Sensation and Risk Seeking: A Inter-Disciplinary Study Comparing Psychological, Simple Gamble and Market Measures

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In Expected Utility Theory (EUT), economists have a very general tool for studying risk preferences and behaviors resulting from them. All EUT requires is (1) a set of state outcomes, (2) a subjective probability assessment over outcomes and (3) a subjective valuation over each possible combination of outcomes. The generality arises from the freedom in defining and valuing the outcome sets. However, in practice, financial economists typically focus only on a single dimension: monetary outcomes. They further restrict themselves by assuming people only care about means and variances of overall wealth. Also, they generally assume a person's risk preferences are internal and fixed. Some psychologists (e.g., Kahneman and Tversky, 1979, and references cited therein) have conducted research along similar lines and, along with some economists (e.g., Machina, 1987, and references cited therein), they have expanded the scope of EUT slightly.

In contrast, many psychologists study risk preferences and behaviors regarding risk in a much wider range of contexts. Often, it is studied within the larger construct of "sensation seeking." Zuckerman (1994, p. 27) defines sensation seeking as "a trait defined by the seeking of varied, novel, complex and intense sensations and experiences, and the willingness to take physical, social, legal and financial risks for the sake of such experience." Commonly a person's basic sensation and risk seeking tendencies are assumed internal and largely fixed. However, a person's experiences, environment and specific context may also influence risk seeking/avoiding behavior. Psychologists measure the general tendency for sensation seeking using various forms of sensation seeking scales (SSSs). They use such scales to study risk taking behavior in a wide range of contexts.[1]

[1]Such contexts include gambling and financial risks (e.g., Anderson and Brown, 1984, and Coventry and Norman, 1997), political preferences, (e.g., Ray, 1984), crime (e.g., White, Labouvie and Bates, 1985), eating behavior (e.g., Schumaker, Groth-Marnat and Small, 1986), relationships (e.g., Donaldson, 1989), sexual behavior (e.g., Arnett, 1990), fashion choices (e.g., Stanforth, 1995) and sports activities (e.g., Heath, 1997).

Both EUT and SSS data are used to study similar phenomena. In fact, they have similar roots. Bernoulli (1738) used a logarithmic valuation scale to explain the St. Petersburg paradox in the first application of what is known now as EUT. In the mid-1800's, psychology's Weber-Fechner laws developed using similar functions (ratio or log scales) to describe responses to increasing levels of sensory stimulation.[2] Wundt (1873) developed the earliest SSS to explain and measure these stimulus-response functions. Researchers in both economics and psychology have re-popularized all of these ideas (largely in the past 50 years).

Here, we use both the economists' means of extracting risk preferences using EUT and the psychologists' means using SSSs. We will compare them and ask whether they can be used to explain and predict behavior in two monetary choice settings. For the SSS, we will use the full Zuckerman (1994) SSS-V and subsets of these questions. The first monetary choice is an individual choice developed by Berg and Rietz (1997) as a simple means of inferring risk preferences. The second uses the Iowa Electronic Markets (IEM, see Berg, Forsythe and Rietz (1997) for a description) to study risk taking inferred from the choices participants make in a reasonably well controlled financial futures market.

We will cross validate the Berg-Rietz measure and the Zuckerman SSS. We will also determine whether risk preferences appear stable across the particular individual and market choices studied. Stability is particularly important for financial research in several contexts. It is important when studying and generalizing behavior across different settings (e.g., investments versus insurance choices). Since the Zuckerman SSS allows for multiple dimensions of risk, it may help explain differences in observed behavior across our two monetary choices and those faced by people in everyday life.[3] If so, expanding the financial economists' usual view of risk to

[2]See Boring (1942) for a discussion of Weber's 1834 work De pulsu, resorptione, auditu et tactu: Annotationes anatomicae et physiologiae and Fechner' 1860 work Elemente der psychophysik.

[3]We anticipate that such differences may arise because of evidence in Berg, Dickhaut and McCabe (1992). They observe different apparent risk preferences across similar gambles in different contexts.

encompass additional dimensions may prove important in explaining a wide range of observed behavior.[4] Further, along these dimensions, we can ask whether agents' choices (e.g., stock brokers) mirror the preferences of principles (e.g., stock buyers) in various settings. Finally, we can study whether market price setters (e.g., exchange traders) are similar to, or differ significantly from, the general population (e.g., all stock holders).

Measures

We use three measures to study risk seeking or avoiding behavior. Here, we will briefly describe each and show how our tests fit together. The current draft contains a mixture of data sources. We are currently collecting a complete dataset on current IEM traders. After discussing the data, we will give results.

As a SSS, we will use the Zuckerman (1994) SSS Form V. It is a survey of 40 questions with binary responses to each (agreement with one of two self-descriptive statements) that are scored and summed. The questions are grouped into four ten-question subscales to measure four different dimensions of sensation seeking: Thrill and Adventure Seeking (TAS), Experience Seeking (ES), Disinhibition (Dis) and Boredom Susceptibility (BS). The Thrill and Adventure Seeking subscale most closely resembles risk preferences as studied by economists. When brevity matters, we will also use our own subset of questions with three questions selected from each subscale. Appendix shows the questions used in our subset and the correspondence between our subset question numbers and the SSS-V question numbers.[5] The overall Zuckerman

[4] For example, changes in apparent risk preferences across gains and losses (e.g., Tversky and Kahneman, 1979 and Kahneman and Tversky, 1986) and preference reversals across risky choices (e.g., Grether and Plott, 1979), differences across races and gender, etc.

[5] We picked the subset questions according to the following criteria:

1. The subset contains 12 items and 3 on each scale. Each item is significantly correlated with its subscale.
2. Half the individual items had significant correlations with Berg-Rietz choice in laboratory sessions. These were our questions 2, 3, 8, 9, 10, 11 and 12.
3. The items seemed like reasonable choice alternatives in context.

SSS, the four subscales and their correlations have been studied extensively across a wide range of contexts (for examples, see Zuckerman (1994) and references cited in footnote 1).

For our individual monetary choice and an economic means of inferring risk preferences, we will use a choice developed by Berg and Rietz (1997). In it, a subject makes a single choice that determines both the probability of receiving a monetary prize (p) and its size ($M). The choices are given in Table 1. The two dimensions of the choice are inversely related in a simple way that makes it easy for subjects to understand and for researchers to infer risk preferences. Specifically, $M=$S(1-p), where M is the monetary payoff, p is the probability of receiving the payoff and S is a scale factor. For example, if S=1, then the expected value is $p(1-p) and the variance is $p(1-p)^3$. Figure 1 shows the expected payoff and variance resulting from these choices. Risk neutral subjects should choose p=0.5 (cutoff = 50) to maximize expected value. Choices larger than 0.5 (cutoff < 50) reflect risk aversion because they decrease the expected value while reducing variance. Similarly, choices less than 0.5 (cutoff > 50) reflect risk seeking because they decrease the expected value while increasing variance.[6] Berg and Rietz (1997) found that this measure was easy to implement, produced a range of risk preference observations and resulted in a sensible correlation pattern across several slightly different choices involving interpersonal effects.

For our market choices, we will study behavior from the IEM. In this market, participants invest their own money and, through the internet, trade contracts with dollar payoffs determined by well-specified future events. We can measure the risk involved with each transaction or the risk held in a trader's portfolio each night. We will study a period when all contracts have binary payoffs (either $1 or $0). In this case, equilibrium implies that a contract's price should equal the expected probability of the $1 payoff regardless of risk preferences (see Rietz, 1997). If a trader buys a contract at price "p" and holds it, it should pay $1 with probability p. This gives an expected value

[6] In fact, for every choice above 50, there is a choice below 50 with the same expected value and a lower variance.

of $p an expected dollar return of p(1-p) + (1-p)(-p) = 0. The variance in value is p(1-p) and the variance in dollar return is (1-p)/p. Each is proportional to the number of contracts held and can be easily generalized to holdings in several contracts. We also develop a binomial tree model of price dynamics for binary payoff IEM contracts. This model gives predicted daily variances and standard deviations in prices that are also proportional to the number of contracts held. The IEM has been used to predict election outcomes for ten years. Oliven and Rietz (1995) observe consistent differences in individual market participant behaviors.

The IEM choices are similar to the Berg-Rietz measure. Both involve a choice to take a $1 or $0 payoff gamble with probability p. However, because the traders are paying for the gamble instead of simply selecting among gambles, the expected returns and variances differ slightly. They also differ in the type of decision and context. The Berg-Rietz measure is a one-time, individual choice. In contrast, the IEM choices are dynamic choices of purchases and sales within a market context. Thus, there are differences between the choices beyond risk and returns that may matter.

Specifically, we use four market months of IEM data from Spring 1998.[7] These months are February (1/21/97 to 2/22/98), March (2/23/98 to 3/22/98), April (3/23/98 to 4/19/98) and May (4/20/98 to 5/17/98). We chose these months because there was active trading in all markets during this time (many traders are students) and because all contracts traded over this time period had “binary” ($1 or $0) payoffs. (This allows for easy computation of implied portfolio standard deviations.) Finally, we break the data into trading months because two of the larger markets (the Computer Industry Returns and Microsoft Price Level) markets had monthly liquidations and new listings. This created obvious disruptions in the data at these monthly intervals. The appendix contains the prospectuses for these markets detailing contracts and payoff rules. Figures 2

[7]Data from Spring 1999 has been collected (along with responses from the full Zuckerman, SSS). However, the market level data has not yet been analyzed.

through 8 show daily closing prices for these markets. Table 2 gives summary statistics for the markets. Each market month lasted from 28 days to longer than the analysis period. Volume averaged $102.55 dollars per day across all the markets for $11,895.59 during the analysis period. (Figure 10 Shows daily dollar volume and the amount of dollars invested in contracts each day.)

For demographic information on IEM traders, we will use the information collected from an on-line survey given to all traders joining the IEM. The appendix contains this survey.[8] Table 3 gives summaries of the demographic information for all registered participants and active participants (those who logged in) in each month. It also gives a demographic summary for the traders who filled out our twelve-question Zuckerman SSS Subset and for current participants who have filled out forms before May 18, 1999. Two-thirds or more of the participants are male. Most are Caucasian. They average 25 to 30 years old. They are typically from high income families. The majority have highschool and college degrees. (Many of the participants are college students.) Most are business majors and most of the student participants are participating as part of a class. Some classes require a few trades. None that we are aware of dictate specific trades be taken.

