and is not left to destiny or fate; these qualities would presumably be important to an entrepreneur. 'Externals' are characterized as seeing happenings in life controlled by luck, chance, or powerful others. The general population falls somewhere between these two extremes; however, one would expect entrepreneurs self-selecting from the internal side of the I-E continuum.

For example, Shapero (1975; p.84) administered the I-E exam to 101 Texan and 34 Italian entrepreneurs and reported I-E scores averaging 6.58, making these entrepreneurs 'more

internal' than non-entrepreneurial individuals.[3] Shapero (p.84) goes on to state "Indeed, to my knowledge, only Peace Corps volunteers have come out more internal [than entrepreneurs]".[4] Another study, by Pandey & Tewary (1979) surveyed individuals in India wanting to obtain start-up capital from a financial firm. Those selected to receive the financing had I-E scores averaging 7.22 while those rejected had scores averaging 9.31, with the difference between these scores being statistically significant at the 5 percent level, implying that those chosen for the start up capital were 'more internal' then those not selected. Here it is important to note the limitations of the I-E scale, because the I-E scale does not have clear demarcations stating something to the effect "you received a score of 12, you are 'more internal'; welcome to the wonderful world of self-reliance, independence and autonomy. Or, you received a score of 20 making you 'more external'; welcome to a world controlled by luck, chance, or powerful others." In fact there is a continuum between the extremes of 'very external' and 'very internal'. Although both studies reported average I-E scores for their respective entrepreneurs as 'internals', it is more precise to state they categorized their entrepreneur group as 'more internal' then their counterparts. These studies imply that, on average, 'more-internal' individuals (those with I-E scores closer to the 'very internal' side of the continuum) will self-select into entrepreneurship more so then 'more external' individuals.

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[3] The authors do not define an entrepreneur for their study; however, they go on to state (p.84) "Italians tend to view the small business as parvenu…" possibly alluding to the sampling of small business owners. Likewise for the Americans in the study, with over 99 percent of businesses in American defined as small (less then 500 employees), one could be fairly confident that these were small business entrepreneurs as well.

[4] This statement makes sense, in that Peace Corps volunteers would need to feel that their individual actions could change the world about them, especially in a foreign country where their actions would have to speak louder then their non-native words.

As Evans & Leighton (1989; p.521) state "As predicted by one of the leading psychological theories, men who believe their performance depends largely on their own actions – that is, have an internal locus of control as measured by a psychological test known as the Rotter Scale – have a greater propensity to start a business." and (p.532) "Self-employed workers at a point in time tend to have a more internal locus of control…and individuals with a more internal locus of control are more likely to enter self-employment…"

The statements and empirical work presented above illustrate how the I-E scale's measure of LOC could lead to a type of risk profiling of individuals and thereby a proxy measure for individual's actual level of risk aversion. That is, on average, the 'more internal' an individual is at a certain point in time, the more likely that person will go into self-employment, thus the I-E scale could be measuring, along with other variables, the degree to which an individual is risk averse. For example, an individual that scores lower on the I-E scale (more internal) could be someone who is also more willing to accept risk then someone who scored higher (more external). This statement could be captured by the 'internal' individual's perception that they hold a certain amount of control over their environment and have the strength within themselves to affect outcomes, thus leading them to taking on more risk then their counterparts would.

Optimism

There is a generally held view that entrepreneurs, as the founders of small business, are overly optimistic individuals compared with the rest of the population. In fact this reasoning has

been used to explain why a large number of new start-up businesses fail.[5] Starting a new business would generally require an individual with a tendency to take a favorable view of circumstances or prospects -an optimist. Shapero (1975; p.85) puts it another way "In order to see starting a company as a credible act, it may also be necessary to be blind to some of the risks." Similarly, de Meza and Southey (1996; p.376) say "…it is from the most over optimistic segment of the population that entrepreneurs will select themselves."

There are some parallels that can be drawn between LOC and optimism as captured by de Meza and Southey (1996; p. 376) "Being an entrepreneur is very much to be in control. The probability of success will, to a large degree, depend on the entrepreneur's abilities. Many of those starting new businesses will have little evidence upon which to base their beliefs about the likelihood of failure or success. The situation would be ripe for unrealistic optimism, particularly with regard to the entrepreneur's perceived abilities." Here the parallel is drawn between "the entrepreneurs perceived abilities" and its implicit measure by LOC.

Otherwise stated, at a point in time 'internals' possess a belief that change in the world comes from within; therefore, the entrepreneurial field is thought to have a predisposition for individuals with a 'more-internal' LOC and be overly optimistic in their abilities to the point of judgmental bias. The bias becoming more severe for an optimist with an internal LOC, an individual with heightened perceived abilities. Judgmental error would bias the individual's own ability to distinguish between risks inherent in doing business and risks that can be diminished

[5] Using data from 1989 through 1998 The US Census Bureau's Business Information Tracking Series (BITS) Headd (2003; p.59) reports that only half (49.6 percent) of new firms started in the United States were still in operation after 4 years and only 40 percent were still open after 6 years.

with the entrepreneur's own abilities; possibly causing them to take on higher levels of risk compared to other sub-sets of the general population.

In sum, the entrepreneurial literature has largely accounted for risk through socio-demographic and psychological proxies. However while these parameters provide a good foundation, the analytical construct of an entrepreneur is clearly not complete. I propose that a natural progression in the study of entrepreneurs is to measure risk preferences and judgmental errors directly using salient methods to provide testable hypotheses in order to systematically evaluate the existing theories on entrepreneurial behavior. The next subsection provides pertinent literature currently used for testing risk aversion and optimism using experimental economics.

Experimental Methodologies to Eliciting Responses

Risk Aversion

How can we assign individuals a measure of risk aversion? The psychology literature has partially addressed this question by testing for causal links between individuals that have self-selected into entrepreneurial roles and their socio-demographic make-up. However, these studies fail to test whether entrepreneurs are inherently different in their degree of risk aversion than the general population. This is where Expected Utility (EU) theory and Multiple Price List (MPL) approaches combine to provide a test of differences in risk aversion between two groups.

Holt and Laury (2002) (HL) used a menu of paired lottery choices, i.e. MPL, similar to Binswanger (1980),[6] but added additional rounds where the choices were hypothetical. Their experiment presented subjects with a choice between two lotteries, defined as A or B, where the crossover point between these two lotteries, the 'safe' and the 'high-risk' lottery, was used to infer the degree of risk aversion. Table 1 illustrates the basic payoff matrix presented to subjects. The first row shows that lottery A offered a 10 percent chance of receiving $2 and a 90 percent chance of receiving $1.60. The expected value of this lottery, EVA, is shown as $1.64; however, the EV columns were not shown to subjects. Similarly, lottery B in the first row has chances of payoffs of $3.85 and $0.10, for an expected value of $0.48. These parameters result in a difference between the expected values, in this case $1.17. As one proceeds down the payoff matrix, the expected value of both lotteries increases; with the expected value of lottery B becoming greater than the expected value of lottery A after the fourth decision row.

For each row the subject chooses decision A or B, with one row later being selected at random for payout to that subject. The logic behind this method is that only extremely risk-loving subjects would choose lottery B in the first row, and only extremely risk-averse subjects would choose lottery A in the second last row. The last decision row is a test that the subjects were awake and understood the instructions; after all, with no risk involved, more is always better! These parameters imply that a risk-neutral subject would switch from decision A to B

[6] Binswanger conducted a field experiment with 330 farmers in rural India. The lotteries were played 7 or 8 times over 6 weeks in different farming villages. A coin toss was used to determine the outcome and had real payoffs that were fairly high relative to the farmers' monthly incomes. Subjects were asked to choose between 7 lottery choices with the riskier alternatives being an average-preserving spreads of the less risky ones; that is, the lottery choices had the same expected value, but a higher variance of payoffs. Results found that as payoffs rose (1/100; 1/10; 1; and 10) nearly 80 percent of the subjects displayed moderate-risk aversion, while risk-neutral and risk-loving behavior almost disappear.

when the EV^B becomes greater than EV^A; therefore, a risk-neutral subject should choose A for the first four rows and B thereafter, denoted by the dashed line in Table 1.[7]

At the heart of the experiment HL wanted to test whether a scaling up of payouts, by a constant *k* would change the amount of risk aversion displayed by the subjects. They set up the experiment with four tasks which followed this order: 1x low-real "baseline" payout (as found in Table 1); 20x high-hypothetical payout; 20x, 50x, or 90x high-real payouts; and finally, a "return to baseline" 1x low-real payout. To control for wealth effects between tasks one and three the subjects were required to initial a statement that said they would forego their previous earnings in order to participate in the higher-real lottery. A statement was also made between task one and two that clarified to the participants that the hypothetical winnings would not be paid out.[8]

The authors then used these data to test the predictive power of constant relative risk aversion (CRRA) over increasing payout schemes blown up by a constant *k* and its affects on the average number of safe choices made by the subjects. HL (p.1646) chose to use CRRA as a benchmark because "the literature on auctions commonly assumes constant relative risk aversion for its computational convenience and its implications for bid function linearity." However, they do not assume that individuals exhibit CRRA, but use the base calculations of CRRA as the basis for their null hypothesis – Does CRRA provide an adequate measure to explain risk aversion over a large payout range from several dollars to several hundred dollars?

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[7] A nice overview of MPL formats and their advantages and disadvantages can be found in Andersen, Harrison, Lau and Rutström (2004).

[8] Holt and Laury (p.6) stated that "Nobody declined to participate, so there is no selection bias." In other words, all subjects proceed through all four tasks of the experiment. This step would not have been useful between the high-real payout of task three and the "return to baseline" task of four. We would expect no one to continue if required to give up their higher earnings to play a lower valued game.

HL used the number of safe lottery choices given by the subjects to infer a range of relative risk aversion. The logic is that when subjects switch between the 'safe' and 'riskier' lotteries they implicitly select an interval of relative risk aversion. Table 2 in Appendix B has a break down of these intervals and the classification associated for each. For example, someone that chooses four 'safe' choices of Option A and then switches to the 'riskier' Option B thereafter would be classified as 'risk neutral' with implied range of relative risk aversion -0.15 < r < 0.15. The variable r is defined as the CRRA coefficient, and is what the subject is implicitly defining when switching between the 'safe' and 'riskier' lotteries. When the switch between the two lotteries takes place the subject is stating that somewhere in that interval the expected utility of the 'safe' Option A is equal to the expected utility of the 'riskier' Option B. Once this equality is passed the 'riskier' Option B has greater expected utility from that point on. These bounds are calculated using the CRRA function, defined as U(x) = x1-r/(1-r), along with the probabilities and payouts for the HL 'baseline' treatment given in Table 1.[9]

Table 3 shows the setup needed to calculate the lower bound for the 'risk neutral' subject (-0.15). Notice that the EUsafe (expected utility for the 'safe' lottery) column is the expected utility derived from the 'safe' payoffs along with their associated probabilities. The EUsafe for four 'safe' choices equals:

$$EUsafe = \left(\$2^{1-r} \Big/ (1-r) \right)(.4) + \left(\$1.60^{1-r} \Big/ (1-r) \right)(1-.4)$$

It is equal to the safe-high-payoff to the (1-r) power, divided by (1-r) all multiplied by the probability of the event occurring plus the safe-low-payoff to the (1-r) power, divided by (1-r) all

[9] The utility of x, U(x), is defined under the von Neumann-Morganstien expected utility theory, the utility that is

multiplied by 1 minus the probability of that event occurring. This equals EUsafe of 1.76. Duplicating this process using the 'riskier' lottery with payouts of $3.85 and $0.10 produces EUrisk (expected utility for the 'riskier' lottery) equal to 1.60. The EUdiff (difference between EUsafe and EUrisk) is 0.16. Up to this point we did not specify r (the middle table of table 4). The objective is to get the EUdiff equal to zero by allowing r to vary until the argument is satisfied. This is accomplished with the 'Goal Seek' function in Excel. It 'forces' the EUdiff to zero by finding a value of r that satisfies the argument, r equal to -0.1426 satisfies this. HL reports this as -0.15. This method can be extended to show all intervals.

HL used these implied intervals to classify all of their treatments. They found that CRRA provided a useful measure of risk aversion for lower payouts; however, it predicted absurd amounts of risk aversion in high stake payouts. They now needed a utility function that would be consistent with the observed subject behavior over a wide range of payoff stakes. Their subject data showed that higher numbers of 'safe choices', Option A, were made for the real high-payoff tasks compared with the real low-payoff task. Stated otherwise, the subjects exhibited higher degrees of risk-aversion for the real high-payoff treatments more than the real low-payoff and CRRA does not model these changes accordingly. A new function was needed that could model these changes. The model proposed was:

> …we introduce a noise parameter, μ, that captures the insensitivity of choice probabilities to payoffs via the probabilistic choice rule:

$$\Pr(chooseOptionA) = \frac{U_A^{1/\mu}}{U_A^{1/\mu} + U_B^{1/\mu}},$$

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derived from the prize in the experiment.

where the denominator simply ensures that the probabilities of each choice sum to one. Notice that the choice probabilities converge to one-half as μ becomes large, and it is straight forward to show that the probability of choosing the option with the higher expected payoff goes to 1 as μ goes to 0…

The next step is to introduce a functional form that permits the type of increasing relative risk aversion seen in our data, but avoids the absurd predictions of the constant absolute risk aversion model. This can be done with a hybrid "power-expo" function (Saha, 1993) that includes constant relative risk aversion and constant absolute risk aversion as special cases:

$$U(x) = \frac{1 - \exp(-\alpha x^{1-r})}{\alpha},$$

which has been normalized to ensure that utility becomes linear in x in the limit as α goes to 0. It is straightforward to show that the Arrow-Pratt index of relative risk aversion is:

$$\frac{-u''(x)x}{u'(x)} = r + \alpha(1-r)x^{1-r}$$

which reduces to constant relative risk aversion of r when $\alpha = 0$, and to constant absolute risk aversion of α when r = 0. For intermediate cases (both parameters positive), the utility function exhibits increasing relative risk aversion and decreasing absolute risk aversion (Abdellaoui, Barrios, and Wakker, 2000).

HL used the proportion of safe choices in each of the ten decisions for the four real-payoff treatments to obtain maximum-likelihood parameter estimates for the "power-expo" utility function. Once the parameter estimates were obtained they were used to plot theoretical predictions for the four real treatments and modeled most of the aggregate data averages closely. The three parameter model granted the flexibility to predict risk aversion needed to explain behavior in both the low and high-stake treatments. The authors state (p.1653) "…this three parameter model does a remarkable job of predicting behavior over a payoff range from several dollars to several hundred dollars."

Joy of Winning and Optimism

How can we empirically test an individual's optimism? One possible answer lies in a concept known as the winner's curse, which is illustrated with an example from Richard Thaler's (1988; p.191) article Anomalies: The Winner's Curse:

> Next time that you find yourself a little short of cash for lunch, try the following experiment in your class. Take a jar and fill it with coins, noting the total value of the coins. Now auction off the jar to your class (offering to pay the winning bidder in bills to control for penny aversion). Chances are very high that the following results will be obtained: (1) the average bid will be significantly less than the value of the coins (bidders are risk averse); (2) the winning bid will exceed the value of the jar. Therefore, you will have money for lunch, and your students will have learned first-hand about the "winner's curse".

The winner's curse can form in one of two ways: (i) the winning bid is greater than the total value of the coins, resulting in a loss for the buyer; or (ii) the total value of the coins is less than the buyer's estimate and thus has a disappointing result. Both scenarios require the winner to be optimistic about their bid and result in regret for the winner.[10] The unhappiness stems from the optimistic bidder's initial overestimation of the expected value of the coins in the jar compared to the actual amount. Thus when informed about their actual winnings, either form of the winner's curse would have occurred.

Experimental evidence of the winner's curse has been provided by a study conducted by Samuelson and Bazerman (1983). They administered a test, similar to the example provided above, to 12 classes of M.B.A students at Boston College with 4 rounds of auctions in each class for a total of 48 auctions. Each round had a jar with contents valued at $8, not known to the students, and in every round the students would place a sealed bid on that jar. No feedback was provided to the students between rounds. The 48 auctions revealed a mean estimate for the jars

of $5.13 - a downward bias relative to the true $8 value. However, the mean winning bid was $10.01 which produced an average loss of $2.01 to the winner, thus providing evidence of the winner's curse in this laboratory setting.

Samuelson and Bazerman (1985) expanded their research of the winner's curse with 'takeover' or 'buy a firm' experiments. Their experimental design assigned subjects to the role of a corporate raider seeking 100 percent control of another firm. A takeover of the firm would occur through a complete purchase of the firm's shares in the market; however, the exact value of the firm's stock, *v*, was not known. After the establishment of the subject's role, the instructions gave two additional pieces of information: (i) *v* under current ownership is uniformly distributed between $0 and $100 dollars per share; (ii) under new ownership the acquired firm would be valued 50 percent higher than under current ownership through better management.[11] It was left to the corporate raider to decide a price per share to place a bid, *B,* for ownership of the firm; with a sale happening only if the bid was greater than or equal to the value of the stock, or $B \geq v$.

The authors chose the parameter *v* to be uniformly distributed between $0 and $100 per share to make sure all positive bids generated expected losses, thus allowing for an extreme case of the winner's curse to form. Under this setting the authors could test two competing hypotheses about subject bidding behavior: normative and naïve. They argued that not revealing the actual value of the firm, instead giving only an interval, would affect different subjects bidding behavior in different ways. The logic being that if an individual believes that their bid

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[10] This statement does not take into account the individuals risk preference.
[11] Samuelson and Bazerman (1985) experiment, version 3, page 109.

will result in a successful acquisition of the firm, then this event should signal to the bidder that they probably overestimated the value of the firm in comparison to its' actual market value. The normative, or rational, bidder would account for this information, revise their estimate of the firm's market value, and lower their bid accordingly. The naïve bidder would fail to account for this information, leaving their estimate of the firm's market value, and subsequently their bid unchanged.

In the 'buy a firm' example, the true value of the firm to be acquired is not known; only the interval is known. Here the rational bidder corrects for the unknown true value of the firm by basing their expected value of an acquisition on the condition that their bid, *B*, is accepted. If *B* is accepted it would signal that the expected value of the company would be valued at *B*/2; therefore, the rational bidder will form an expectation of the value of an acquisition that is 150 percent of the expected value of the company less the bid. In contrast, a naive bidder, ignoring the information asymmetry, would condition their bid on the expected v only, thus leading the naïve bidder to believe the expected value of the firm to be 150 percent the expected value of the firm, less the bid. To recap: a naïve bidder would condition their bid on an expected v, while the rational bidder would base their expected value of the firm conditioned on their bid being accepted. Mathematically this is shown for a rational and naïve bid, respectively:

$$E[V] = (1.5 * B/2) - B$$

Equation 1: Rational Bid Function

$$E[V] = (1.5 * v) - B$$

Equation 2: Naive Bid Function

Equation (2) states that a naïve corporate raider will place an expected value of an acquisition equal to 150 percent of the expected value under current ownership less the bid. Equation (1) corrects for the asymmetric information and has the rational corporate raider basing their expected value of an acquisition conditioned on the bid, *B*, being accepted. If *B* is accepted then the expected value of the company would be worth *B*/2; therefore, the rational bidder will place an expected value of an acquisition equal to 150 percent of the expected value of the company less the bid. Expanding equation (1) shows that the expected value is only (3/4)*B*; clearly (3/4)*B* is less than *B* and the rational bidder's optimal bidding strategy would be not to bid at all under these parameters.

Their study examined bidding patterns in the lab with parameters designed to form an extreme form of the winner's curse. The experiment was run with 595 MBA students at the University of Boston under hypothetical and monetary reward conditions. In either case the rational optimal bidding strategy would have been a bid of zero to avoid losses; however, in both treatments (real and hypothetical) over 90 percent of the subjects made positive bids with the majority in the range between $50 and $75, thus rejecting rational bidding behavior.[12] Samuelson and Bazerman (p.117) state that "there is substantial evidence that many subjects looked for mutually profitable opportunities based on a naïve model of negotiator behavior, leading most of them to surprising losses."

[12] Samuelson and Bazerman state (p.114) that "the bulk of the experiments did *not* employ monetary payoffs… [however] it was important to ensure that subjects had sufficient incentives to make serious decisions. To test subject incentives, a subsample of students participated in Version 3 of the exercise where monetary payoffs were at stake. Subject behavior under this experimental treatment was found to be statistically indistinguishable from behavior in the experiments without monetary payoffs."

If there is a winner's curse, then is there a loser's curse as well? Interestingly enough there is, and it is the exact opposite of the winner's curse. Holt and Sherman (1994) hypothesized that the winner's curse could be the product of two separate states: (i) a bidder is naïve and ignores information asymmetry; (ii) the subject experiences a pure joy of winning, which increases the possibility that overbidding, is due to a 'utility of winning'. Both states produce overbidding, a subsequent loss, and the winner's curse, so the authors designed a way to test for these distinct causes of the winner's curse.

Following the works of Bazerman (1984) and Samuelson and Bazerman (1985), Holt and Sherman (1994) (HS) designed a modified takeover experiment with varying parameters to allow for three treatments in the game: (i) the winner's curse, producing overbidding; (ii) a situation in which the 'joy of winning' is overshadowed, the loser's curse, producing underbidding; (iii) where the winner's curse equals the loser's curse, a "no curse state". They speculated that if in the "no curse state" there was a residual tendency to overbid, it could provide evidence of a 'joy of winning'. They proposed the model:

> Suppose the value of a firm to its current owner is v, where v is uniformly distributed in the range from X to X+R. When a bid, B, is greater than v and so is accepted, the value to the bidder is Mv, where M > 1. The expected gain to a bidder will be the value of the item less the amount bid for it, all times the probability of having the bid accepted. It is easy to see that (B-X)/R represents the probability of having a bid B accepted, since it is the probability that v is less than B. The optimal bid will take into account the current owner's decision rule in order to use the added information that would be revealed by the fact of winning. If the bidder wins, for instance, the value of the firm to the current owner cannot exceed B. Indeed, its expected value must be $X + (B - X)/2$, which is the average value that would lie between X and B if bid B were accepted. For a risk-neutral bidder, the optimal bid maximizes the integral of $Mv - B$ over the interval from $v = X$ to $v = B$. It is straightforward to express this expected-earnings integral as the product of the acceptance probability and the expected earnings conditional on acceptance, as shown in equation (1a):
>
> $$\left(\frac{B-X}{R}\right)\left[M\left(X+\frac{B-X}{2}\right)-B\right]$$
>
> Equation 1a: Rational Objective Function

$$\left(\frac{B-X}{R}\right)\left[M\left(X+\frac{R}{2}\right)-B\right]$$

Equation 1b: Naïve Objective Function

Suppose that a naïve bidder, in contrast, does not condition the value of a purchase on the level of the accepted bid but, rather, assumes that the value is $M(X+R/2)$, because $X+R/2$ is the expected value of v. This yields the naïve objective in equation (1b). Both objectives are concave in the choice variable B. Differentiation of the alternative objective in (1a) and (1b) with respects to B yields alternative first-order conditions for rational and naïve bidding:

$$M\left(X+\frac{B-X}{2}\right)-B+(B-X)\frac{M}{2}-(B-X)=0$$

Equation 2a: FOC for Rational Objective Function

$$M\left(X+\frac{R}{2}\right)-B+***-(B-X)=0$$

Equation 2b: FOC for Naive Objective Function

where the "* * *" indicates a missing term to be discussed below. The intuition behind the winner's and loser's curse can be found from a comparison of these two conditions. By the concavity of the objective functions in B, any factor that makes the left side of the first-order condition in (2) larger will result in higher bids, and visa versa.

First, note that it is never optimal to bid above the range of seller values, because a bid of $X+R$ will always be accepted. Since $B-X \le R$, the first term on the left side of (2) is lower for rational bidding. This is the winner's curse effect; the far left-hand terms in (2) are the buyer expected values, conditional on a bid's acceptance, and the lower conditional valuation for the rational bidder will lead to lower bids.

Next consider the term $(B-X)M/2$, which is present in (2a), but is missing from (2b), where the $***$ appears. This term represents the rational observation that B is the upper limit of seller values that will result in a purchase, so increasing the bid by 1 at the margin will raise the expected seller value of a purchased unit by ½, which is multiplied by M to get the buyer value. In the rational-bidding condition in (2a) this product of ½ and M is multiplied by $(B-X)$, which is proportional to the probability of making a purchase. The result is a positive term that tends to raise the rational bid by (2a), as compared with the naïve bid. The failure of a naïve bidder to raise B in this manner generates the loser's curse effect.

The rational and naïve bids, denoted by BR and BN, respectively, are obtained directly from (2):

$$B_R=\left(\frac{1}{2-M}\right)X$$

Equation 3a: Rational Bid Function

$$B_N=\left(\frac{M+1}{2}\right)X+\left(\frac{M}{4}\right)R.$$

Equation 3b: Naive Bid Function

The bidding functions in (3) are linear and provide a basis for several null hypotheses. In particular, if X and R are varied across several treatments, the coefficient for R in a linear bid regression should be zero for a rational bidder and should be positive for a naïve bidder.

The authors then used the bid function in equation (3) in Holt and Sherman (1994) to obtain parameters that allowed for the 3 treatments, shown in Table 4, to form these predictions:

a. $B_R \prec B_N$; the winner's curse

b. $B_R = B_N$; no curse

c. $B_R \succ B_N$; the loser's curse

It is worth noting a few things about these parameters. The parameters X, R, and M were first chosen to keep expected payout under rational bidding constant and were then later doubled. The second step was to diminish erratic behavior that may occur in a laboratory setting from too low a payout, e.g. the subjects would not take the task seriously because there would be no reward for doing so. For example, with parameters X at 1.5, R at 4.5, and M at 1.5, the winner's curse treatment, would yield a rational bid of \$3. Plugging the \$3 bid into equation (1a) implies an expected gain of \$0.125; this payout was later doubled to \$0.25. Next, the expected gain from a naïve bid was \$0.04 lower in the winner's and loser's curses compared to the no curse treatment. The authors state that the symmetry in deviation across both curses is desirable in order to diminish any bias associated with deviations in behavior because of cost of departures that would favor one curse over the other. Last, the expected gain from naïve bidding was also doubled, but calculated in a different manner. In order to compare the competing hypotheses, it was necessary to find the rational interpretation of using a naïve bid; therefore expected gains

from naïve bids are obtained from plugging the naive bids into equation (1a) as well, the expected profit formula for the rational model. This step shows the expected gain of a naïve bid from a rational perspective.

The modified takeover experiment was administered to 50 undergraduate students at the University of Virginia. Each subject was assigned the role of a bidder, with initial wealth set to $6, $8, or $12, and was assigned one of two treatment conditions; either a no-curse/winner's curse/loser's curse treatment or no-curse/loser's curse/winner's curse treatment.[13] They were told to place a bid for each curse in a treatment and repeat the experiment 10 times for a total of 30 bids.

Their findings indicate that the students fall victim to the loser's curse as predicted by the naïve-bidding rule. Also, the data for the no curse treatment were close to predicted rational and naïve bids, indicating no strong evidence for a 'utility of winning' that would bias bids upwards.

[13] Holt and Sherman used the no-curse treatment first in both tasks. Ordering the curses in this manner permits testing of order effects for the winner's and loser's curses, but not in the 'no curse' treatment. Harrison, Johnson, McInnes, and Rutström (2004) point out that not varying the order of the treatments can confound results, and possibly lead to an incorrect interpretation of findings if not correctly accounted for.