We conduct the following measurements and comparisons: (1) We give the Zuckerman SSS and the Berg-Rietz measure to a sample of volunteer subjects, comparing the results to each other. We use these results to develop the subset of questions given to IEM traders.[9] (2) We give this subset of questions to traders and record their market risk taking behaviors, comparing the two measures to each other. (3) We are in the process of running the Berg-Rietz measure on IEM traders and recording their market risk taking behaviors to compare the results to each other. (4) We are in the process of giving a complete Zuckerman SSS to current IEM traders and recording their market risk taking behaviors to compare the results to each other. (5) Finally, we are in the

[8] In January 1999, we began running a new trading system with a slightly modified version of this demographic survey.

[9] IEM traders can be surveyed electronically after they attach to the market. We use a subset of questions because very short surveys are better adapted to this procedure. Again, we recently began giving the entire survey to current traders.

process of comparing the results of IEM traders that have both Zuckerman and Berg-Rietz measures. We are currently collecting a full set of data on all measures for the same set of current IEM traders.[10]

Related Work

While many researchers have studied the Zuckerman SSS (e.g., see Zuckerman (1994) and the references cited in footnote 1), three studies relate closely to our work.

Wong and Carducci (1991) associate SSS scores with "everyday financial matters" through survey methods. They gave undergraduate students the SSS Form V and a twelve-item questionnaire on financial risk taking to 233 undergraduate students. They divide their sample into "high" and "low" sensation seekers. Based on responses to their financial questionnaire, they report that "high sensation seekers displayed greater risk-taking tendencies in everyday financial matters than low sensation seekers." We will also study decisions in a wider context. The IEM is much larger in scope than a traditional laboratory experiment. However, our study differs from Wong and Carducci by observing real financial decisions instead of survey responses. Further, our IEM traders are self-selected into the market and make actual decisions with their own money over a long time span.

Anderson and Brown (1984) study SSS scores and gambling behavior across students and experienced gamblers and, for gamblers, across laboratory and "real" environments. In their laboratory session, they give a monetary prize for the participant with the highest level of winnings at the end of the experiment. This incentive mechanism, known as tournament style incentives, creates a significant difference in incentives between their laboratory and real environments that can cause significant differences in behavior by itself (see James and Isaac, 1997). These

[10]Participation in surveys and Berg/Rietz measures are optional. Some traders will likely complete neither, some one and some both. However, as currently configured, a trader must complete the Zuckerman survey before being allowed to complete the Berg/Rietz measure.

differences arise because the tournament incentives create risk seeking attitudes in and of themselves. Instead of being subject the marginal risk of every dollar they bet, participants are only subject to the change in probability of finishing with the highest amount. Anderson and Brown (1984) found no difference between mean SSS scores of students and gamblers. They also found that the SSS score correlates with bet size only in the "real" environment and not under tournament incentives. This correlation held for all subscales except for TAS. Here, we will also compare a laboratory type setting (using the Berg-Rietz choice) and a much more "real" setting, using the IEM. However, in both settings, the participants are subject to the marginal risks of each individual choice.

Harlow and Brown (1990) correlate SSS scores with behavior in sealed bid auction markets. They find that the TAS, Dis and BS are correlated with apparent risk taking behavior in their auctions across all subjects. The TAS correlation held for men and the Dis and BS correlations held for women. In sealed bid auctions, the desire to win the auction and risk seeking behaviors are easily confused. Both make a subject bit higher. Because of this and data censoring (at bids of 0 and the subject value), estimating risk aversion from sealed bid auction data proves difficult (see Rietz, 1993). Further, market dynamics can lead to apparent irrational behavior (see, Thaler, 1992). We will study the correlation between SSS scores in an individual choice (avoiding the estimation problems of sealed bid auctions). We will also study actions in a large scale oral double auction market (the IEM). Oral Double Auction markets have been shown to converge quickly and be efficient in a wide variety of situations (e.g., see Sunder, 1995).

Preliminary Results

Zuckerman SSS-V and Berg-Rietz Laboratory Results

Martin Daly and Margot Wilson have given the full Zuckerman SSS and the Berg-Rietz measure to a sample of student subjects at McMaster University. They found that the Berg-Rietz

measure is significantly correlated with the overall Zuckerman SSS score and the scores for each subscale. Table 4 summarizes and shows the correlations across the Zuckerman and Berg-Rietz measures. Men are significantly more risk seeking according to the Berg-Rietz measure ($p<0.001$). The Berg-Rietz measure correlated significantly with the overall Zuckerman SSS-V and each of the four subscales using all the data. For both men and women, it is significantly correlated overall and for the TAS subscale. It is also significantly correlated with the BS subscale for men and the Dis subscale for women. (To be completed.)

Zuckerman SSS-V and Berg-Rietz IEM Results

We are currently giving the full Zuckerman SSS and the Berg-Rietz measure to IEM traders. Table 5 summarizes the results up to May 18, 1999 and shows the correlations across the Zuckerman and Berg-Rietz measures. Comparing tables 4 and 5 shows that, on average, the IEM traders do not appear significantly different from the laboratory participants. Men are significantly more risk seeking than women (mean scores of 19.23 versus 16.21, t-test statistic = 3.22, $p=0.0015$). However, there is not a significant difference between men and women on the Berg-Rietz choice (mean choices of 5.45 versus 5.40, t-test statistic = 0.18, $p = 0.858$). Further, the correlations in Table 5 are much weaker than in Table 4. Overall, the Berg-Rietz measure correlated at only the 90% level of confidence with the total measure and the BS subscale. For men, it is correlated at the 90% level with Dis and BS scales, while it is not correlated with any scales for women. (To be completed.)

An outreach program to minority institutions has led to a dramatic increase in minority participation in the IEM.[11] The spring 1999 data shows this change. This allows us to test for differences in minority populations meaningfully. Non-Caucasians were significantly more likely

[11]The program is funded by the US Department of Education, Fund for the Improvement of Post Secondary Education (FIPSE).

to leave the Zuckerman survey incomplete (5% incomplete versus 15% incomplete, t-test statistic = 2.50, p = 0.0134). We find that non-Caucasian traders have significantly lower scores on the SSS (mean scores of 19.98 versus 14.64, t-test statistic = 5.99, p = 0.0000). However, there is not a significant difference on the Berg-Rietz choice (mean choices of 5.46 versus 5.36, t-test statistic = 0.35, p = 0.8515). Some of the decrease in correlation SSS-V scores and Berg/Rietz responses may result from racial differences in the Zuckerman SSS responses. The correlations for Caucasians was 0.1825 (p=0.0531) and for non-Caucasians it was -0.1081 (p=0.4192). We are collecting more data to understand these issues better. (To be completed.)

Zuckerman SSS-V Subset and IEM Risk Taking Results

We ran the IEM SSS-V Subset survey on the IEM during all of 1998 and received 507 complete response and 122 partial responses. If the actual number of responses was greater than four, we scored the partial responses by weighting the responses by the actual number of questions answers in the overall subscale. We dropped the 10 participants who gave four or fewer responses. Partial responses were removed from individual subscales.

Figure 12 gives a histogram of the scores. Table 7 gives summary information broken down by subscale and gender. The overall average SSS Subset score was 5.915 with a standard deviation of 2.319 and a median of 6. The 25^{th} percentile was 4 and the 75^{th} percentile was 8. According to χ^2 statistics, men had slightly higher subES, subDIS and overall subscale scores. TAS had the highest subscale followed by ES, Dis and BS. As shown by Table 8, each of these differences was significant. Table 9 gives a factor analysis of the responses along with rotated factor loadings. As the table shows, the data factors into four principle components. The first rotated factor loading corresponds roughly to the TAS subscale, the second to Dis and the third and fourth to mixtures of ES and BS questions. Since these factor roughly into the predicted subscales, we will use the subscales for analysis below. (Similar analysis with factor scores gives

similar results.)

Full Zuckerman SSS-V and IEM Risk Taking Results

Section to be completed. This section will likely replace the subscale section and replace most of the data analysis below because it will provide a complete dataset of a common set of traders.

Sensation Seeking Subset and IEM Portfolio Data

Measurement

We measure the portfolio value for each trader each day by marking the portfolio to market. Each contract's price should equal the market's assessment of the probability of a $1 payoff. Using normalized closing prices,[12] we can assign probabilities to all possible liquidation values for each portfolio in each market. For example, consider the market on November 7, 1997. The closing prices in the Computer Industry Returns market were: P_{AAPLk}=0.141, P_{IBMk}=0.534, P_{MSFTk}=0.192 and P_{SP500k}=0.101. The normalized prices were: p_{AAPLk}=0.1457, p_{IBMk}=0.5517, p_{MSFTk}=0.1983 and p_{SP500k}=0.1043. The closing prices in the Microsoft Price Level market were: $P_{MS130kH}$=0.680 and $P_{MS130kL}$=0.432. The normalized prices were: $p_{MS130kH}$=0.6115 and $p_{MS130kL}$=0.3885. The expected portfolio value for a trader with $5 in cash and 1, 2, 3, 4, 5 and 6 contracts, respectively, was:

E(Value) = 5.000 + 1x0.1457 + 1x0.5517 + 1x0.1983 + 4*0.1043 + 5x0.6115 + 6*0.3885 =

12.649

Generally, we will determine the expected value as:

$$E(Value) = C + p_A Q_A + p_I Q_I + p_M Q_M + p_S Q_S + p_H Q_H + p_L Q_L$$

where, Q denotes the quantity held and the subscripts A, I, M, S, H and L denote the AAPL return

[12]Closing prices are the last trade price before midnight on each day. We normalize these prices by dividing each price by the sum of all closing prices in the contracts market. Deviations in prices from probabilities due to non-synchronous trading.

contract, the IBM return contract, the MSFT return contract, the S&P500 return contract, the Microsoft "higher" contract and the Microsoft "Lower" contract, respectively. These were the only contracts trading at that time, so this is the overall expected value of the portfolio. Similar arguments hold for components of the portfolio invested on other markets with “binary” ($1 or $0 payoffs) at any given point in time.

We track the trader's portfolio across time and measure its ex-post volatility using the time series variance of the expected portfolio value.

We will measure theoretical risk held by each trader in two ways. The first recognizes that each contract will pay off either $0 or $1 if held to liquidation. We will call the implied standard deviation if held to liquidation the risk to liquidation. The second assumes a binomial tree price process consistent with two IEM contract properties: (1) the zero expected aggregate return and (2) the binary payoff structure. We will compute a measure of risk based on the daily standard deviation in value implied by this process. We will call this the daily risk held by the trader.

We measure the (implied theoretical) standard deviation or risk to liquidation of holdings for each trader in each market each day by marking the portfolio to market and proceeding as follows.[13] Again, using normalized closing prices, we can assign probabilities to all possible liquidation values for holding in each market. Because of the simple correlation structure for contracts within a market, we can easily compute the standard deviation for these market holdings. For example, consider again the market on November 7, 1997. The implied standard deviation of holdings in the computer industry returns market for a trader with 1, 2, 3, and 4 contracts, respectively, was:

$$\text{Var(Computer Returns market)} = 1^2 \times 0.1457 + 2^2 \times 0.5517 + 3^2 \times 0.1983 + 4^2 \times 0.1043 - (1 \times 0.1457 + 2 \times 0.5517 + 3 \times 0.1983 + 4 \times 0.1043)^2 = 0.6931$$

[13]Here, we study market by market risk held. This is reasonable since most traders hold contract positions in one market at a time. Working with aggregate standard deviations creates problems because of inter-market correlations. We are working on solving this issue.

$$\sigma(\text{Computer Returns Market}) = 0.6931^{0.5} = 0.8325$$

Again, generally, we will assign the standard deviation as:

$$\sigma(\text{Computer Returns Market}) = [\, p_A Q_A^2 + p_I Q_I^2 + p_M Q_M^2 + p_S Q_S^2 - (p_A Q_A + p_I Q_I + p_M Q_M + p_S Q_S)^2 \,]^{0.5}$$

Again, similar arguments hold for all markets with binary contracts. To obtain an aggregate measure, we simply sum contracts across markets. This ignores intermarket diversification. Market information alone does not give sufficient information to determine intermarket correlations. Therefore, any assessment of diversification would require outside data and hypotheses on how traders form expectations. Ignoring this diversification factor seems to matter little here for three reasons. First, few traders hold open positions in multiple markets. Second, the results obtained from the time series standard deviations mirror those found with the summed implied standard deviations. Finally, results using individual market implied standard deviations mirror the aggregate results.

Figure 11 shows the implied risk to liquidation held by Zuckerman subset respondents (summed across markets) broken down by their total Zuckerman subset scores. Risk starts near zero because, until they trade, participants hold no risk. Risk escalates rapidly as traders take open positions. The large jumps in risk held result from periodic liquidations, new contract listings and the resulting changes in trader portfolio positions. Because of these radical changes, we analyze the information based on trading months that run from Computer Industry and Microsoft Price Level market liquidation dates. (The Monday after the third Friday of each month.) We track the trader's market holdings across time and implied risk held using the time series average of the standard deviations held in each market month.

We measure the risk to liquidation held by each trader relative to their portfolio value by dividing the monthly average expected portfolio value by the monthly average implied standard deviation held. This gives a risk/value measure similar to a Sharpe ratio. (We do not use return

in the denominator because there is no overall aggregate return in this market.)

We measure the daily risk held by each trader as follows. First, we develop a price process that is consistent with binary IEM contracts. Then, we will compute daily risk according to the implied standard deviations of contract prices according to this process in much the same way as we calculated risk to liquidation above. The price process must have two properties to be consistent with the IEM. First, there should be zero aggregate expected return, $E(p_{t+1}|p_t)=p_t$. Second, the price at liquidation must converge to either \$0 or \$1. Traders will drive the price to one of these levels given the realization of the payoff determining event for each contract. Define the date on which the liquidation value is determined as T.[14] Then, $p_T \in \{0,1\}$. The following (time dependent) binomial process satisfies these conditions:

$$p_{t+1} = \begin{cases} p_t + \dfrac{1-p_t}{T-t} & \text{with probability } p_t \text{ and} \\ p_t - \dfrac{p_t}{T-t} & \text{with probability } 1-p_t. \end{cases}$$

Notice that, according to this process, $E(p_{t+1}|p_t) = p_t$ and $p_T \in \{0,1\}$. Further, the standard deviation of p_{t+1} given p_t is simply the standard deviation to liquidation above ($[p_t(1-p_t)]^{0.5}$) if $T-t=1$ (i.e., the day before liquidation). Finally, the standard deviation of p_{t+1} given p_t is $\{[p_t(1-p_t)]^{0.5}\}/(T-t)$ (i.e., the standard deviation to liquidation divided by the number of days left to liquidation). This process is time and path dependent. The risk to liquidation is constant for a given price. The daily risk is proportional to the number of days remaining in the contract for a given price. Thus, a \$0.50 price with 10 days remaining to liquidation implies less daily risk than a \$0.50 price the day before liquidation. This makes sense because, while there many paths and intermediate prices that could be attained with 10 days left to liquidation, the price will be driven to either \$0 or \$1 by the next day if only one day remains to liquidation.

[14] I will often refer to this as the liquidation data though, technically, many contracts are actually liquidatded several days later.

We measure daily risk aggregated across markets and contracts in the same manner as we measured risk to liquidation above.

Finally, we measure the return attained by each trader each market month and over the course of the entire horizon. Returns are annualized by multiplying by 365 and dividing by the number of days in the period. (Following Money Market conventions. Returns, and all other statistics, are also adjusted for intra-period deposits and withdrawals.)

Results

Table 10 shows the average portfolio values, time series standard deviations in values, implied daily standard deviations, standard deviations to liquidation and returns for active participants.[15] It also shows Wilcoxon rank sum tests[16] for differences between participants who responded to the Zuckerman subset of questions and those who did not. In general, the Zuckerman subset respondents hold larger, higher volatility portfolios. Their risk/value ratios also tend to be higher in later months. However, they do not attain significantly higher returns. We also divide respondents according to scores on the Zuckerman subset questions into three groups "low," "medium" and "high." Cutoffs are 4 and 8. This leaves approximately 1/4 of traders in the high group, 1/4 in the low and ½ in the medium group. (Recall, that the 25th and 75th percentiles were 4 and 8. Results from a cutoff at the median of 6 into two groups differ little.) Table 10 gives Wilcoxon rank sum statistics for differences between low and high scoring respondents and shows few significant differences. If anything, the results show that low subset score participants held more risk (but not more risk relative to their portfolio size).

Table 11 shows how the Zuckerman Subset responses relate to the average portfolio value, time series standard deviations and implied standard deviation using Mean Absolute Deviation

[15]Those who logged in at least once during the trading month.

[16]We use Wilcoxon tests because the distribution ranges from zero up to, potentially, unlimited amounts and is heavily skewed. However, results t-test differ little.

(MAD) regression with bootstrapped (1000 replications) standard errors.[17] The table shows no discernable multivariate relationship between subset or subscale scores and the average portfolio value, portfolio returns or standard deviations of portfolio values. (Individual correlations show similar results.)

Sensation Seeking and IEM Activity

We measure trading activity in two ways. We total the number of trades involving the participant and total the dollar value of these trades. Second, we measure the portfolio volatility based on last and current trade prices both before and after the trade. From this, we measure the effective change in implied standard deviation resulting from the trade. We measure ordering activity in a similar way. However, instead of measuring implied volatility before and after the actual trade, we measure the change that would have occurred if they were to execute at the stated price and quantity. In each case, we assume that the order price reflects the trader's expectations about the value of the ordered contract and we normalize the other contract prices accordingly.

To be completed.

Sensation Seeking and Berg-Rietz Measures on IEM Traders

To be completed.

Further Research (From proposal)

We propose to continue this research to cross validate the Zuckerman and Berg-Rietz measures across Canadian and U.S. students. We will document any differences (e.g., cross

[17] We use MAD estimation because of the obvious non-normality and asymmetry of the data. This places much less weight on the large outliers in the dataset. We bootstrap the standard errors for this reason as well. The bootstrapping should also adjust for the behavior of the estimator in the, relatively, small sample sizes we have. OLS regressions on logged variables give similar results, but delete all active traders who made no changes in their portfolios from the data set. Finally, we cannot use MAD estimation on returns because the median returns is zero for each regression.

population or cross gender) in the correlations. We also propose to expand this portion of the study to include significant numbers of minorities.[18] Zuckerman (1994, pp. 99-123) cites data suggesting that: men score higher on the SSS than women, younger adults score higher than older, whites score higher than blacks, actively religious subjects score lower than inactive or non-religious subjects. In addition, birth order, marital status and level of education may be related to SSS scores.

From the existing results, we developed a preliminary 12-question subset. This subset was given to IEM traders during and all of 1998, resulting in approximately 600 responses. So far, we have investigated the relationship between our subset of Zuckerman SSS questions and one measure of risk taking behavior (the risk held by each trader each night according to the most recent market prices). We do not find a significant correlation between our subset of questions and risk taking behavior measured this way. We propose to study several other measures of risk taking (e.g., activity and ordering behavior and transaction by transaction data). We propose to refine our subset of questions using results from further Berg-Rietz and Zuckerman SSS studies. We also anticipate being able to expand the sample to include more traders and higher fractions of minorities.[19] Finally, we propose to expand our study to markets in which different contract payoff structures exist.

In addition, we propose to develop the system for giving the Berg-Rietz measure directly to IEM traders. This will allow the last two-way and the three-way comparison of measures. We will correlate the Berg-Rietz measures to the Zuckerman SSS subset responses and to the observed risk taking behavior in the market.

We anticipate that this research will be publishable in high quality economics, finance and

[18]Recently, concerns have been raised about the lack of direct participation of women and minorities in financial markets and under-investing by these groups (e.g., see Frisby, 1998).

[19]The IEM is currently enrolling a larger number of minority traders because of a grant from the U.S. Department of Education.

psychology journals. As noted above (e.g., footnote 1), the Zuckerman SSS has served as the basis for a great deal of published research in psychology. The IEM has also served as the basis for a variety of research in progress and research published in economics and political science journals. We anticipate that the original Berg-Rietz research will be publishable in an accounting, finance or economics journal. This measure is already being used by several other researchers who have contacted us for permission to use it.