CHAPTER THREE: METHODOLOGY

Testing for Risk Aversion

Following the design of Holt and Laury (2002) (HL) I designed a menu of paired lottery choices to test whether entrepreneurs are inherently different in their degree of risk aversion than a control group comprised of salaried employees.

The design mimics HL and uses a 10x real-payoff version of their "baseline" treatment. This allows for consistency with the current literature and preserves the CRRA intervals used for demarcation of risk classes. However, I add on to the design in the following ways: (i) a one-shot game is played, instead of subjects facing a sequence of MPL tasks; (ii) subjects were presented with either the 10x real-payoff in a table using the same order as the HL study, 'top to bottom', or in an alternate order, 'bottom to top'; and (iii) I used entrepreneurs and non-entrepreneurial professionals instead of students.

The one-shot game allowed for a 'snap-shot' of a subject's risk aversion. This method did not allow for subject learning as the HL study had done over the four tasks with different payouts to find if the scaling of a constant k in lottery payouts affected risk aversion; this was never my intention. The next modification was based on findings by Harrison, Johnson, McInnes, and Rutström (2004), who argue that the HL study was confounded by a simple order effect and that their main conclusions might therefore be accounted for by simply varying the order of the instrument. Following this finding I created two MPL formats that were 10x treatments of HL's 'baseline' treatment, only differing in the order of presentation to the

subject.[14] Version X, 'top to bottom', displayed the associated probabilities concurrent with a 10x payout of HL, where Decision Row 1 indicated Option A as having a 10 percent chance of receiving $20 and a 90 percent chance of receiving $16.00. Table 5 in Appendix B shows the expected value of this lottery, EV^A, as $16.40; as in the HL study, the EV columns were not given to subjects. Similarly, lottery B in the first row has chances of payoffs of $38.50 and $1.00, for an expected value of $4.75. Thus results in a difference between the expected values, in this case $11.65 (= $16.40 - $4.75). As one proceeds down the payoff matrix, the expected value of both lotteries increases. The expected value of lottery B becomes greater than the expected value of lottery A after the fourth decision row. Version Y inverts the row order, leaving the same expected values intact, so that Decision Row 1 in X is now Decision Row 10 in Y. Having both versions of the risk aversion instrument will allow for testing of order effects.

Testing for Joy of Winning and Optimism

Following the design of Holt and Sherman (1994) (HS) I implemented a modified takeover experiment with varying parameters that allow for the three curse treatments in a bidding game: the winner's curse, loser's curse, and a "no curse state". These parameters are given in Table 6. Using these three curse treatments I tested for a 'joy of winning' and for judgmental errors possibly stemming from over-optimism in our entrepreneurial treatment group. A 'joy of winning' would be revealed if in the "no curse state" there is a residual tendency for entrepreneurs to overbid. Judgmental errors possibly stemming from over-optimism could be

[14] Please refer to Appendix C for the 2 different versions of the paired menu choices given to subjects, version X

ascertained either in the loser's or winner's curse portion of the experiment.[15] The errors arise when bids are closer to the naïve prediction. This would mean that in the winner's curse naïve bids would be greater than rational bids, and in the loser's curse naïve bids were less than rations bids. To recap, I use the bidding instrument, given in Appendix C, to test for 'joy of winning' and judgmental errors possibly stemming from over-optimism that could be present in entrepreneurs.

My design is modified from HS in the following ways: (i) it was a one-shot game; (ii) the initial endowment of wealth was drawn from a card deck ranging between $5 and $15 with quarter increments (5.00, 5.25,..., 14.75, 15.00); (iii) the order of the curses was randomized in the bidding task, allowing for four variations of the curse treatments; (iv) the parameters X and R were different; and (v) entrepreneurs were used in a field setting.

The subjects were directed to read the bidding decision task as one of the attendants read it to them aloud. We informed the subjects that they were being given an opportunity to bid for the chance of getting an additional sum, in addition to the $10 participation fee. In this task the subject placed a bid, up to a specified amount, that their bid would be greater than or equal to a random monetary value drawn from a card deck within a known interval. If their bid was greater than or equal to the value drawn from the deck they would win an amount of money.[16] In the event of a win, the payout is defined as 1.5 multiplied by the value of the card drawn, less their

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(top to bottom) and version Y (bottom to top).

[15] Recall that the winner's curse can result from either a 'joy of winning' or the bidder ignores information asymmetry and bids naively.

[16] Conceptually think of the card game "War". In this card game two persons each holding half a deck of cards (from the same deck), face down, draw the top card from their respected half decks, and the person that shows the highest valued card wins, ace being the highest. In the event of a tie a 'war' is declared. For our purposes, a tie goes

initial bid. Since it was possible to make a loss in this task the subject was given an initial endowment of wealth. This was accomplished by pulling a card from a deck ranging between $5 and $15 demarcated in quarter increments. In the event that negative profits were earned from this task the payment would be subtracted from this initial endowment.

Next the procedures for the bidding tasks were explained. Here they had a chance of getting an additional sum of money by placing three separate bids on three separate intervals of cards. The bids could be any number in even quarters, as long as it was not so large that it would lead to a loss for sure. Maximum bids were provided for each interval. These intervals represented cash amounts between $3.50 and $10.50, $4 and $15, and $3 and $6; again all intervals were demarcated in quarter increments and had a corresponding card deck. After the bids were placed for each interval one interval was later selected at random to play out. The subject would win the additional sum of money if their bid was greater than or equal to a random pull of the card associated with that range. The bidding task was given to each subject only once. Each interval used to bid corresponded to one of the curse treatments: winner's curse, loser's curse, and the 'no curse' treatment.

The interval $3.50 to $10.50 was the "no curse treatment", $4 to $15 was the winner's curse, and $3 to $6 the loser's curse. This is where our study varied considerably from HS in two distinct areas. First recall that HS used two variations of the curse treatment presentations to the subjects, no-curse/winner's curse/loser's curse and a no-curse/loser's curse/winner's curse. It was discussed previously in Chapter Two that allowing the winner's curse and the loser's curse

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to the subject. Our study doesn't split a deck of cards, however allows the subjects to place a bid, bounded between ranges that will not let them lose for sure, and in the event that their bid is higher than a random value, they win.

to vary at random from subject to subject controls for order effects between these two separate bidding tasks. However, HS used the no-curse bidding task first in both cases, thus possibly confounding results. Following Harrison, Johnson, McInnes, and Rutström (2004) I alternated the order of the curse treatments allowing for four variations of the bidding task; a no-curse/winner's curse/loser's curse, loser's curse/winner's curse/no-curse, no-curse/loser's curse/winner's curse, and winner's curse/loser's curse/no-curse treatments. By randomly varying the curse treatments' order I am able to test for possible order effects that could otherwise cloud the results.

Next recall the parameters X and R that were originally used in the HS study (p.646) were chosen "…so that the earnings reduction for naïve bidding was the same in both of these treatments [winner's curse and loser's curse]. This comparable effect of departures from rationality on earnings is desirable for a study of bidding biases, since the extent of the bias may be affected by the cost of the non-optimal behavior. Choosing parameters to balance earnings in this manner requires that the bidding biases differ between the winner's curse and loser's curse treatments." Simply put, using Table 4 we see that the difference for a naïve bidder between the winner's curse and the no curse treatment is $0.04 and the difference for a naïve bidder between the no curse treatment and loser's curse is again $0.04. HS argue that these symmetric cost departures are optimal for controlling bidding biases that could result in bid differences between these treatments. This point is well taken; however, if we focus our attention on the predicted rational and naïve bids for the winner's and loser's curses we see that the cost departure in the winner's curse between the expected rational and naïve bid is a difference of $0.56, while in the loser's curse this difference is only $0.19. It may be more prudent to align the symmetries of the

cost departures between the expected rational and naïve bids for the winner's and loser's curses compared with the no curse treatment, letting expected gain fall where it may. Looking at Table 6 for our model we see that the cost departure for the expected rational bid compared to the expected naïve bid is $1.13 for the winner's curse and $1.12 for the loser's curse, thus allowing us to focus on bidding behavior in a more robust manner.

Procedures

The field data was collected at the bi-annual national Small Business Innovation Research (SBIR) conference hosted in Atlanta, Georgia in April, 2004. The SBIR program is a federally funded competitive program that provides grants to small business entrepreneurs who want to work with governmental agencies to provide needed technologies. Attached to the SBIR convention is the Small Business Tech Expo (SBTE) in which we secured a booth in the exhibit area in order to run the experiments. Appendix A contains the SBIR public announcement designed to attract entrepreneurs as well as a more thorough description of the SBIR program.

Our booth was set along side the Atlanta SBTE exhibitors section of the SBIR conference with a banner reading "Research Study: Cash for Participation". The booth was run for a single day by two University of Central Florida Professors, Julie Elston and Elisabet Rutström, and me. In order to present a 'professional' image, everyone wore black pants with matching black and gold polo shirts that sported embroidery of the university's logo. University of Central Florida business cards were also available at the table.

As individuals were drawn in by our banner or word of mouth, one of the three booth attendants would approach the potential participants and explain that we were conducting a study

of economic decision making, taking around 15 minutes to complete, and suggesting that if they participated they would receive $10 for their participation with the possibility of earning even more. A general written description of the research study was also given to the potential participant at that time (see Appendix C). If the participant expressed interest in the study they were given an Informed Consent Form that detailed their rights as a subject. They needed to sign this form in order to proceed with the tasks. Once the consent form was signed, the participant was issued a packet of instruments for the entire experiment, with each packet corresponding to a unique identification number. The packet was given inside a folder and the participants were instructed not to proceed between tasks without notifying one of the three attendants. These two steps provided some measure of privacy to the participants when they were recording responses and helped ensure that they proceeded in the task order that was given to them. A copy of the instructions can be found in Appendix C.

The experiment was broken down into three parts. Part I was a socio-demographic survey of individuals and their firm, should they own one. In Parts II and III the subjects were presented with two decisions tasks: either a paired lottery choice MPL or a bidding instrument. The order, in which the subjects received these tasks, and how they were presented, were randomized to allow for testing of order effects. After completing parts I through III in their entirety the subject would see how the two decision tasks played out, receive the participation fee and any other accumulated earnings, sign a receipt acknowledging acceptance of their winnings, and finally provide an e-mail address should they want a summary of our findings.

CHAPTER FOUR: FINDINGS

Recall that the hypotheses tested in this paper are: (i) entrepreneurs are less risk averse than non-entrepreneurs; (ii) entrepreneurs will experience a 'joy of winning' compared to non-entrepreneurs; and (iii) entrepreneurs will suffer from judgmental bias, possibly in the form of over-optimism, more than non-entrepreneurs.

Socio-Demographic

Data was collected from 62 individuals that had chosen to participate in the study, with 33 (53%) classified as individuals with some form of entrepreneurial experience and 29 (47%) as individuals that were non-entrepreneurs. The classifications were results of the information that was provided on the form "Questions About You and Your Firm" in Part I of the study. For example, the 33 participants that were categorized with some form of entrepreneurial experience had indicated that they were self-employed and provided information on an entrepreneurial firm or they indicated employment either full or part-time in another firm, along with information on an entrepreneurial firm as well.[17] Non-entrepreneurs had indicated that they were either full or part-time employment in another firm and did not provided information relating to an entrepreneurial firm. For this study I use entrepreneurs as the treatment group and the non-entrepreneurs as the control group.

[17] At the beginning of the study it became apparent that many individuals held positions in both self-employment and employment in another firm. Our questionnaire was not set up to handle these individuals. For purposes of our study, these individuals are all considered entrepreneurs. In many cases the participant had written their line of

The demographic characteristics of these two groups differ. Entrepreneurs are more likely to be Asian or of Asian decent (16% vs. 4%), more likely to obtain a post-graduate degree at college (59% vs. 52%), less likely to have a higher household income (47% vs. 61%)[18], despite being around the same age (42 years vs. 43 years).

Risk Aversion

Table 2 displays the CRRA intervals that are used to classify our subjects' elicited lottery responses into relative risk intervals. The subject's first switch from the 'safe' lottery to the 'riskier' lottery is used to define the lower bound of their CRRA interval. The upper bound of the subject's CRRA interval is calculated in the same manner; however, it uses the first instance the subject chose the 'riskier' lottery.[19] The subject's mid-point of their CRRA is symmetrically located between the upper and lower bounds. For example, an individual that chose 5 'safe' choices followed by 5 'riskier' choices would imply a CRRA somewhere between 0.15 and 0.41, with a mid-point of 0.28 (one-half above the lower bound and one-half below the upper bound). This method for assessing risk attitudes has the advantage that the only assumption being made is that of constant relative risk aversion.[20] However, the disadvantage is that some of the subject's responses are lost due to censoring. Censoring occurs when the individual's CRRA

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employment on the questionnaire making identification easier. However, in all instances a coherent story needed to be constructed in order for some confidence in the classification.

[18] Household income in excess of $100,000 for year 2003 was used to differentiate for 'high income' households.
[19] Anderson, Harrison, Lau, and Rutström (2004) discuss the use of iterative MPL (iMPL) formats that narrow the interval of CRRA, thus allow for a more precise measurement of CRRA.
[20] Holt and Laury (2002) state that CRRA provides an adequate measure of subject behavior for low payout treatments. Our study uses a 10x scaling of their "baseline" treatment, which is below their higher payout ranges.

interval includes at least one or both bounds are expressed as $\pm\infty$. To illustrate this example, imagine an individual that is extremely risk averse. They would choose 9 'safe' choices in the lottery, only switching to the 'riskier' option when it is a sure thing. Their implied lower bound of CRRA is 1.37 and the upper bound is $+\infty$, clearly a mid-point cannot be specified and therefore these individuals were excluded.[21]

Figure 1 in Appendix B shows the elicited interval mid-points for the entrepreneur and non-entrepreneur groups. There is one main conclusion that can be drawn by looking at this figure. A comparison between the entrepreneurs and non-entrepreneurs clearly shows that the entrepreneur group has a mode that is more risk loving than the mode of the non-entrepreneur group. This would imply that entrepreneurs are less risk averse than their non-entrepreneurial counterparts. We also observe heterogeneity in the sample of elicited measures of risk aversion for the entrepreneur group. This may be attributed to how I originally defined the entrepreneur. Recall that the definition of entrepreneurs aggregated individuals that were both self-employed entrepreneurs and still held a job along with individuals that were solely self-employed. This definition could account for the wide range of risk attitudes seen in the entrepreneur group. Where an argument could be made that an individual that still held a job while also self-employed would be viewed as an individual that is not willing to accept the full risk of self-employment; and thus account for the more risk averse observations that we see in Figure 1. Whether or not this is the case Figure 1 alerts us that there is heterogeneity in the sample of entrepreneurs that will need to be accounted for in later statistical tests.