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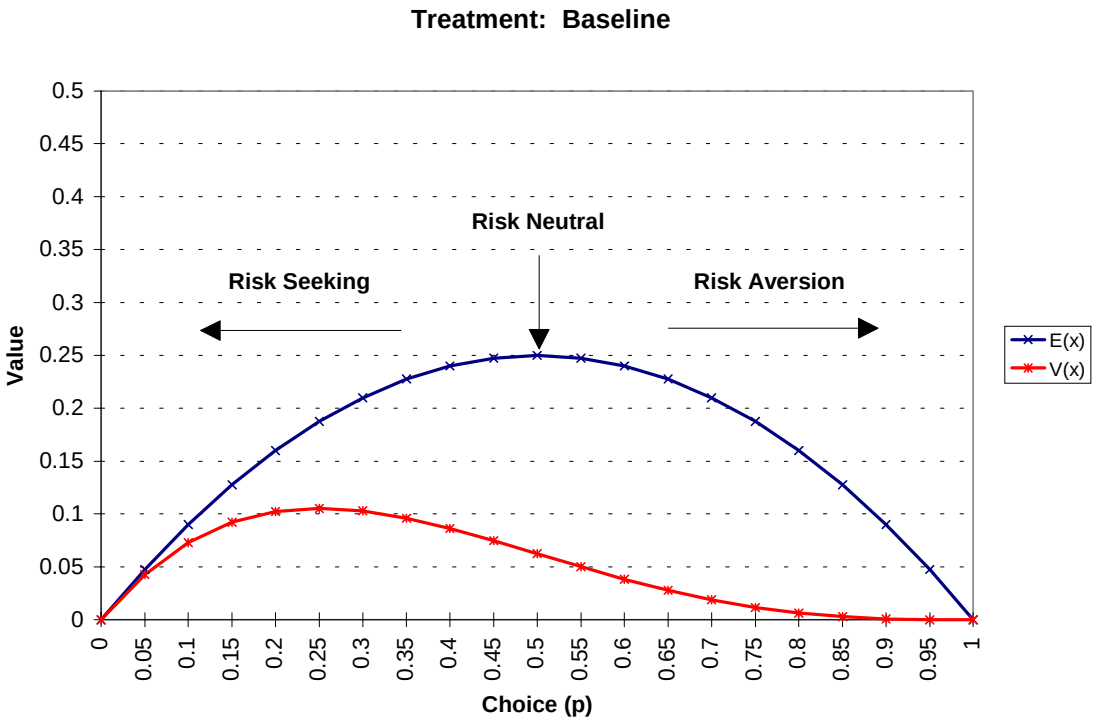