[21] This is present in 8 of our subjects, thus the n = 54 (62-8=54) in Figure 1.

Figure 2 is a graphical representation of Table 7. Both use an interval regression model to estimate risk attitudes of entrepreneurs correcting for heteroskedasticity. The advantage of the interval regression approach is that censoring only occurs if an individual's CRRA interval includes both bounds expressed as $\pm\infty$; this effectively removed the 8 observations that were previously censored.[22] However, a disadvantage of the interval regression approach is that if subject's demographic information is missing the complete observation is dropped.[23]

Table 7, the interval regression output, uses the non-entrepreneur group as the control group. I test for average effects, after controlling for heteroskedasticity, for the following dummy variables: entrepreneurs, the order in which the task was presented (risk instrument or bidding instrument first), the order of the bidding instrument (version X or Y), age, gender, race, higher education, marital status, and higher income. Looking first at the constant we see a value of 0.971, which is interpreted as the CRRA for the control group of non-entrepreneurs, before controlling for the other explanatory variables in the model. From Table 2 we find that a CRRA value of 0.971 would imply that on average the control group makes 8 'safe' choices before switching to the 'riskier' lottery. Next we see that the coefficient for entrepreneurs is -0.336, implying that the entrepreneur group has an average CRRA equal to 0.635 (0.971 - 0.336 = 0.635). A CRRA value of 0.635 implies, on average, that the group of entrepreneurs will make 6 'safe' choices before switching to the 'riskier' lottery. This finding confirms the conclusion that the entrepreneur group is less risk averse than the non-entrepreneur group, and we can reject the

[22] Table 7 uses an n = 53. This is due to 'goofy' observations, such as subjects that had multiple switch points or subjects that did not provide all their demographic information (3 subjects).
[23] This is the case for figure 2 with n = 59, the n is reflective of the 3 subjects that failed to provide ALL demographic information. Therefore they are censored.

hypothesis that entrepreneurs exhibit the same amount of CRRA compared to the control group of non-entrepreneurs at the 1% significance level (p-value 0.002).

Joy of Winning

Holt and Sherman (1994) speculated that the winner's curse could be the product of two separate forces: (i) a bidder is naïve and ignores information asymmetry; and (ii) the subject experiences a pure joy of winning, which increases the possibility that overbidding, is due to a 'joy of winning'. If there is a 'joy of winning' it would be shown by a residual tendency to overbid in the 'no curse' treatment.

Figure 3 displays observed bids for the three treatments across all subjects. The vertical lines in each treatment show the risk neutral bids for rational and naïve bidders (calculated in Table 6). Looking at the bid pattern for the 'no curse' treatment we see tremendous variance in the bidding behavior across all subjects. However, this figure plots bids under the assumption of risk neutrality. We know from previous findings that there is a statistically significant difference in CRRA between our two groups. Therefore, controlling for these differences must be dealt with first before looking at any 'joy of winning' behavior. The individual subjects' mid-point from their elicited CRRA, implied from the risk aversion task, is used to control for these differences.

Figure 4 shows the effect of risk aversion on bidding behavior. Taking the 'no curse' treatment for example, if a subject had a CRRA of 1.17 it would imply that their predicted bid would be $11.93, almost $5.00 above the risk neutral bid prediction of $7.00. Likewise, a subject that had a CRRA of -0.32 would have a predicted bid of $6.51, almost $0.50 below the

risk neutral bid prediction. This figure clearly shows why risk attitudes should be accounted for when testing for any 'joy of winning' behavior.

Each subject provided 3 bids (one for each curse treatment) and an implied risk aversion measure (from the lottery choice experiment). To test for a 'joy of winning' I compare the percentage differences between the actual bid provided by each subject for the 'no curse' treatment against their predicted bid given their individual elicited CRRA mid-point value. Evidence for a 'joy of winning' would be shown if this percentage difference is positive and statistically significant.

Table 8 displays this percentage difference for various model specifications. Panel A shows the average percentage difference of bids for the pooled sample of the entrepreneur and non-entrepreneur groups. The actual bid exceeded the predicted bid by a little more than 23 percent in the 'no curse' treatment. To test for a 'joy of winning' we need to show that the exceeded difference of 23 percent is statistically significant and greater than the null hypothesis that it is equal to the predicted rational bid. To do so, I set my null hypothesis that the ratio of actual bids to predicted bids is equal to 1, while the alternate hypothesis contends that the ratio is something greater than 1. Therefore the use of a right-tailed t-test is employed to test these competing hypotheses. The t-test statistic is found as 3.6610 (p-value 0.0003), thus accepting the alternate hypothesis that the ratio is something greater than 1. This finding implies that the pooled groups had experienced a residual tendency to overbid in the 'no curse' treatment, thus supporting an initial claim of a 'joy of winning'. Panels B and C also test for the occurrence of a 'joy of winning' in the same manner; however, each panel isolates our subjects to their respected groups. Panel B shows the average percentage difference of bids for the non-

entrepreneur group. Their actual bid exceeded their predicted bid by about 15 percent in the 'no curse' treatment. This finding is also positive and statistically significant around the 5 percent level (p-value 0.0534). Panel C shows the average percentage difference of bids for the entrepreneur group. Their actual bid exceeded their predicted bid by about 30 percent in the 'no curse' treatment. This finding is positive and statistically significant at the 1 percent level (p-value 0.0007).

Further, Table 9 tests whether the overbidding by non-entrepreneurs and entrepreneurs differed by a statistically significant amount. If this can be shown it would provide evidence that non-entrepreneurs exhibit a lower 'joy of winning' than entrepreneurs. Otherwise stated, the non-entrepreneur group did overbid, but by not as much as the entrepreneur group. This is tested by obtaining the difference between the means of the two groups and testing if that difference is equal to zero. I find that the difference between the two means is not statistically significant (p-value 0.2508), thus lending no support the claim that the bidding behavior is different between the two groups.

To restate, I find initial evidence of a 'joy of winning' when both groups are pooled together. This result still holds even after controlling for the event that the subject is either an entrepreneur or non-entrepreneur. Thus there is evidence to support the claim that both entrepreneurs and non-entrepreneurs exhibit a 'joy of winning', and that the size of the effect is larger for entrepreneurs.

Optimism

Judgmental error, possibly stemming from over-optimism, can be tested for in the winner's and loser's curse treatments. These errors would occur if the subjects' bidding behavior is closer to the predicted naïve level than the predicted rational level. I use the subject's actual bid and divide it by the predicted rational bid conditioned on the individual's elicited CRRA value, and whether or not the individual experienced a 'joy of winning' to develop a ratio in both the loser's and winner's curse treatments. With these ratios we can test whether bidding behavior is indeed rational. In other words, I use the elicited CRRA for the subject to calculate their predicted rational bid, and then scale this prediction up by their elicited 'joy of winning' from their 'no curse' responses. I then take the ratio of their observed bid in the winner's and loser's curse treatments to their predicted bid.

Table 10 shows deviations from rational bid predictions controlling for CRRA and any 'joy of winning' for the individuals in the winner's curse treatment. Panel A shows that actual bids for all subjects, both entrepreneurs and non-entrepreneurs, exceeded the predicted rational bid by little more than 5 percent. To support evidence of judgmental errors for the combined groups a t-test must show that actual bids being 5 percent higher is significantly different from the predicted rational bid. This finding is not statistically significant at any conventional confidence level (p-value 0.4584). Panel B focuses on the subset of non-entrepreneurs. We see that they exceeded the predicted rational bid by almost 10 percent; however, this result is not statistically significant either (p-value 0.4311). Panel C performs this test for the entrepreneur group. The entrepreneurs exceeded their predicted rational bid by about 2 percent; this also is not statistically significant (p-value 0.8407).

Further, Table 11 tests whether the ratio of actual bids to predicted rational bids, accounting for individual CRRA and any 'joy of winning', made by the non-entrepreneurs and entrepreneurs differed between their groups by a statistically significant amount in the winner's curse treatment. If this difference were found to be statistically significant it could provide evidence that one of the groups experienced greater judgmental errors than the other. However, I find that the difference between the two means is not statistically significant (p-value 0.2508), thus lending no support the claim that there is a difference in judgmental errors between the two groups.

Table 12 shows these deviations from the predicted rational bid for the loser's curse treatment. Panel A shows that actual bids for both groups combined were higher than the predicted rational bid by almost 25 percent. Here we see initial evidence of judgmental errors by accepting the alternative hypothesis that the mean for the pooled groups is statistically different from the predicted rational bids at a confidence level of 6.5 percent. This provides us with an initial measure of judgmental errors before accounting for the occurrence that the individual is either a non-entrepreneur or entrepreneur. Panel B focuses on the subset of non-entrepreneurs. We see that they exceeded the predicted rational bid by little more than 22 percent; however, this result is not statistically different from the predicted rational bid (p-value 0.2836). Panel C performs this test for the entrepreneur group. The entrepreneurs exceeded their predicted rational bid by almost 27 percent; this also is not statistically different from the predicted rational bid at a conventional level of confidence (p-value 0.1317). Lastly, Table 13 tests whether the ratio of actual bids to predicted rational bids made by both groups differed by a statistically

significant amount in the loser's curse treatment. Again, I find that the difference between the two means is not statistically significant (p-value 0.2508), thus lending no further support to the claim that there is a difference in judgmental errors between the two groups.

In summary, no evidence of judgmental errors was found in the winner's curse treatment, however, evidence of judgmental errors was initially shown in the loser's curse treatment when all subjects were pooled together. This result disappeared after individually testing both the entrepreneur and non-entrepreneur groups separately. There is little evidence to claim that entrepreneurs suffer from judgmental errors more than non-entrepreneurs. [24]

[24] All tests were also performed using the ratio of actual subject bids to the predicted naïve bid, again controlling for individual CRRA and any 'joy of winning' effects. Findings from these tests do not support any conclusions contrary to what has been presented using the predicted rational bids.

CHAPTER FIVE: CONCLUSION

This thesis was motivated by evidence that there may be restrictions imposed on the supply of entrepreneurs. This evidence came from an international study that found, for industrialized countries, many individuals who are currently employed in another firm state that they actually prefer to be self-employed. However, examining self employment data for the U.S., Great Britain, and Germany we see that there is a large disparity between the percentages of individuals who are actually self-employed and those that had indicated they wished to be self-employed. These differences raised the question: Why don't more of these individuals actually become self-employed?

Looking for an answer I turned to entrepreneurial literatures from the areas of psychology, management, and economics. Earlier attempts were made by the social sciences to characterize and define what makes an entrepreneur distinct by interviewing those individuals that had self-selected into becoming an entrepreneur, and then looking for causal relationships in their socio-demographic profile that could account for their chosen role. These socio-demographic elicitations resulted in many assumptions about entrepreneurs. These assumptions seemed to indicate a risk loving attitude and over-optimism in entrepreneurs as compared to non-entrepreneurs. However, until assumptions are explicitly tested, they are just assumptions. I wanted to test if there was an underlying difference in risk preferences and optimism between entrepreneurs and non-entrepreneurs that could possibly explain why certain individuals select into self-employment while others do not. This was implemented by using experimental methods to provide testable hypotheses in order to systematically evaluate the existing theories on entrepreneurial behavior.

The use of lottery choice and bidding experiments, performed on entrepreneurs and non-entrepreneurs in the field, allowed me to directly elicit measures of risk attitudes, a 'joy of winning', and judgmental bias possibly stemming from over-optimism for the entrepreneur. It was shown that entrepreneurs are generally more risk loving than a non-entrepreneur control group. Further, there is evidence to support the claim that entrepreneurs and non-entrepreneurs both exhibit a 'joy of winning', and that the size of the effect is slightly larger for entrepreneurs. However, there is little evidence to conclude that entrepreneurs suffer from judgmental errors more than non-entrepreneurs.

These findings show that one restriction in the supply of entrepreneurs may be inherent in how much risk they are willing to subject themselves to. The Oxford Dictionary states it best, defining "risk" as "*The chance that is accepted in economic enterprise and considered the source of (an entrepreneur's) profit*." Here we see that those who selected into the role of an entrepreneur were indeed largely those individuals with a more risk loving attitude.

Extensions of this research include testing entrepreneurs in other countries to find if these results hold across cultures. Another extension would be to test for differences in risk attitudes between different subsets of entrepreneurs; recall that this study focused on high-technology entrepreneurs. It would be wise to account for a broader sample to see if the implication for risk aversion is the same in other areas of entrepreneurial activity.

APPENDIX: A

SBIR – Public Announcement

The National SBIR/STTR Conference and Small Business Tech Expo (SBTE)
Technology Connections: Funding, Strategies, and Partnerships
April 26-29, 2004 Hilton Atlanta Hotel Atlanta, GA

This year, the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) program will provide $2 billion to small businesses through federal programs to help entrepreneurs take their ideas from conception to reality. This conference gives you the tools you need to obtain part of the $2 billion available to small business innovators.

CONFERENCE TOPICS INCLUDE:

- SBIR/STTR 101: An Overview of the SBIR and STTR Programs
- Federal Agency Overviews
- The Do's and Dont's of Proposal Writing
- Writing a Cost Proposal
- Identifying Your Market Opportunities
- Increasing Your Chances with SBIR/STTR
- Partners (STTR): University & Federal Labs
- Partners: Utilizing Incubators
- Leveraging & Protecting Your Intellectual Property
- Managing SBIR/STTR Projects – The Basics
- What the Agencies Look For & How They Do It
- Phase III Government Contracts – What's Relevant Now?
- Exploring Alternative Financing Programs
- Accessing the Other 97% Federal R&D Funding
- Corporate Alliances – Overview

NETWORKING OPPORTUNITIES

This conference provides each participant with multiple opportunities to meet and network with SBIR and STTR Program Managers, and fellow attendees, including SBIR/STTR award winners, speakers, and experts from businesses and the government willing to work with you to move your business ahead.

Extra Bonus: Conference participation guarantees entry into the co-located Small Business Tech Expo (SBTE) sponsored in part by NASA. The expo will showcase new technologies, support services available to small business and technology development, and commercialization opportunities. For more details and exhibiting opportunities visit: www.barayevents.com/sbte

FEDERAL AGENCIES PARTICIPATING IN THE SBIR/STTR PROGRAMS

Department of Agriculture, Department of Commerce, Department of Defense, Department of Education, Department of Energy, Department of Health and Human Services, Department of Homeland Security, Department of Transportation, Environmental Protection Agency, National Aeronautics and Space Administration, National Science Foundation.

If you think that your small business could benefit from more than $2 billion in government grants and contracts, this is the opportunity you can't afford to miss.

SBIR - Overview

The SBIR program began in 1983 as a way to channel government R&D funds to, as legislation defines it; American owned and independently operated for profit small business with no more than 500 employees, a principal researcher employed by the business and a product that appears to have commercial potential. The funds used in the program are from ten government agencies with additional R&D obligations over $100 million and they are required to set aside a certain percentage of their funds, 2.5 percent since 1997, to small business R&D. The ten agencies that contribute money to the program include the Departments of: Commerce, Health and Human Services, Defense, Education, Agriculture, Energy, and Transportation, the Environmental Protection Agency, the National Aeronautics and Space Administration, and the National Science Foundation. Every year each of these government agencies publishes a list of R&D topics that will merit funding and review individual proposals from small business based on those specified topics.

Selection for the SBIR grant is based on small business qualification, degree of innovation, technical merit, and future potential in the market. When a proposal is accepted by an agency the small business will potentially go through 3 phases of the SBIR program: Phase I is a limited effort startup phase that determines feasibility and scientific and technical merit of an idea. This phase has been restricted by legislation to ideas “that appear to have commercial potential.” The amount that can be awarded in Phase I is $100,000 and is usually for six months. Phase II awards can be applied for by winners of Phase I only. Small businesses that win this award go into detailed R&D, usually resulting with a prototype product or process. Emphasis on commercial potential is also increased. The amount that can be awarded in Phase II is $750,000

and usually lasts about two years. Phase III involves private sector investment and support for introducing the new product or process into the market place. Small businesses conduct Phase III with non-SBIR funds to pursue commercial applications of the R&D funded in Phases I and II for the private or public market, if intended for use by the federal government.

A small business is allowed to receive one Phase I and/or II per year per project; therefore, it is possible for a single company to be awarded multiple awards in one year for different projects and likewise over time as well. Please see www.sbirworld.com for a more detailed approach of the SBIR program.

APPENDIX: B

Table 1

The Ten Paired Lottery-Choice Decisions with "Baseline" Payoffs

Option A				Option B				EV^A	EV^B	Expected Payoff Difference
0.1	$2.00	0.9	$1.60	0.1	$3.85	0.9	$0.10	$1.64	$0.48	$1.17
0.2	$2.00	0.8	$1.60	0.2	$3.85	0.8	$0.10	$1.68	$0.85	$0.83
0.3	$2.00	0.7	$1.60	0.3	$3.85	0.7	$0.10	$1.72	$1.23	$0.50
0.4	$2.00	0.6	$1.60	0.4	$3.85	0.6	$0.10	$1.76	$1.60	$0.16
0.5	$2.00	0.5	$1.60	0.5	$3.85	0.5	$0.10	$1.80	$1.98	-$0.18
0.6	$2.00	0.4	$1.60	0.6	$3.85	0.4	$0.10	$1.84	$2.35	-$0.51
0.7	$2.00	0.3	$1.60	0.7	$3.85	0.3	$0.10	$1.88	$2.73	-$0.85
0.8	$2.00	0.2	$1.60	0.8	$3.85	0.2	$0.10	$1.92	$3.10	-$1.18
0.9	$2.00	0.1	$1.60	0.9	$3.85	0.1	$0.10	$1.96	$3.48	-$1.52
1	$2.00	0	$1.60	1	$3.85	0	$0.10	$2.00	$3.85	-$1.85

Table 2

Risk Aversion Classifications Based on Lottery Choices

Number of Safe Choices	Range of Relative Risk Aversion for $U(x) = x^{1-r}/(1-r)$	Risk Preference Classification
0-1	r < -0.95	highly risk loving
2	-0.95 < r < -0.49	very risk loving
3	-0.49 < r < -0.15	risk loving
4	-0.15 < r < 0.15	risk neutral
5	0.15 < r < 0.41	slightly risk averse
6	0.41< r < 0.68	risk averse
7	0.68 < r < 0.97	very risk averse
8	0.97 < r < 1.37	highly risk averse
9-10	1.37 < r	stay in bed

Source: Holt and Laury. Risk Aversion and Incentive Effects, pg. 10

Table 3

Implied Lower Bound Calculation for 'Risk Neutral' Subject

Probability	Payoffs of Safe Option A		Payoffs of Riskier Option B	
0.1	$2.00	$1.60	$3.85	$0.10
0.2	$2.00	$1.60	$3.85	$0.10
0.3	$2.00	$1.60	$3.85	$0.10
0.4	$2.00	$1.60	$3.85	$0.10
0.5	$2.00	$1.60	$3.85	$0.10
0.6	$2.00	$1.60	$3.85	$0.10
0.7	$2.00	$1.60	$3.85	$0.10
0.8	$2.00	$1.60	$3.85	$0.10
0.9	$2.00	$1.60	$3.85	$0.10
1	$2.00	$1.60	$3.85	$0.10

r	EUsafe	EUrisk	EUdiff
0.0000	1.64	0.48	1.17
0.0000	1.68	0.85	0.83
0.0000	1.72	1.23	0.50
0.0000	1.76	1.60	**0.16**
0.0000	1.80	1.98	-0.18
0.0000	1.84	2.35	-0.51
0.0000	1.88	2.73	-0.85
0.0000	1.92	3.10	-1.18
0.0000	1.96	3.48	-1.52
0.0000	2.00	3.85	-1.85

r	EUsafe	EUrisk	EUdiff
-0.1426	1.54	0.47	1.08
-0.1426	1.58	0.87	0.72
-0.1426	1.63	1.27	0.36
-0.1426	1.67	1.67	**0.00**
-0.1426	1.71	2.07	-0.36
-0.1426	1.76	2.48	-0.72
-0.1426	1.80	2.88	-1.08
-0.1426	1.85	3.28	-1.43
-0.1426	1.89	3.68	-1.79
-0.1426	1.93	4.08	-2.15

*HL report this as -0.15

Table 4

HS Model Parameters, Bids, and Expected Gains

	Parameters			Bids		Expected gains (doubled)	
Treatment	X	R	M	B_R	B_N	B_R	B_N
Winner's curse	1.50	4.50	1.50	3.00	3.56	0.250	0.215
No curse	1.00	2.00	1.50	2.00	2.00	0.250	0.250
Loser's curse	0.50	0.50	1.50	1.00	0.81	0.250	0.215

Table 5

Version X: Ten Paired Lottery-Choice Decisions

Option A				Option B				EV^A	EV^B	Expected Payoff Difference
0.1	$20.00	0.9	$16.00	0.1	$38.50	0.9	$1.00	$16.40	$4.75	$11.65
0.2	$20.00	0.8	$16.00	0.2	$38.50	0.8	$1.00	$16.80	$8.50	$8.30
0.3	$20.00	0.7	$16.00	0.3	$38.50	0.7	$1.00	$17.20	$12.25	$4.95
0.4	$20.00	0.6	$16.00	0.4	$38.50	0.6	$1.00	$17.60	$16.00	$1.60
0.5	$20.00	0.5	$16.00	0.5	$38.50	0.5	$1.00	$18.00	$19.75	-$1.75
0.6	$20.00	0.4	$16.00	0.6	$38.50	0.4	$1.00	$18.40	$23.50	-$5.10
0.7	$20.00	0.3	$16.00	0.7	$38.50	0.3	$1.00	$18.80	$27.25	-$8.45
0.8	$20.00	0.2	$16.00	0.8	$38.50	0.2	$1.00	$19.20	$31.00	-$11.80
0.9	$20.00	0.1	$16.00	0.9	$38.50	0.1	$1.00	$19.60	$34.75	-$15.15
1	$20.00	0	$16.00	1	$38.50	0	$1.00	$20.00	$38.50	-$18.50

Table 6

Model Parameters, Bids, and expected gains

	Parameters			Bids		Expected gains	
Treatment	X	R	M	B_R	B_N	B_R	B_N
Winner's curse	4.00	11.00	1.50	8.00	9.13	0.727	0.670
No curse	3.50	7.00	1.50	7.00	7.00	0.875	0.875
Loser's curse	3.00	3.00	1.50	6.00	4.88	1.500	1.289

Figure 1

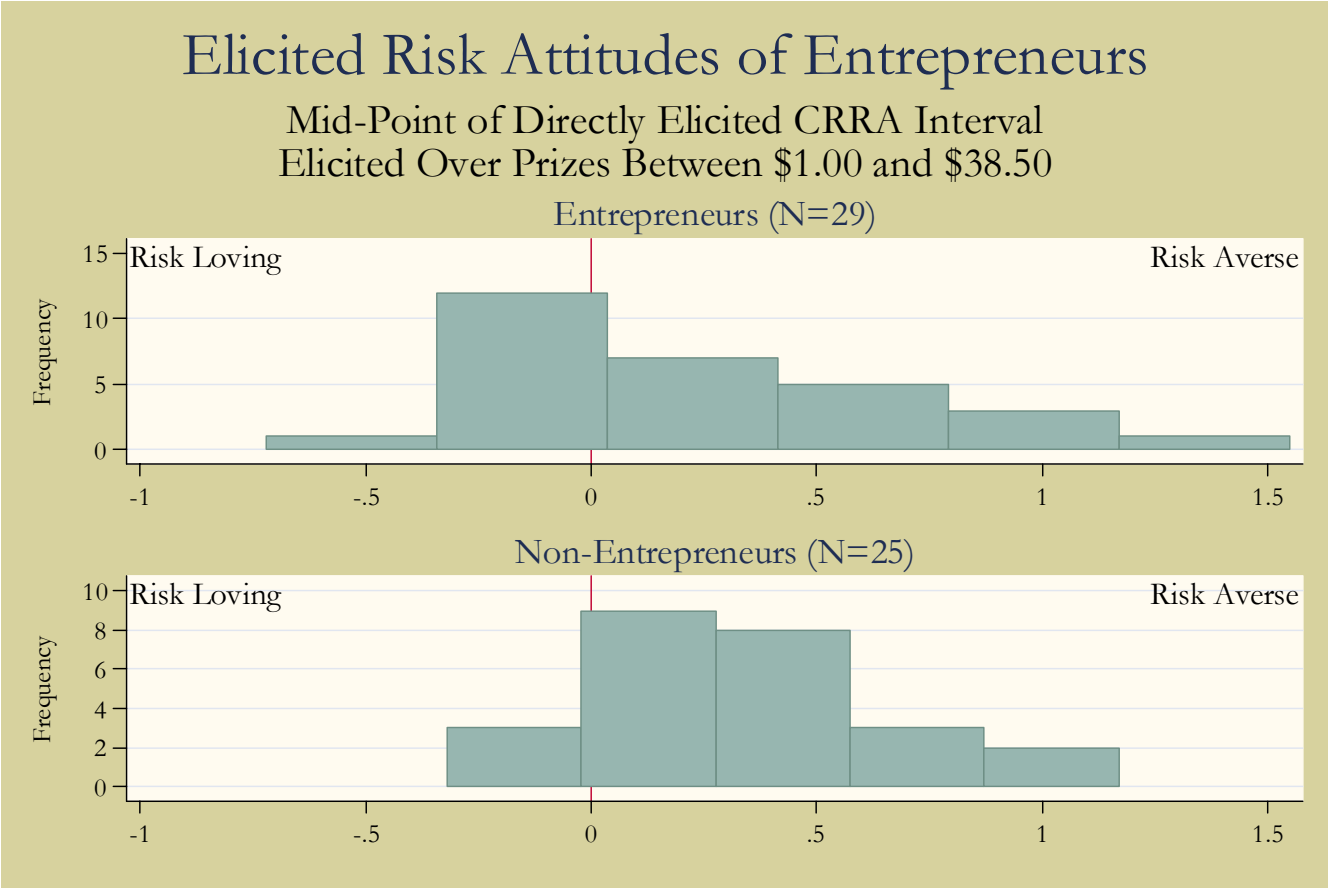
Elicited Risk Attitudes of Entrepreneurs
Mid-Point of Directly Elicited CRRA Interval
Elicited Over Prizes Between $1.00 and $38.50
Entrepreneurs (N=29)
Risk Loving
Risk Averse
Frequency
15
10
5
0
-1
-.5
0
.5
1
1.5
Non-Entrepreneurs (N=25)
Risk Loving
Risk Averse
Frequency
10
8
6
4
2
0
-1
-.5
0
.5
1
1.5

Table 7

Stata Output for Estimated Risk Attitudes of Entrepreneurs

```
. intreg crraLO crraHI EntrepreneurE $treatR $rhs if odd==0 & georgia==1, het(EntrepreneurE $treatR) robust
                                                  Number of obs             =        53
                                                  Wald chi2(11)             =     42.93
                                                  Prob > chi2               =         0
Interval regression                               Log pseudolikelihood      =   -83.977
```