Figure 1: Expected Payoff and Standard Deviation in the Berg/Rietz Choice

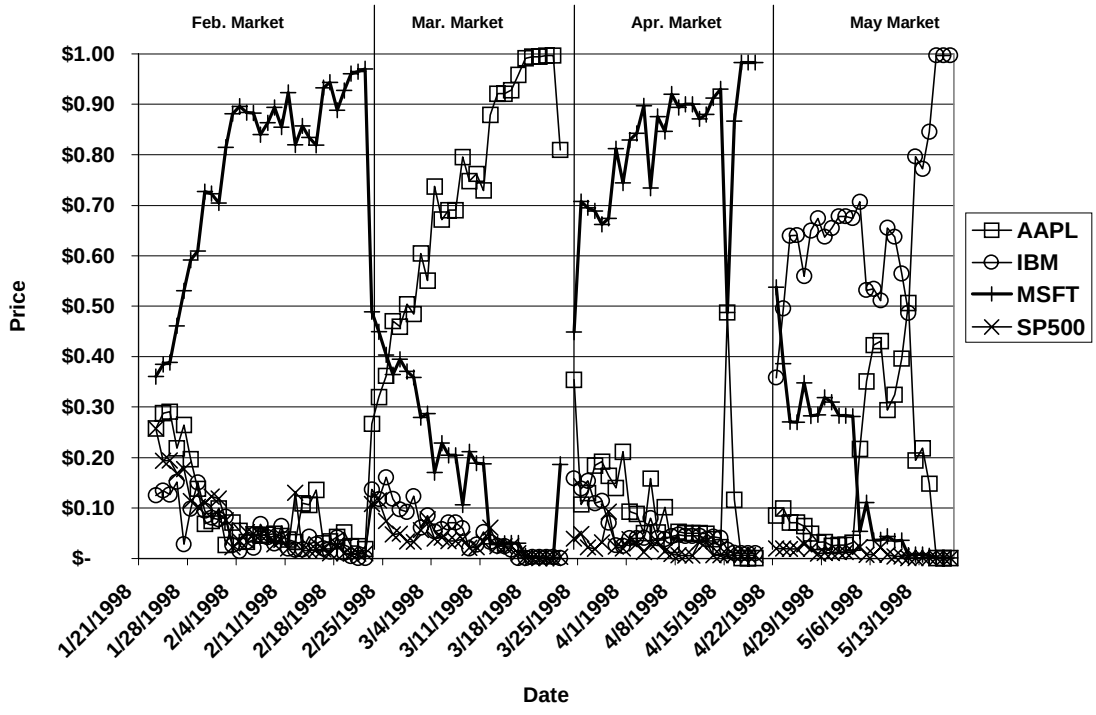

Figure 2: Prices in the Computer Industry Returns Markets

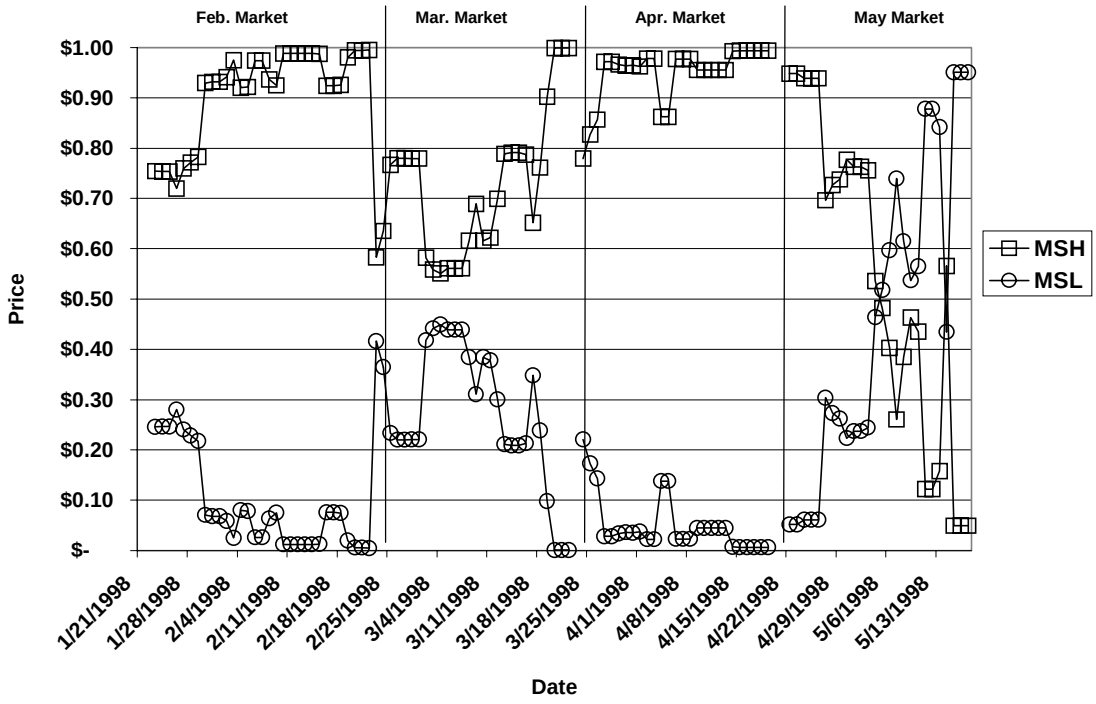

Figure 3; Prices in the Microsoft Price level Markets

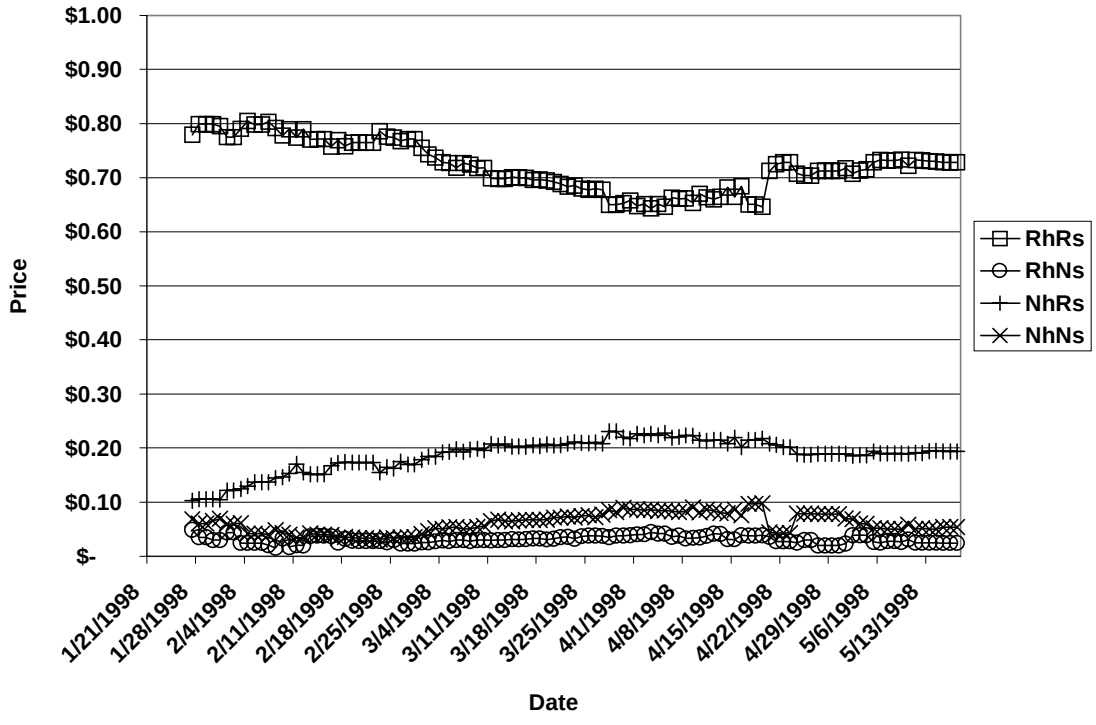

Figure 4: Prices in the Congressional Control Markets

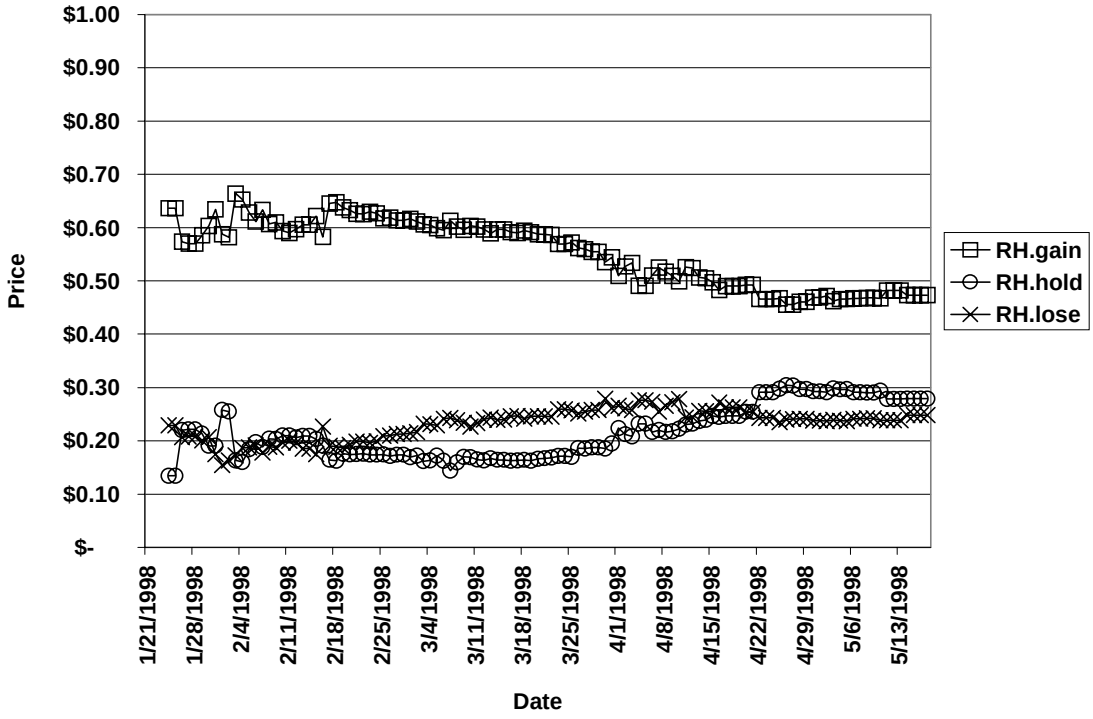

Figure 5: Prices in the House Control Market

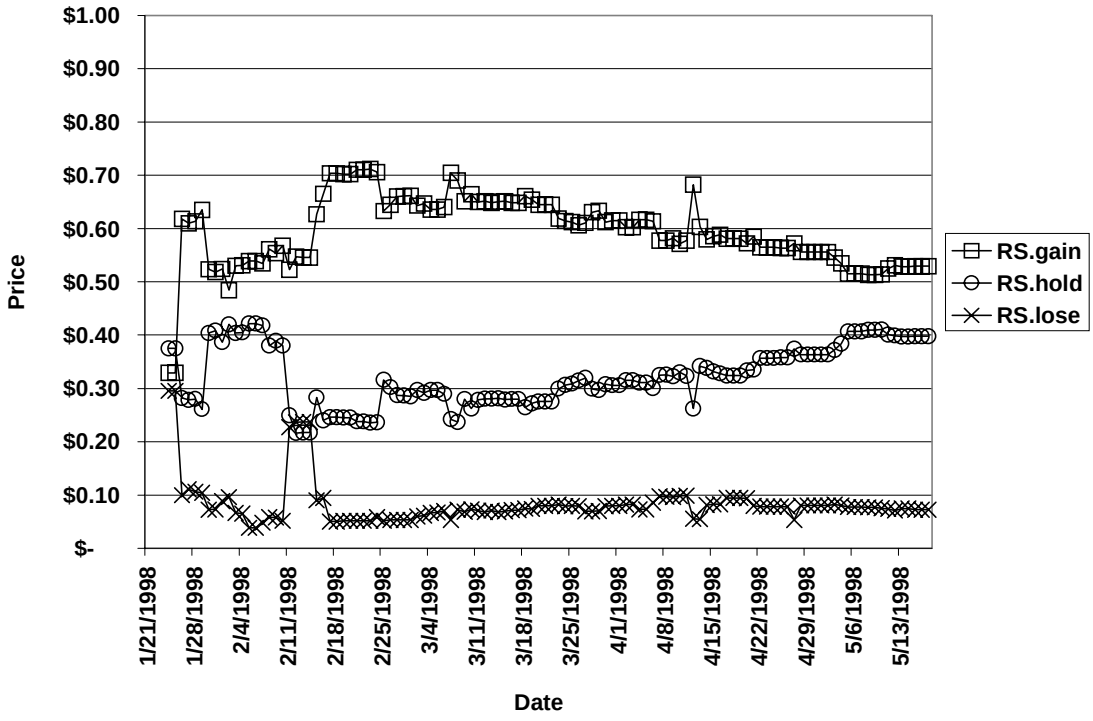

Figure 6: Prices in the Senate Control Market

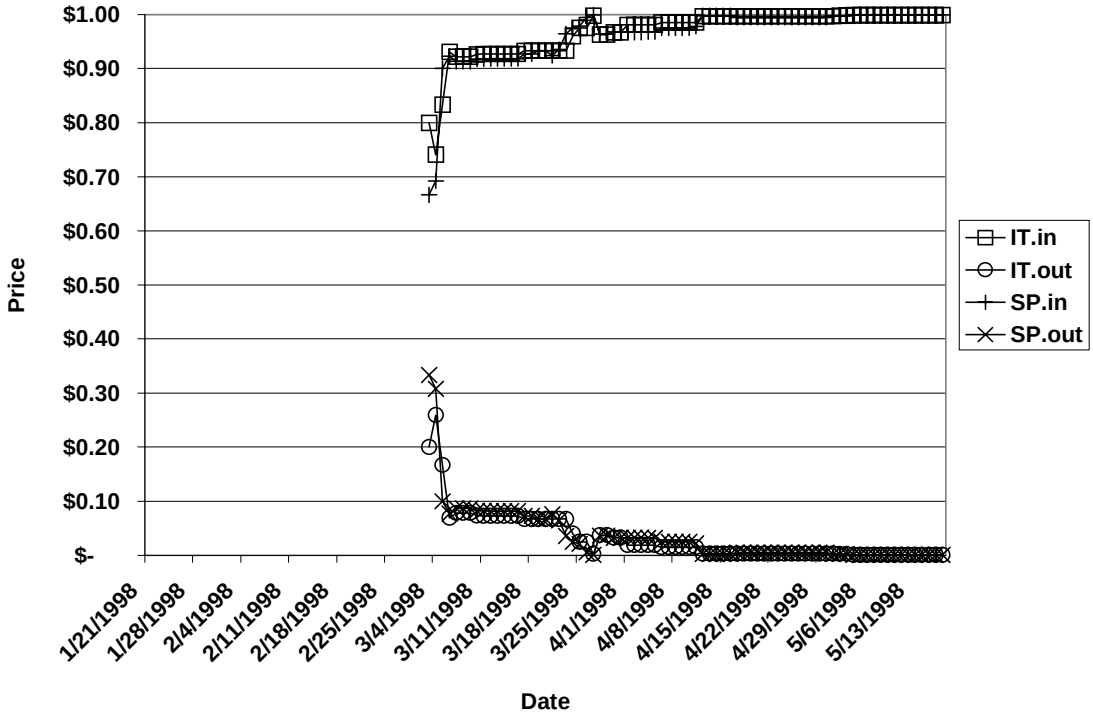

Figure 7: Prices in the Italy and Spain European Economic and Monetary Union Markets