	Coefficient	Robust Std.	z	P > | z |	[95% Confidence Interval]	
model						
Entrepreneur	-0.3365	0.111	-3.03	0.002	-0.5538	-0.1191
Endowment	0.0271	0.013	2.03	0.420	0.0009	0.0532
OrderTask	0.0616	0.145	0.43	0.670	-0.2221	0.3453
OrderRow	-0.0170	0.134	-0.13	0.899	-0.2790	0.2450
Age	-0.0237	0.005	-4.65	0.000	-0.0337	-0.0137
Female	-0.1229	0.122	-1.01	0.315	-0.3624	0.1167
Black	0.1298	0.093	1.40	0.162	-0.5212	0.3117
Asian	0.4309	0.435	0.99	0.322	-0.4224	1.2842
HigherEd	0.1468	0.090	1.63	0.104	-0.0302	0.3239
Married	0.0631	0.100	0.63	0.528	-0.1328	0.2589
HighInc	0.1530	0.123	1.24	0.214	-0.0880	0.3940
_cons	0.9715	0.211	4.61	0.000	0.5588	1.3841
lnsigma						
Entrepreneur	0.7199	0.410	1.76	0.079	-0.0835	1.5234
Endowment	-0.0037	0.050	-0.07	0.641	-0.1011	0.0937
OrderTask	0.8061	0.379	2.13	0.034	0.0629	1.5494
OrderRow	0.6721	0.289	2.32	0.020	0.1054	1.2387
_cons	-2.0557	0.670	-3.07	0.002	-3.3686	-0.7428

Legend: Unless otherwise stated, all variables are binary dummy variables in which 1 denotes true and 0 denotes false. "Entrepreneur" indicates the subjects that indicated current ownership and operation of an entrepreneurial firm; "OrderTask" indicates if the risk aversion task came second; "OrderRow" indicates if the rows in the risk aversion task were the (vertically) reverse of those shown in Table 1; "Age" is a non-binary variable indicating the age in years; "Female" indicates females; "Black" indicates a reported black racial-ethnic category; "Asian" indicates a reported Asian racial-ethnic category; "HigherEd" indicates if the subject has completed some post-graduate education; "married" indicates if the subject is currently married; "HighInc" indicates subjects with household incomes, for 2003, over $100,000.

Figure 2

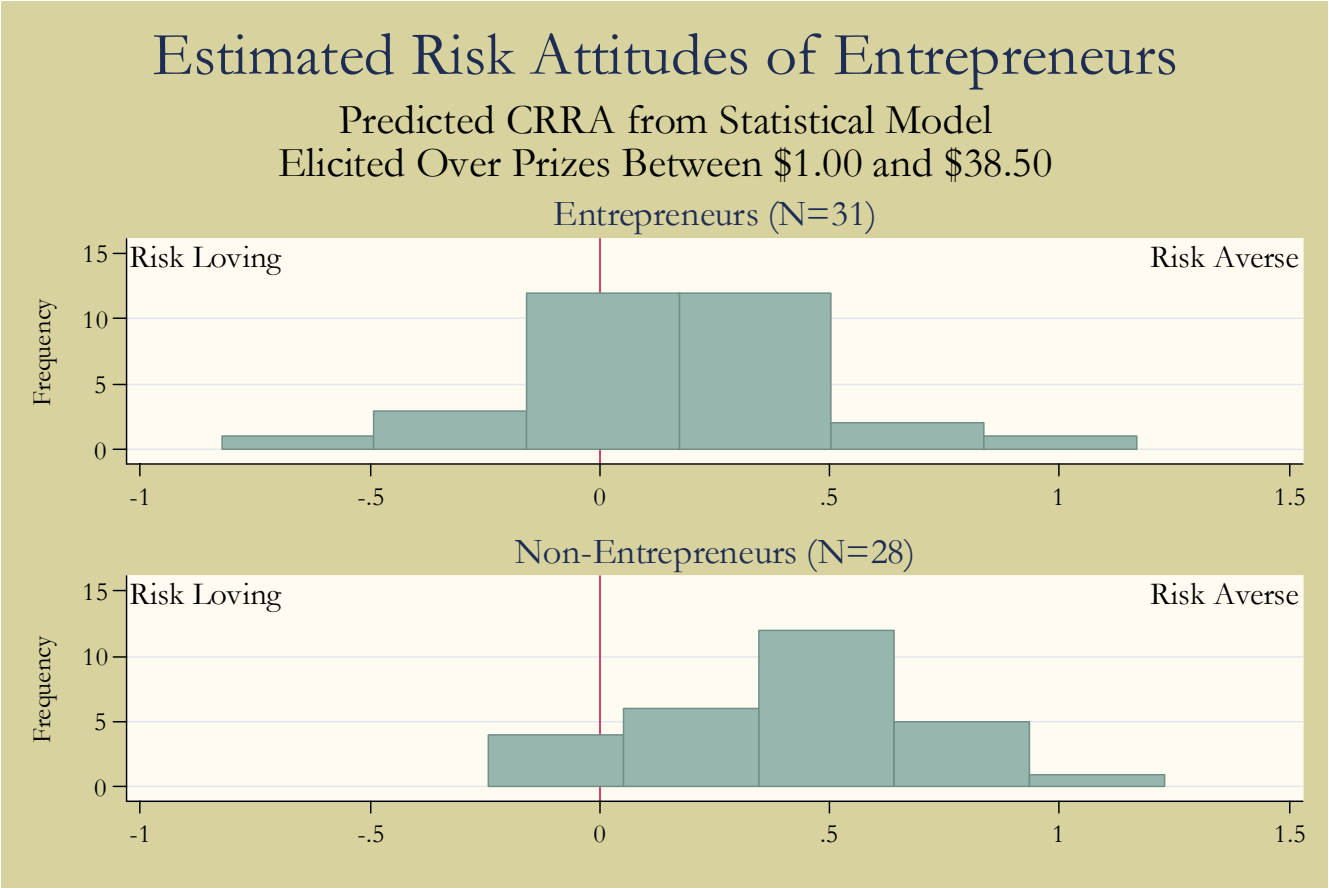
Estimated Risk Attitudes of Entrepreneurs
Predicted CRRA from Statistical Model
Elicited Over Prizes Between $1.00 and $38.50
Entrepreneurs (N=31)
Risk Loving
Risk Averse
Frequency
15
10
5
0
-1
-.5
0
.5
1
1.5
Non-Entrepreneurs (N=28)
Risk Loving
Risk Averse
Frequency
15
10
5
0
-1
-.5
0
.5
1
1.5

Figure 3

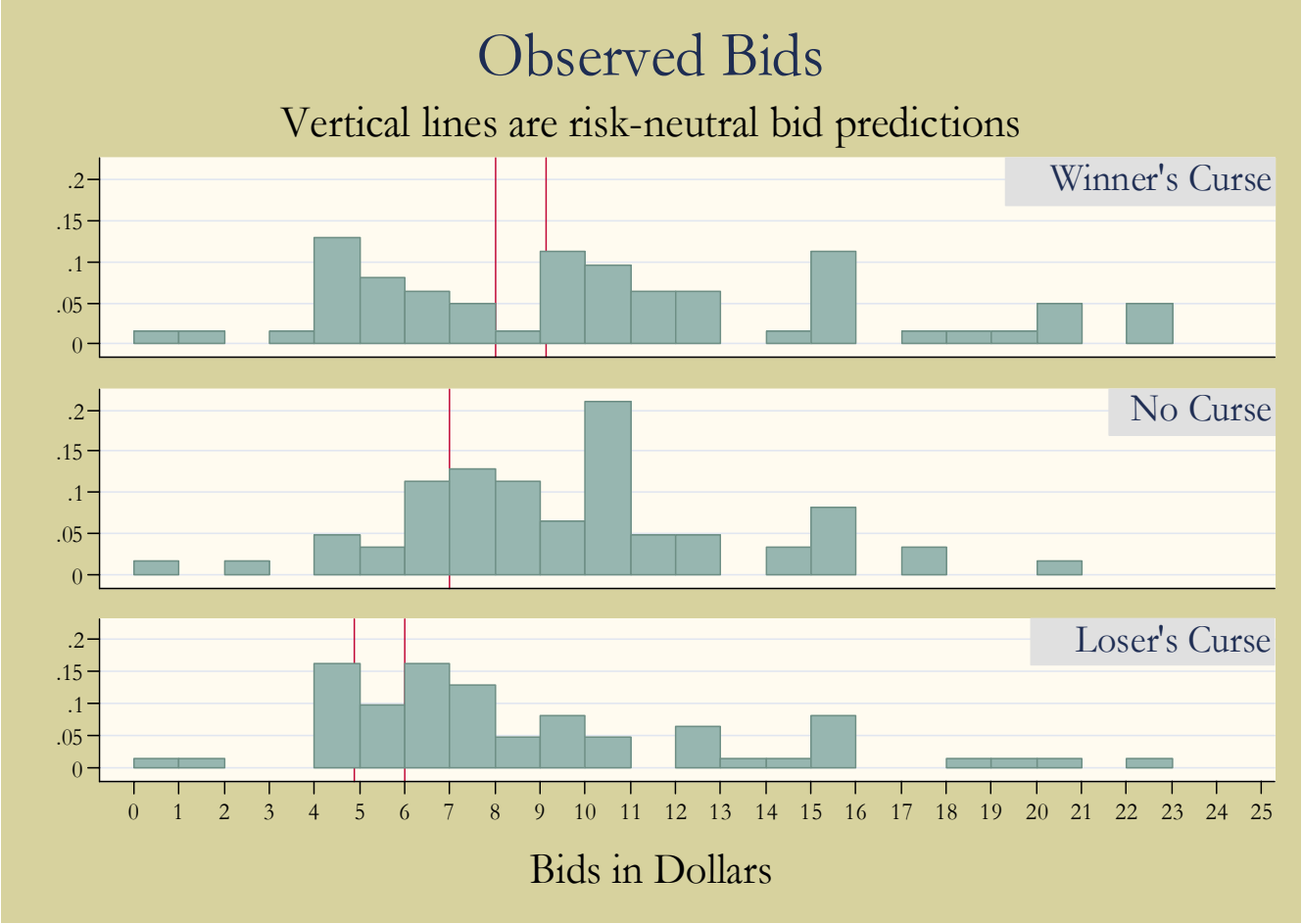
Observed Bids
Vertical lines are risk-neutral bid predictions
Winner's Curse
No Curse
Loser's Curse
.2
.15
.1
.05
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Bids in Dollars

Figure 4

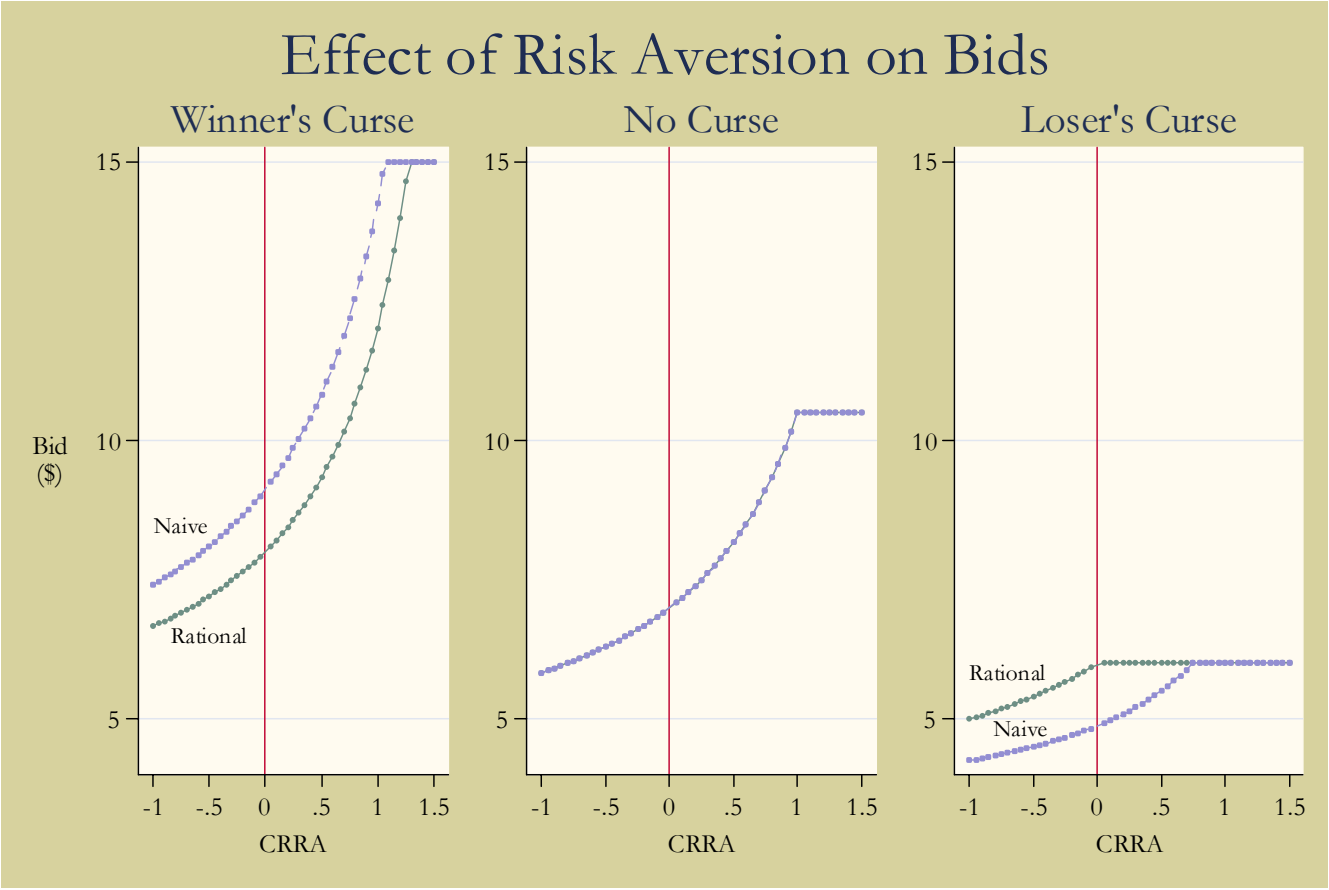
Effect of Risk Aversion on Bids
Winner's Curse
No Curse
Loser's Curse
Bid ($)
15
10
5
Naive
Rational
-1
-.5
0
.5
1
1.5
CRRA