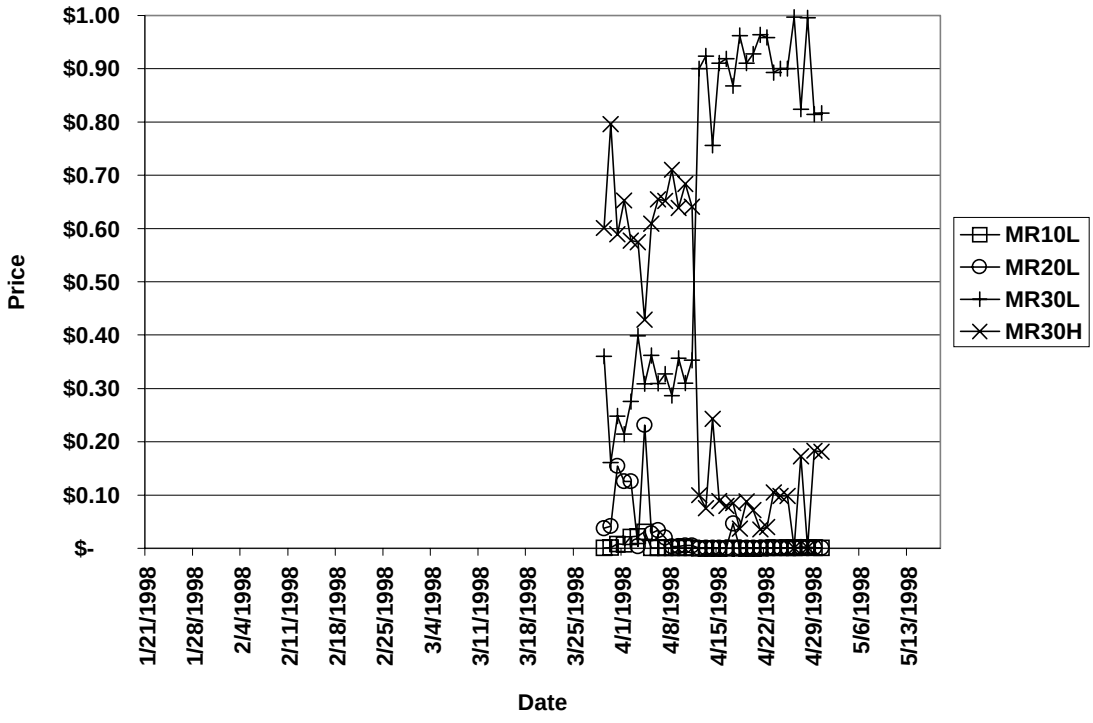

Figure 8: Prices in the Mercury Rising Movie Market

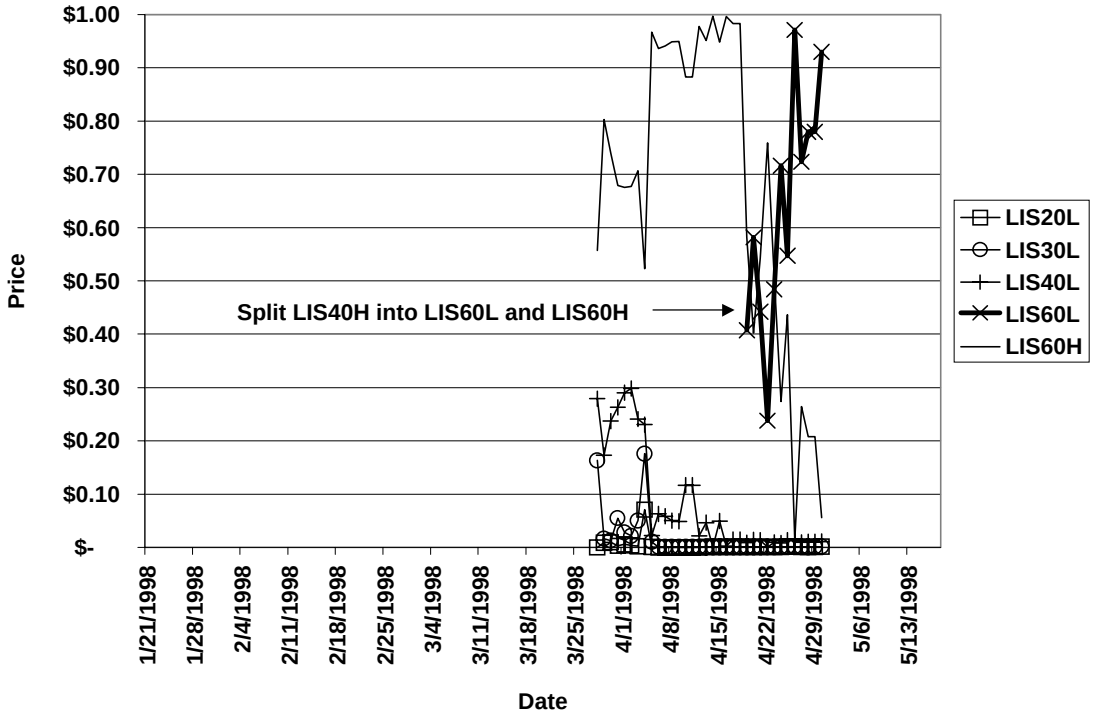

Figure 9: Prices in the Lost in Space Movie Market

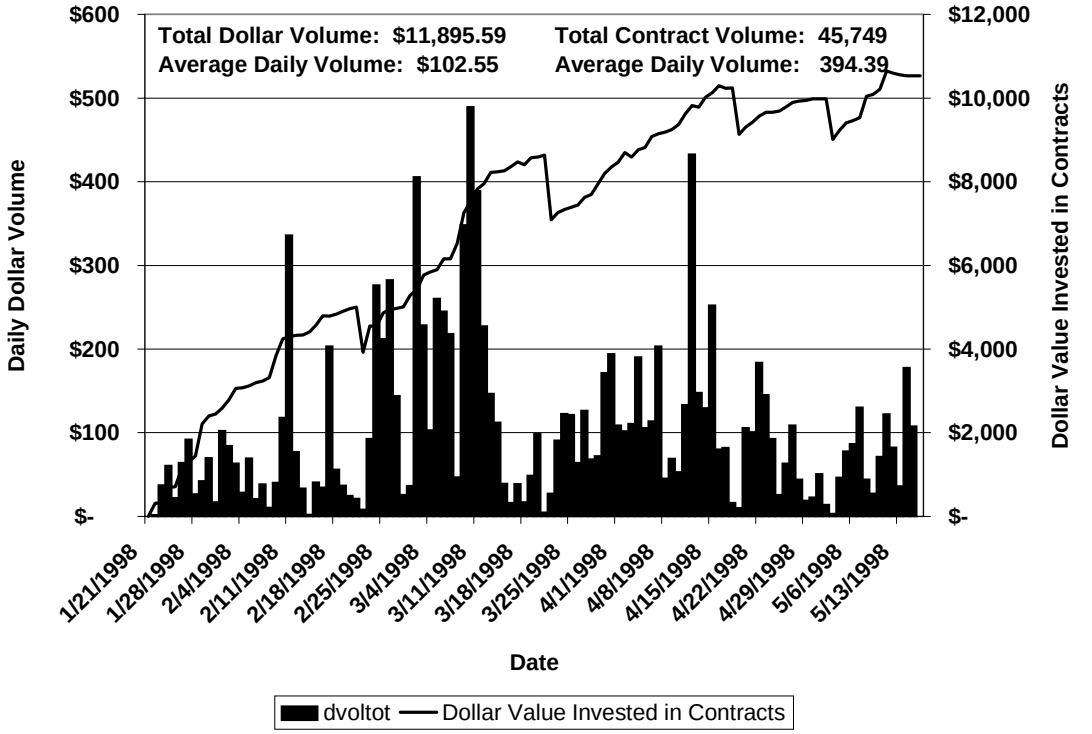

Figure 10: Daily Dollar Volumes and Daily Dollar Amounts Invested in Contracts (Marked to Market at Daily Closing Prices)

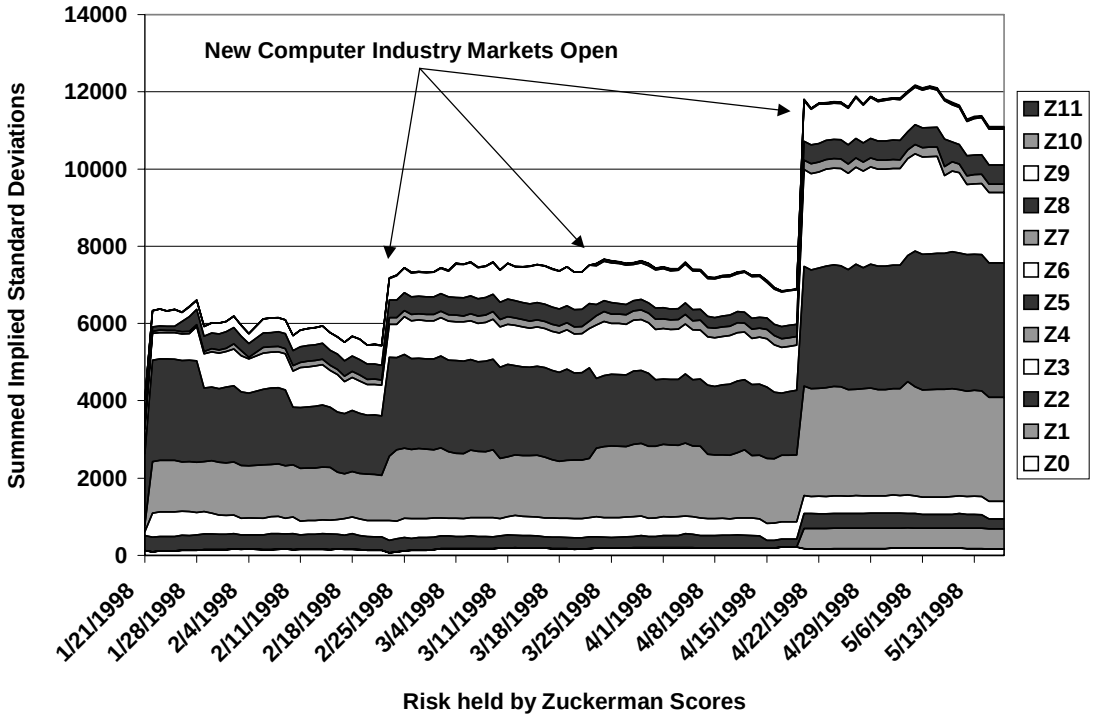

Figure 11: Summed Portfolio Standard Deviations Across all Markets

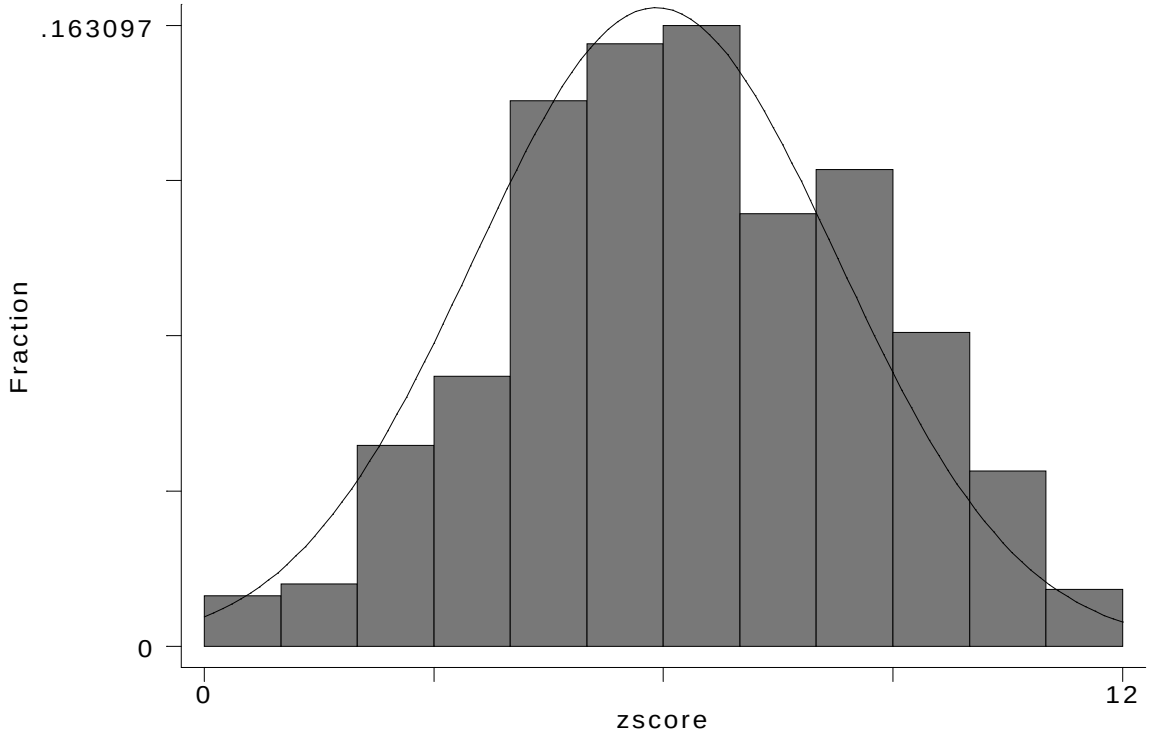

Figure 12: Histogram of Zuckerman Subset Scores for IEM Traders

Table 1: Berg/Rietz Payoff Table				
Cutoff Choice	Ticket ≥ Cutoff		Ticket < Cutoff	
	Payoff	Prob.	Payoff	Prob.
5	$0.25	0.95	$0.00	0.05
15	$0.75	0.85	$0.00	0.15
25	$1.25	0.75	$0.00	0.25
35	$1.75	0.65	$0.00	0.35
45	$2.25	0.55	$0.00	0.45
55	$2.75	0.45	$0.00	0.55
65	$3.25	0.35	$0.00	0.65
75	$3.75	0.25	$0.00	0.75
85	$4.25	0.15	$0.00	0.85
95	$4.75	0.05	$0.00	0.95

Table 2: IEM Market Summaries					
Market	Month	Trading Days	Total Volume	Total Dollar Volume	Winning Contract
Computer Industry Returns	Feb.	33	3579	$514.85	MSFTb
	Mar.	28	4486	$964.67	AAPLc
	Apr.	28	3310	$538.75	MSFTd
	May	28	2182	$614.48	IBMe
Microsoft Price Level	Feb.	33	462	173.73	MS135bH
	Mar.	28	945	494.44	MS080cH
	Apr.	28	670	134.96	MS080dH
	May	28	687	355.18	MS090eL
Congressional Control	–	114	11,104	2,287.06	RhRs
House Control	–	114	6,259	2,083.79	RH.Hold
Senate Control	–	114	7,180	2,248.09	RS.Hold
Italy EMU	–	65	394	156.73	IT.in
Spain EMU	–	65	782	271.87	SP.in
LIS Movie	–	45	1926	577.54	LIS60L
MR Movie	–	45	1783	469.46	MR30L

Table 3: Demographic Information

	Spring 1998 Participant Type*						Spring 1999 Partici-pants
	All Reg.	Active				SSS-V Resp.	
		Feb	Mar	Apr	May		
Total Number	909	144	229	285	161	596	247
Gender (%)							
Women	35.09	21.32	26.73	21.35	21.43	35.87	41.46
Men	64.91	78.68	73.27	78.65	78.57	64.13	58.54
Race (%)**							
Caucasian	74.57	80.15	86.98	78.29	84.87	75.98	60.00
African American	6.93	2.21	2.33	4.57	1.97	6.00	24.49
Other	18.50	17.64	10.69	17.14	13.16	18.02	15.51
Age							
Average	25.57	27.36	25.95	28.25	27.92	26.46	26
Std. Dev.	8.39	9.91	7.98	7.99	8.11	8.91	8.75
Annual Family Income (%)							
<$20,000	17.3	12.98	13.4	20.24	19.05	17.45	11.07
$20,000 to $35,000	11.49	12.21	10.53	10.71	12.93	12.18	16.39
$35,000 to $50,000	16.16	19.85	16.75	14.88	14.97	15.45	19.67
$50,000<	44.32	45.80	48.8	45.24	43.54	44.18	45.90
Don't know	10.73	9.16	10.53	8.93	9.52	10.73	6.97
Education (%)							
High School	60.57	52.67	60.19	34.88	37.16	58.05	61.73
Bachelor's/Associate's	17.16	16.03	16.11	27.91	26.65	17.73	20.99
Master's	9.33	11.45	9.95	15.7	16.22	10.31	7.41
Doctorate	8.33	14.5	9.48	16.86	14.19	9.76	7.82
Other	4.6	5.34	4.27	4.65	6.08	4.16	2.06
Major (%)							
Business/Economics	65.26	57.14	64.95	59.20	57.72	62.34	76.15
Other or Not a student	34.74	42.86	35.05	40.80	42.28	37.66	23.85
Participation Required? (%)							
Yes	73.51	57.46	64.79	52.60	51.35	68.54	71.61
No	11.19	17.91	17.37	21.39	23.25	13.02	16.95
Not a student	15.3	24.63	17.84	26.01	25.00	18.44	11.44

*Participant types are:
All registered participants have accounts
Active participants logged into their accounts during each trading month.
Zuckerman Respondents also responded to the Zuckerman Sensation Seeking Subscale.

**The dramatic shift in race in the Spring 1999 data results from an outreach program to minority institutions.

Table 4: Full Zuckerman SSS-V and Berg-Rietz Measures in the Laboratory			
	All Subjects	Men	Women
Number of Subjects	257	142	115
Berg-Rietz Measures			
Mean	51.0	59.3	46.1
Std. Dev.	27.5	21.3	20.7
Zuckerman SSS-V Scores			
Total	19.0	20.1	17.6
TAS	6.9	7.3	6.4
Dis	4.4	4.9	4.1
BS	3.0	3.3	2.7
ES	4.8	4.6	5.0
Correlations			
Total	0.297**	0.256**	0.250**
TAS	0.247**	0.225**	0.184**
Dis	0.221**	0.121	0.293**
BS	0.181**	0.213**	0.148
ES	0.153**	0.096	0.102

** Significant at the 95% level of confidence.

Table 5: Full Zuckerman SSS-V and Berg-Rietz Measures from the IEM

	All Subjects	Men	Women
Number of Subjects	243	101	70
Berg-Rietz Measures			
Mean	55.3	54.0	54.1
Std. Dev.	18.7	16.4	19.4
Zuckerman SSS-V Scores			
Total	18.6	19.5	16.7
TAS	6.2	6.2	5.7
Dis	4.5	4.6	3.8
BS	3.1	3.7	2.5
ES	4.8	5.0	4.7
Correlations			
Total	0.11*	0.09	0.14
TAS	0.04	-0.10	0.14
Dis	0.07	0.17*	-0.04
BS	0.12*	0.17*	0.17
ES	0.07	0.05	0.14

*Significant at the 90% level of confidence.
**Significant at the 95% level of confidence.

Table 6: Zuckerman SSS-V Subset Scores and Berg-Rietz Measures in the Laboratory			
	All Subjects	Men	Women
Number of Subjects	257	142	115
Berg-Rietz Measures			
Mean	51.0	59.3	46.1
Std. Dev.	27.5	21.3	20.7
Zuckerman SSS-V Subset Scores			
Total	5.4	5.8	5.0
TAS	2.0	2.1	1.9
Dis	1.5	1.6	1.4
BS	1.1	1.2	1.0
ES	0.8	1.0	0.7
Correlations			
Total	0.136*	0.120	0.068
TAS	0.124*	0.081	0.129
Dis	0.077	0.081	0.001
BS	0.042	0.003	0.044
ES	0.090	0.055	0.055

*Significant at the 95% level of confidence.

Table 7: IEM SSS Subset Summary					
Scale	Participants			Men versus Women	
	All	Men	Women	t-test	χ^2-test
subTAS					
mean	1.958	1.989	1.859	1.4146	5.3143
std dev	(1.009)	(0.997)	(1.036)	(0.1578)	(0.150)
no obs	572	353	184		
subES					
mean	1.781	1.858	1.624	2.961*	9.7300*
std dev	(0.874)	(0.801)	(0.899)	(0.003)	(0.021)
no obs	544	359	186		
subDis					
mean	1.272	1.291	1.257	0.3637	7.9102*
std dev	(1.007)	(0.976)	(1.060)	(0.7162)	(0.048)
no obs	526	344	179		
subBS					
mean	0.885	0.850	0.972	- 1.6616	3.8756
std dev	(0.804)	(0.801)	(0.822)	0.0972	0.275
no obs	556	359	180		
subTotal					
mean	5.915	6.040	5.700	1.6709	51.3614*
std dev	(2.319)	(2.212)	(2.448)	(0.0953)	(0.028)
no obs	582	365	196		

Table 8: t-Tests for differences in subset scores				
	subTAS	subES	subDis	subBS
subTAS	—	3.510*	11.756*	20.898*
subES	—	—	9.196*	19.514*
subDis	—	—	—	7.248*
subBS	—	—	—	—

*Significant at the 95% level of confidence.

Table 9: Factor Analysis of Zuckerman Subset Responses
(obs=507)

Panel A: Principal Factors
(Four Factors Retained)

Factor	Eigenvalue	Difference	Proportion	Cumulative
1	1.22009	0.78631	1.0545	1.0545
2	0.43377	0.14996	0.3749	1.4293
3	0.28382	0.13719	0.2453	1.6746
4	0.14663	0.16195	0.1267	1.8014
5	-0.01532	0.03508	-0.0132	1.7881
6	-0.05039	0.01960	-0.0436	1.7446
7	-0.06999	0.01975	-0.0605	1.6841
8	-0.08974	0.01988	-0.0776	1.6065
9	-0.10962	0.03783	-0.0947	1.5118
10	-0.14746	0.04097	-0.1274	1.3843
11	-0.18843	0.06785	-0.1628	1.2215
12	-0.25628	.	-0.2215	1.0000

Panel B: Rotated Factor Loadings
(Orthogonal Rotation)

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Uniqueness
Resp. 1	-0.25431	0.00087	0.07397	0.14921	0.90759
Resp. 2	0.45280	0.00447	0.19272	0.08745	0.75016
Resp. 3	0.15728	-0.04181	0.20467	0.28928	0.84794
Resp. 4	0.46071	0.10780	0.16729	0.01979	0.74775
Resp. 5	0.06582	0.11462	-0.02676	0.25067	0.91898
Resp. 6	0.16220	0.26898	0.33865	0.00512	0.78663
Resp. 7	0.17271	0.06776	0.32714	0.10060	0.84844
Resp. 8	0.14080	0.10389	0.36244	0.02393	0.83745
Resp. 9	0.43675	0.09908	-0.04836	-0.00437	0.79708
Resp. 10	0.04056	0.46693	0.03886	-0.01284	0.77866
Resp. 11	0.03666	0.28773	0.11345	-0.11832	0.88900
Resp. 12	0.11975	0.40463	0.10430	0.07098	0.80602

Table 10: Average Portfolio Statistics and Rank Sum Statistics for Active* Participants in Each Month