Table 8

No Curse ~ Percentage Difference Between Actual Bid and Predicted Bid Accounting for Individual CRRA

Panel A: Both Groups

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
joy	61	1.2329	0.0636	0.4969	1.1057	1.3602

Degress of Freedom: 60

Ho: mean(joy) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 3.6610	t = 3.6610	t = 3.6610
P < t = 0.9997	P > | t | = 0.0005	P > t = 0.0003

Panel B: Non-Entrepreneur Group

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
joy	29	1.1555	0.0933	0.5026	0.9644	1.3467

Degress of Freedom: 28

Ho: mean(joy) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 1.6664	t = 1.6664	t = 1.6664
P < t = 0.9466	P > | t | = 0.1068	P > t = 0.0534

Panel C: Entrepreneur Group

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
joy	32	1.3031	0.0864	0.4890	1.1268	1.4794

Degress of Freedom: 31

Ho: mean(joy) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 3.5062	t = 3.5062	t = 3.5062
P < t = 0.9993	P > | t | = 0.0014	P > t = 0.0007

* Where Ho: refers to the null hypothesis
Ha: refers to the alternate hypothesis

Table 9

No Curse ~ Percentage Difference Between Actual Bid and Predicted Bid Accounting for Individual CRRA and Group

Group	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf. Interval]	
0 (non-entrepreneurs)	29	1.1555	0.0933	0.5026	0.9644	1.3467
1 (entrepreneurs)	32	1.3031	0.0864	0.4890	1.1268	1.4794
combined	61	1.2329	0.0636	0.4969	1.1057	1.3602
difference		-0.1476	0.1272		-0.4022	0.1071

Satterhwaite's Degress of Freedom: 58.0567

Ho: mean (0) - mean (1) = difference = 0

Ha: difference < 0	Ha: difference = 0	Ha: difference > 0
t = -1.1600	t = -1.1600	t = -1.1600
P < t = 0.1254	P > l t l = 0.2508	P > t = 0.8746

* Where Ho: refers to the null hypothesis

Ha: refers to the alternate hypothesis

Table 10

Winner's Curse ~ Deviations from Predicted Bids Expressed as a Percentage Accounting for Individual CRRA and 'Joy'

Panel A: Both Groups

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
bratio	60	1.0537	0.07192	0.55701	0.9098	1.1976

Degress of Freedom: 59

Ho: mean(bratio) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 0.7463	t = 0.7463	t = 0.7463
P < t = 0.7708	P > l t l = 0.4584	P > t = 0.2292

Panel B: Non-Entrepreneur Group

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
bratio	28	1.0947	0.1186	0.6273	0.8515	1.3380

Degress of Freedom: 27

Ho: mean(bratio) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 0.7992	t = 0.7992	t = 0.7992
P < t = 0.7844	P > l t l = 0.4311	P > t = 0.2156

Panel C: Entrepreneur Group

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
bratio	32	1.0177	0.0875	0.4950	0.8393	1.1962

Degress of Freedom: 31

Ho: mean(bratio) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = .2026	t = .2026	t = .2026
P < t = 0.5796	P > l t l = 0.8407	P > t = 0.4204

* Where Ho: refers to the null hypothesis
Ha: refers to the alternate hypothesis

Table 11

Winner's Curse ~ Deviations from Predicted Rational Bid Accounting for Group, CRRA, and 'Joy'

Group	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf. Interval]	
0 (non-entrepreneurs)	28	1.0947	0.1186	0.6273	0.8515	1.3380
1 (entrepreneurs)	32	1.0177	0.0875	0.4950	0.8393	1.1962
combined	60	1.0537	0.0719	0.5571	0.9098	1.1976
difference		0.0770	0.1473		-0.2188	0.3728

Satterhwaite's Degress of Freedom: 51.1996

Ho: mean (0) - mean (1) = difference = 0

Ha: difference < 0	Ha: difference = 0	Ha: difference > 0
t = 0.5227	t = 0.5227	t = 0.5227
P < t = 0.6983	P > l t l = 0.6034	P > t = 0.3017

* Where Ho: refers to the null hypothesis
Ha: refers to the alternate hypothesis

Table 12

Loser's Curse ~ Deviations from Predicted Bids Expressed as a Percentage Accounting for Individual CRRA and 'Joy'

Panel A: Both Groups

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
bratio	60	1.2477	0.1318	1.0212	0.9841	1.5117

Degress of Freedom: 59

Ho: mean(bratio) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 1.8805	t = 1.8805	t = 1.8805
P < t = 0.9675	P > l t l = 0.0650	P > t = 0.0325

Panel B: Non-Entrepreneur Group

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
bratio	28	1.2228	0.2036	1.0775	0.8050	1.6406

Degress of Freedom: 27

Ho: mean(bratio) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 1.0940	t = 1.0940	t = 1.0940
P < t = 0.8582	P > l t l = 0.2836	P > t = 0.1418

Panel C: Entrepreneur Group

Variable	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf.	Interval]
bratio	32	1.2699	0.1743	0.9862	0.9144	1.6255

Degress of Freedom: 31

Ho: mean(bratio) = 1

Ha: mean < 1	Ha: mean = 1	Ha: mean > 1
t = 1.5483	t = 1.5483	t = 1.5483
P < t = 0.9341	P > l t l = 0.1317	P > t = 0.0659

* Where Ho: refers to the null hypothesis
Ha: refers to the alternate hypothesis

Table 13

Loser's Curse ~ Deviations from Predicted Rational Bid Accounting for Group, CRRA, and 'Joy'

Group	Observation	Mean	Std. Error	Std. Dev.	[95 % Conf. Interval]	
0 (non-entrepreneurs)	28	1.2228	0.2036	1.0775	0.8050	1.6406
1 (entrepreneurs)	32	1.2699	0.1743	0.9862	0.9144	1.6255
combined	60	1.2479	0.1318	1.0212	0.9841	1.5117
difference		-0.0471	0.2681		-0.5843	0.4900

Satterhwaite's Degress of Freedom: 55.2388

Ho: mean (0) - mean (1) = difference = 0

Ha: difference < 0	Ha: difference = 0	Ha: difference > 0
t = -0.1759	t = -0.1759	t = -0.1759
P < t = 0.4305	P > l t l = 0.8610	P > t = 0.5695

* Where Ho: refers to the null hypothesis
Ha: refers to the alternate hypothesis

APPENDIX: C

WELCOME TO THE RESEARCH STUDY

DESCRIPTION

This is a study of economic decision making. We think you will find it interesting, you will be paid $10 for your participation *and* you could earn additional money. How much you earn will depend partly on chance and partly on the choice you make in decision problems which you will be presented with. The instructions are simple and you will benefit from following them carefully.

The problems are not designed to test you. What we want to know is what choices you would make in them. The only right answer is what you really would choose. That is why the problems give you the chance of earning real money. You will be paid in cash as soon as you finish the task.

The task will proceed in three short parts.

The first part consists of a few questions about your firm and you. This information is for research use only. The published results of our research will not identify any firm or individual, or the choice he or she made in any way. Nor will we give this identifying information to anyone else.

The second and third part are short decision problems in which chance may play a part. Each decision-problem requires you to make a choice. This is described in more detail when you have completed the first part. Both of these parts may result in additional earnings over and above the $10 participation fee.

We expect the entire task to take less than 15 minutes.

ID: _____ **Part 1: Some Questions About You and Your Firm**

In this survey most of the questions asked are descriptive. We will not be grading your answers and your responses are completely confidential. We will not be recording your name or the name of your firm on this sheet. Please think carefully about each question and give your best answers.

Questions About Your Firm

1. How old is your firm, in years? _____

2. What type of product or service do you provide? _____

3. Have you ever experienced a shortage of capital in running your firm? (Circle one number)

   01 Never
   02 Rarely
   03 Occasionally
   04 Often
   05 Always

4. Do you have a shortage of capital now?

   01 Yes 02 No

5. How did you primarily finance your firm's start up? (Circle all that apply)

   01 Inheritance
   02 Gift
   03 Credit cards
   04 Earnings from another job
   05 SBIR grant
   06 Private loan from a bank or person
   07 Other

6. Have you ever applied for or received an SBIR grant?

   Applied: 01 Yes 02 No
   Received: 01 Yes 02 No

8. How do you finance your firm now? Enter rough percentages for each:

   01 Government loans or grants _____
   02 Private loans from banks or people _____
   03 Credit cards _____
   04 Earnings from another job _____
   05 Cash from operations _____
   06 Equity capital _____
   07 Other _____

9. What would you estimate to be the annual revenue of your firm? _____

10. What would you estimate to be the value of the assets of your firm? _____

11. What is the state and ZIP code of the main location of your firm? _____

Questions About You

1. What is your AGE? _____ years

2. What is your sex? (Circle one number.)

01	Male	02	Female

3. Which of the following categories best describes you? (Circle one number.)

01	White	06	Hispanic-American
02	African-American	07	Hispanic
03	African	08	Mixed Race
04	Asian-American	09	Other
05	Asian		

4. What is your current employment status, and that of your spouse or domestic partner? (Circle one number for each)

You	Your spouse or *domestic partner*	
01	01	Self-employed only
02	02	Part-time employment in another firm
03	03	Full-time employment in another firm
04	04	Actively seeking employment
05	05	Unemployed

5. What is the **highest** level of education you have **completed**? (Circle one number)

01	Less than high school	04	Vocational or trade school
02	GED or High School Equivalency	05	Bachelor's degree at college
03	High school	06	Higher degree at college

6. Are you currently...

01	Single and never married?	03	Separated or divorced?
02	Married?	04	Widowed?

7. How many people live in your household? Include yourself, your spouse and any dependents. Do not include your parents or roommates unless you claim them as dependents.

_____

8. Please circle the category below that describes the total amount of INCOME earned in 2003 by the people in your household (as "household" is defined in the previous question). [Consider all forms of income, including salaries, tips, interest and dividend payments, scholarship support, student loans, parental support, social security, alimony, and child support, and others.]

01	$25,000 or under	06	$100,001 - $125,000
02	$25,001 - $45,000	07	$125,001 - $150,000
03	$45,001 - $65,000	08	$150,001 - $175,000
04	$65,001 - $85,000	09	$175,001 - $200,000
05	$85,001 - $100,000	10	over $200,000

XRW **Decision Task**

Your decision sheet shows ten decisions listed on the left. Each decision is a paired choice between "Option A" and "Option B." You will make a choice on each row and record these in the final column.

Here is a ten-sided die that will be used to determine payoffs. The faces are numbered from 0 to 9, and we will use the 0 face of the die to serve as 10. Look at Decision 1 at the top. Option A pays $20.00 if the throw of the ten sided die is 1, and it pays $16.00 if the throw is 2-10. Option B yields $38.50 if the throw of the die is 1, and it pays $1.00 if the throw is 2-10.

The other Decisions are similar, except that as you move down the table, the chances of the higher payoff for each option increase. In fact, for Decision 10 in the bottom row, the die will not be needed since each option pays the highest payoff for sure, so your choice here is between $20.00 or $38.50.

After you have made all of your choices, you will throw this die twice, once to select one of the ten decisions to be used, and a second time to determine what your payoff is for the option you chose, A or B, for the particular decision selected. Even though you will make ten decisions, only one of these will end up affecting your earnings, but you will not know in advance which decision will be used.

We will not perform the dice roll until after you have completed the next short task.

XWR **Decision Task**

Your decision sheet shows ten decisions listed on the left. Each decision is a paired choice between "Option A" and "Option B." You will make a choice on each row and record these in the final column.

Here is a ten-sided die that will be used to determine payoffs. The faces are numbered from 0 to 9, and we will use the 0 face of the die to serve as 10. Look at Decision 1 at the top. Option A pays $20.00 if the throw of the ten sided die is 1, and it pays $16.00 if the throw is 2-10. Option B yields $38.50 if the throw of the die is 1, and it pays $1.00 if the throw is 2-10.

The other Decisions are similar, except that as you move down the table, the chances of the higher payoff for each option increase. In fact, for Decision 10 in the bottom row, the die will not be needed since each option pays the highest payoff for sure, so your choice here is between $20.00 or $38.50.

After you have made all of your choices, you will throw this die twice, once to select one of the ten decisions to be used, and a second time to determine what your payoff is for the option you chose, A or B, for the particular decision selected. Even though you will make ten decisions, only one of these will end up affecting your earnings, but you will not know in advance which decision will be used.

ID: X_____

Decision	**Option A**	**Option B**	**Your Choice** (Circle A or B)
1	$20.00 if throw of die is 1 $16.00 if throw of die is 2-10	$38.50 if throw of die is 1 $1.00 if throw of die is 2-10	A B
2	$20.00 if throw of die is 1-2 $16.00 if throw of die is 3-10	$38.50 if throw of die is 1-2 $1.00 if throw of die is 3-10	A B
3	$20.00 if throw of die is 1-3 $16.00 if throw of die is 4-10	$38.50 if throw of die is 1-3 $1.00 if throw of die is 4-10	A B
4	$20.00 if throw of die is 1-4 $16.00 if throw of die is 5-10	$38.50 if throw of die is 1-4 $1.00 if throw of die is 5-10	A B
5	$20.00 if throw of die is 1-5 $16.00 if throw of die is 6-10	$38.50 if throw of die is 1-5 $1.00 if throw of die is 6-10	A B
6	$20.00 if throw of die is 1-6 $16.00 if throw of die is 7-10	$38.50 if throw of die is 1-6 $1.00 if throw of die is 7-10	A B
7	$20.00 if throw of die is 1-7 $16.00 if throw of die is 8-10	$38.50 if throw of die is 1-7 $1.00 if throw of die is 8-10	A B
8	$20.00 if throw of die is 1-8 $16.00 if throw of die is 9-10	$38.50 if throw of die is 1-8 $1.00 if throw of die is 9-10	A B
9	$20.00 if throw of die is 1-9 $16.00 if throw of die is 10	$38.50 if throw of die is 1-9 $1.00 if throw of die is 10	A B
10	$20.00 if throw of die is 1-10	$38.50 if throw of die is 10	A B

DECISION ROW CHOSEN BY FIRST THROW OF THE DIE: _____

THROW OF THE DIE TO DETERMINE PAYMENT: _____

EARNINGS: _____

YRW

Decision Task

Your decision sheet shows ten decisions listed on the left. Each decision is a paired choice between "Option A" and "Option B." You will make a choice on each row and record these in the final column.

Here is a ten-sided die that will be used to determine payoffs. The faces are numbered from 0 to 9, and we will use the 0 face of the die to serve as 10. Look at Decision 10 at the bottom. Option A pays $20.00 if the throw of the ten sided die is 1, and it pays $16.00 if the throw is 2-10. Option B yields $38.50 if the throw of the die is 1, and it pays $1.00 if the throw is 2-10.

The other Decisions are similar, except that as you move up the table, the chances of the higher payoff for each option increase. In fact, for Decision 1 in the top row, the die will not be needed since each option pays the highest payoff for sure, so your choice here is between $20.00 or $38.50.

After you have made all of your choices, you will throw this die twice, once to select one of the ten decisions to be used, and a second time to determine what your payoff is for the option you chose, A or B, for the particular decision selected. Even though you will make ten decisions, only one of these will end up affecting your earnings, but you will not know in advance which decision will be used.

We will not perform the dice roll until after you have completed the next short task.

YWR

Decision Task

Your decision sheet shows ten decisions listed on the left. Each decision is a paired choice between “Option A” and “Option B.” You will make a choice on each row and record these in the final column.

Here is a ten-sided die that will be used to determine payoffs. The faces are numbered from 0 to 9, and we will use the 0 face of the die to serve as 10. Look at Decision 10 at the bottom. Option A pays $20.00 if the throw of the ten sided die is 1, and it pays $16.00 if the throw is 2-10. Option B yields $38.50 if the throw of the die is 1, and it pays $1.00 if the throw is 2-10.

The other Decisions are similar, except that as you move up the table, the chances of the higher payoff for each option increase. In fact, for Decision 1 in the top row, the die will not be needed since each option pays the highest payoff for sure, so your choice here is between $20.00 or $38.50.

After you have made all of your choices, you will throw this die twice, once to select one of the ten decisions to be used, and a second time to determine what your payoff is for the option you chose, A or B, for the particular decision selected. Even though you will make ten decisions, only one of these will end up affecting your earnings, but you will not know in advance which decision will be used.

ID: Y_____

Decision	Option A	Option B	**Your Choice** (Circle A or B)
1	$20.00 if throw of die is 1-10	$38.50 if throw of die is 1-10	A B
2	$20.00 if throw of die is 1-9 $16.00 if throw of die is 10	$38.50 if throw of die is 1-9 $1.00 if throw of die is 10	A B
3	$20.00 if throw of die is 1-8 $16.00 if throw of die is 9-10	$38.50 if throw of die is 1-8 $1.00 if throw of die is 9-10	A B
4	$20.00 if throw of die is 1-7 $16.00 if throw of die is 8-10	$38.50 if throw of die is 1-7 $1.00 if throw of die is 8-10	A B
5	$20.00 if throw of die is 1-6 $16.00 if throw of die is 7-10	$38.50 if throw of die is 1-6 $1.00 if throw of die is 7-10	A B
6	$20.00 if throw of die is 1-5 $16.00 if throw of die is 6-10	$38.50 if throw of die is 1-5 $1.00 if throw of die is 6-10	A B
7	$20.00 if throw of die is 1-4 $16.00 if throw of die is 5-10	$38.50 if throw of die is 1-4 $1.00 if throw of die is 5-10	A B
8	$20.00 if throw of die is 1-3 $16.00 if throw of die is 4-10	$38.50 if throw of die is 1-3 $1.00 if throw of die is 4-10	A B
9	$20.00 if throw of die is 1-2 $16.00 if throw of die is 3-10	$38.50 if throw of die is 1-2 $1.00 if throw of die is 3-10	A B
10	$20.00 if throw of die is 1 $16.00 if throw of die is 2-10	$38.50 if throw of die is 1 $1.00 if throw of die is 2-10	A B

DECISION ROW CHOSEN BY FIRST THROW OF THE DIE:_____

THROW OF THE DIE TO DETERMINE PAYMENT: _____

EARNINGS: _____

ID: WLR _____ **Decision Task**

In this task you will have the opportunity to bid for the chance of getting an additional sum of money. Your bid can be any number in even quarters as long as it is not so large that it will lead to a loss for sure. We will tell you what that maximum is.

You will draw a card from this deck to determine a value. If the value is less than your bid you will get the extra money. The money you get will be equal to 1.5 times the value, but we will then subtract your bid from that.

You will be given three opportunities to bid, but we will only select one for payment at the end. This will be done randomly. Since it is possible to make a loss, we will give you a sum of money up front in addition to your earnings. This will be an amount between $5 and $15 and you will draw a card to determine that now.

Any loss will be subtracted out of this sum, but you will be paid the remainder. If you do not make a loss you will be paid both your earnings and this sum of money. The three opportunities differ in the range of values that can be drawn from the deck of cards:

- The first time the value will be drawn between $3.50 and $10.50. This will be done using the deck of cards.
- The second time the value will be drawn between $4 and $15.
- The third time the value will be drawn between $3 and $6.

Additional amount of money: _____
Please write down your three bids here:

Bid1: _____ (maximum bid is $15.75)

Bid 2: _____ (maximum bid is $22.50)

Bid 3: _____ (maximum bid is $9)

We will fill in the remainder after you have drawn the cards. First we will go on to the other short task.

Value 1:	Bid1 > Value1?	[1.5 H Value1] - Bid1 =
Value 2:	Bid2 > Value2?	[1.5 H Value2] - Bid2 =
Value 3:	Bid3 > Value3?	[1.5 H Value3] - Bid3 =

ID: RWL _____ **Decision Task**

In this task you will have the opportunity to bid for the chance of getting an additional sum of money. Your bid can be any number in even quarters as long as it is not so large that it will lead to a loss for sure. We will tell you what that maximum is.

You will draw a card from this deck to determine a value. If the value is less than your bid you will get the extra money. The money you get will be equal to 1.5 times the value, but we will then subtract your bid from that.

You will be given three opportunities to bid, but we will only select one for payment at the end. This will be done randomly. Since it is possible to make a loss, we will give you a sum of money up front in addition to your earnings. This will be an amount between $5 and $15 and you will draw a card to determine that now.

Any loss will be subtracted out of this sum, but you will be paid the remainder. If you do not make a loss you will be paid both your earnings and this sum of money. The three opportunities differ in the range of values that can be drawn from the deck of cards:

- The first time the value will be drawn between $3.50 and $10.50. This will be done using the deck of cards.
- The second time the value will be drawn between $4 and $15.
- The third time the value will be drawn between $3 and $6.

Additional amount of money: _____
Please write down your three bids here:

Bid1: _____ (maximum bid is $15.75)

Bid 2: _____ (maximum bid is $22.50)

Bid 3: _____ (maximum bid is $9)

We will fill in the remainder after you have drawn the cards.

Value 1:	Bid1 > Value1?	[1.5 H Value1] - Bid1 =
Value 2:	Bid2 > Value2?	[1.5 H Value2] - Bid2 =
Value 3:	Bid3 > Value3?	[1.5 H Value3] - Bid3 =

ID: RLW _____ **Decision Task**

In this task you will have the opportunity to bid for the chance of getting an additional sum of money. Your bid can be any number in even quarters as long as it is not so large that it will lead to a loss for sure. We will tell you what that maximum is.

You will draw a card from this deck to determine a value. If the value is less than your bid you will get the extra money. The money you get will be equal to 1.5 times the value, but we will then subtract your bid from that.

You will be given three opportunities to bid, but we will only select one for payment at the end. This will be done randomly. Since it is possible to make a loss, we will give you a sum of money up front in addition to your earnings. This will be an amount between $5 and $15 and you will draw a card to determine that now.

Any loss will be subtracted out of this sum, but you will be paid the remainder. If you do not make a loss you will be paid both your earnings and this sum of money. The three opportunities differ in the range of values that can be drawn from the deck of cards:

- The first time the value will be drawn between $3.50 and $10.50. This will be done using the deck of cards.
- The second time the value will be drawn between $3 and $6.
- The third time the value will be drawn between $4 and $15.

Additional amount of money: _____
Please write down your three bids here:

Bid1: _____ (maximum bid is $15.75)

Bid 2: _____ (maximum bid is $9)

Bid 3: _____ (maximum bid is $22.50)

We will fill in the remainder after you have drawn the cards.

Value 1:	Bid1 > Value1?	[1.5 H Value1] - Bid1 =
Value 2:	Bid2 > Value2?	[1.5 H Value2] - Bid2 =
Value 3:	Bid3 > Value3?	[1.5 H Value3] - Bid3 =

ID: LWR _____ **Decision Task**

In this task you will have the opportunity to bid for the chance of getting an additional sum of money. Your bid can be any number in even quarters as long as it is not so large that it will lead to a loss for sure. We will tell you what that maximum is.

You will draw a card from this deck to determine a value. If the value is less than your bid you will get the extra money. The money you get will be equal to 1.5 times the value, but we will then subtract your bid from that.

You will be given three opportunities to bid, but we will only select one for payment at the end. This will be done randomly. Since it is possible to make a loss, we will give you a sum of money up front in addition to your earnings. This will be an amount between $5 and $15 and you will draw a card to determine that now.

Any loss will be subtracted out of this sum, but you will be paid the remainder. If you do not make a loss you will be paid both your earnings and this sum of money. The three opportunities differ in the range of values that can be drawn from the deck of cards:

- The first time the value will be drawn between $3.50 and $10.50. This will be done using the deck of cards.
- The second time the value will be drawn between $3 and $6.
- The third time the value will be drawn between $4 and $15.

Additional amount of money: _____
Please write down your three bids here:

Bid1: _____ (maximum bid is $15.75)

Bid 2: _____ (maximum bid is $9)

Bid 3: _____ (maximum bid is $22.50)

We will fill in the remainder after you have drawn the cards. First we will go on to the other short task.

Value 1:	Bid1 > Value1?	[1.5 H Value1] - Bid1 =
Value 2:	Bid2 > Value2?	[1.5 H Value2] - Bid2 =
Value 3:	Bid3 > Value3?	[1.5 H Value3] - Bid3 =

Request for information on the survey and experiments – VOLUNTARY

If you would like to receive a copy of a brief summary of the survey and our experiments, please provide your name and contact information below. We will not be using this information for any other purpose than to send you the summary. If you do not want to receive this information, then do not write anything. Note that we will not connect your name with the ID you used for the responses you gave us.

NAME: _____

ADDRESS: _____

_____

_____

_____

E-MAIL: _____

FAX: _____

APPENDIX: D

University of Central Florida

Department of Economics

Informed Consent Form

The following information is provided so that you can decide whether you wish to participate in the present research study. Even if you agree to participate, you are free to withdraw at any time. Should you decide to withdraw, you will forgo your earnings, however. Your participation is voluntary, and is not a class requirement.

This study investigates the way in which people make economic decisions. You will receive detailed instructions concerning today's experiment in a moment. You will be asked to answer some descriptive questions about yourself and to make decisions which will affect the payoffs to yourself, and may also affect the payoffs to others that participate in the study. All your decisions will be made in private, and will not be revealed to other participants. Your task will be performed on a computer or by filling in paper forms. We do not expect the experimental session to last more than 1 or 2 hours (whichever you were informed of in the recruitment), and you will be paid in cash at the end of the session. Your payment will depend on your own decisions, possibly on the decisions made by others, and also on chance, and you will be given more detail about this at the start of the experiment. A standard participation fee of $5 is paid in addition to any earnings you may make in the task itself.

The study does not involve any physical or psychological risks. Be assured that your name will not be associated in any way with the research findings. The data from the experiments will be stored on computers, but completely separate from your personal data. All decisions stored in the data files will have references only to an anonymous participant ID. If you participate in more than one study by the Economics department, your decisions in one task may be linked to your decisions in another task, but this will be done only by linking the anonymous participant ID numbers. Access to your personal information is restricted to UCF researchers using the lab for scientific research purposes and will be used only for tracking your participation and for recruitment purposes. Any questions you might have about this project can be sent to econlab@bus.ucf.edu. We guarantee that we are not attempting to deceive any participants in any way during the study. The instructions you will receive will accurately explain the task and how earnings are determined.

Do not hesitate to ask questions about these procedures. At the end of the experiment you may request a brief description of the purpose and results of the experiment. This will be e-mailed to you when the series of experiments are completed in several months. If you have any questions about your rights as a research subject, you may contact the IRB Coordinator, Attention: Mr. Chris Grayson, Office of Research, 12443 Research Parkway, Suite 207, Orlando, FL 32826, Phone (407) 823-2901, E-Mail: cgrayson@mail.ucf.edu.

Sincerely,

Elisabet Rutström, Professor of Economics, Principal Investigator

I have read the procedures above. I voluntarily agree to participate in this study, and I have received a copy of this description.

_____ _____

Signature of Subject **Date**

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DATE 9/30/2003

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