Item	Month	Stat.	Active Participants: All	Active Participants: SSS Subset Resp.	Active Participants: Rank Sum z-Stat (Prob.)	Active SSS Subset Respondents: Low subTot (≤4)	Active SSS Subset Respondents: High subTot (≥8)	Active SSS Subset Respondents: Rank Sum z-Stat (Prob.)
Average Portfolio Value for Active Participants	Feb.	No.	233	108	-5.190**	32	32	0.593
		Mean	55.72	98.71	0.0000	94.83	87.07	(0.5530)
		Std. Dev.	163.50	228.99		154.29	237.40	
	Mar.	No.	388	165	-4.142**	49	51	1.093
		Mean	50.84	78.43	(0.0000)	76.80	61.53	(0.2744)
		Std. Dev.	160.08	193.72		128.11	197.37	
	Apr.	No.	276	139	-4.595**	38	42	1.098
		Mean	64.56	91.38	(0.0000)	98.52	77.18	(0.272)
		Std. Dev.	171.47	219.97		141.90	236.03	
	May	No.	243	116	-4.345**	34	33	2.333**
		Mean	78.12	122.28	(0.0000)	148.58	72.34	(0.0197)
		Std. Dev.	199.44	254.99		182.87	247.93	
Ex-Post Daily Standard Deviation in Portfolio Value	Feb.	No.	233	108	-2.328**	32	32	2.006**
		Mean	1.13	1.87	0.0199	2.44	1.17	(0.0448)
		Std. Dev.	3.48	4.80		4.01	3.18	
	Mar.	No.	388	165	-3.011**	49	51	1.431**
		Mean	9.37	14.01	(0.0026)	15.24	10.23	0.1525
		Std. Dev.	30.96	34.72		25.26	29.06	
	Apr.	No.	276	139	-3.080**	38	42	-0.904
		Mean	1.90	2.23	(0.0021)	2.41	2.200	(0.3659)
		Std. Dev.	6.61	5.67		6.03	6.37	
	May	No.	243	116	-4.224**	34	33	2.295**
		Mean	16.11	25.00	(0.0000)	30.96	15.25	(0.0217)
		Std. Dev.	40.16	51.35		37.37	50.36	

Table 10: Average Portfolio Statistics and Rank Sum Statistics for Active* Participants in Each Month

			Active Participants			Active SSS Subset Respondents		
Item	Month	Stat.	All	SSS Subset Resp.	Rank Sum z-Stat (Prob.)	Low subTot (≤4)	High subTot (≥8)	Rank Sum z-Stat (Prob.)
Average Implied Daily Risk Summed Across All Markets	Feb.	No. Mean Std. Dev.	233 0.304 0.917	108 0.383 1.146	-0.837 (0.4027)	32 0.608 1.579	32 0.202 0.705	2.010** (0.0445)
	Mar.	No. Mean Std. Dev.	388 0.262 0.844	165 0.303 0.813	0.297 (0.7667)	49 0.403 0.922	51 0.275 1.028	0.173 (0.8630)
	Apr.	No. Mean Std. Dev.	276 0.319 0.940	139 0.403 1.076	-3.117** (0.0018)	38 0.610 1.498	42 0.376 1.100	-0.228 (0.8195)
	May	No. Mean Std. Dev.	243 0.489 1.335	116 0.730 1.735	-5.456** (0.0000)	34 0.847 1.740	33 0.769 2.298	0.019 (0.9849)
Average Implied Risk to Liquidation Summed Across All Markets	Feb.	No. Mean Std. Dev.	233 6.00 19.95	108 10.05 27.28	-2.317** (0.0205)	32 10.19 20.68	32 10.88 37.22	2.023** (0.0430)
	Mar.	No. Mean Std. Dev.	388 11.58 50.75	165 20.12 69.23	-3.629** (0.0003)	49 24.42 60.51	51 18.33 89.69	0.918 (0.3588)
	Apr.	No. Mean Std. Dev.	276 20.11 81.80	139 29.16 95.23	-4.014** (0.0001)	38 39.534 81.321	42 28.832 127.648	0.160 (0.8727)
	May	No. Mean Std. Dev.	243 25.25 88.64	116 41.09 105.44	-6.251** (0.0000)	34 56.52 99.24	33 36.50 132.12	0.460 (0.6456)

Table 10: Average Portfolio Statistics and Rank Sum Statistics for Active* Participants in Each Month

Item	Month	Stat.	Active Participants			Active SSS Subset Respondents		
			All	SSS Subset Resp.	Rank Sum z-Stat (Prob.)	Low subTot (≤4)	High subTot (≥8)	Rank Sum z-Stat (Prob.)
Ratio of Average Implied Risk to Liquidation to Average Portfolio Value	Feb.	No.	233	108	-0.259 (0.7960)	32	32	1.602 (0.1091)
		Mean	0.11340.	0.1214		0.1188	0.1058	
		Std. Dev.	1940	0.2277		0.1757	0.2003	
	Mar.	No.	387	165	-1.794 (0.0728)	49	51	0.659 (0.5099)
		Mean	0.165	0.199		0.236	0.183	
		Std. Dev.	0.285	0.327		0.411	0.262	
	Apr.	No.	275	139	-2.769** (0.0056)	38	42	-1.568 (0.1186)
		Mean	0.216	0.247		0.232	77.176	
		Std. Dev.	0.301	0.285		0.287	236.03	
	May	No.	243	116	-5.500** (0.0000)	34	33	-1.392 (0.1639)
		Mean	0.238	0.340		0.287	0.446	
		Std. Dev.	0.385	0.460		0.362	0.568	
Annualized Portfolio Return	Feb.	No.	224	104	-1.662 (0.0966)	32	29	-0.978 (0.3280)
		Mean	-0.330	-0.1955		-0.5332	0.2105	
		Std. Dev.	1.736	1.8580		2.3297	0.9261	
	Mar.	No.	344	150	-1.065 (0.2869)	45	45	-0.727 (0.4674)
		Mean	-0.6201	-0.4068		-0.4695	-0.0565	
		Std. Dev.	2.9559	2.6023		2.5156	2.1517	
	Apr.	No.	275	139	-1.502 (0.1331)	38	42	-0.117 (0.9071)
		Mean	0.0497	0.1120		-0.0401	0.1694	
		Std. Dev.	4.8278	4.3659		2.5824	6.5132	
	May	No.	243	116	-0.442 (0.6582)	34	33	-1.306 (0.1914)
		Mean	13.1191	27.2507		0.1354	-0.1987	
		Std. Dev.	203.014	293.7958		2.9894	4.6869	
	Overall	No.	651	244	-1.158 (0.2470)	65	74	-0.334 (0.7386)
		Mean	0.0514	-0.2556		-0.2698	-0.3798	
		Std. Dev.	5.4659	2.5778		2.6436	3.1580	

*Active participants are those who logged in at least once during the trading month.
**Significant at the 95% level of confidence.
***Significant at the 90% level of confidence.

Table 11: Bootstrapped MAD Regression Estimates for Portfolio Characteristics and Zuckerman Subset Scores

Characteristic	Month	No of Obs (Total/Subscale Regressions)	Stat	Total Subset Regression Coefficients			Subscale Regression Coefficients					
				Gender	subTot	Const.	Gender	subTAS	subDis	subBS	subES	Const
Average Portfolio Value for Active Participants	Feb.	108/89	Est	0.664	-0.000	10.002**	5.405	-5.731	1.782	-0.300	1.866	18.030
			T-Stat	0.104	-0.001	2.192	0.478	-0.763	0.374	-0.039	0.335	0.892
			(Prob.)	(0.918)	(1.000)	(0.031)	(0.634)	(0.448)	(0.709)	(0.969)	(0.739)	(0.375)
	Mar.	165/137	Est	0.980	-0.017	9.627**	6.555	-4.931	0.932	-0.389	2.557	14.541
			T-Stat	0.225	-0.098	7.610	1.205	-1.084	0.534	-0.143	0.884	1.529
			(Prob.)	(0.822)	(0.922)	(0.000)	(0.231)	(0.280)	(0.594)	(0.887)	(0.378)	(0.129)
	Apr.	139/122	Est	2.528	-0.076	10.463**	4.743	-4.400	-0.198	-2.340	4.777	13.875
			T-Stat	0.579	-0.086	2.014	0.839	-0.743	-0.085	-0.593	1.041	1.038
			(Prob.)	(0.563)	(0.932)	(0.046)	(0.403)	(0.459)	(0.933)	(0.554)	(0.300)	(0.301)
	May	116/98	Est	13.883	-1.967	20.900	10.141	-14.44	-0.594	-1.520	4.302	39.141
			T-Stat	0.721	-0.386	0.768	0.699	-1.005	-0.105	-0.204	0.604	1.055
			(Prob.)	(0.472)	(0.700)	(0.444)	(0.486)	(0.318)	(0.917)	(0.839)	(0.548)	(0.294)
Ex-Post Daily Standard Deviation in Portfolio Value	Feb.	108/89	Est	0.235**	-0.008	0.066	0.208	-0.083	-0.002	0.050	0.023	0.156
			T-Stat	2.257	-0.248	0.272	1.175	-0.733	-0.033	0.582	0.230	0.401
			(Prob.)	(0.026)	(0.805)	(0.786)	(0.243)	(0.466)	(0.974)	(0.562)	(0.819)	(0.690)
	Mar.	165/137	Est	0.183	-0.004	1.918**	0.671	-0.414	0.024	0.105	0.185	2.300
			T-Stat	0.283	-0.095	5.669	0.771	-0.559	0.081	0.230	0.387	1.384
			(Prob.)	(0.778)	(0.925)	(0.000)	(0.442)	(0.577)	(0.935)	(0.819)	(0.699)	(0.169)
	Apr.	139/122	Est	0.344	0.090	-0.268	0.557**	0.038	-0.005	-0.245	0.231	-0.265
			T-Stat	1.345	1.134	-0.788	2.214	0.327	-0.036	-1.302	1.327	-0.682
			(Prob.)	(0.181)	(0.259)	(0.432)	(0.029)	(0.744)	(0.972)	(0.196)	(0.187)	(0.497)
	May	116/98	Est	2.892	-0.200	3.097	3.350	-2.679	0.080	-1.439	2.174	5.497
			T-Stat	0.714	-0.184	0.545	1.243	-1.037	0.073	-0.906	1.351	0.814
			(Prob.)	(0.477)	(0.855)	(0.587	(0.217)	(0.302)	(0.942)	(0.367)	(0.180)	(0.418)

Table 11: Bootstrapped MAD Regression Estimates for Portfolio Characteristics and Zuckerman Subset Scores

Characteristic	Month	No of Obs (Total/Subscale Regressions)	Stat	Total Subset Regression Coefficients			Subscale Regression Coefficients					
				Gender	subTot	Const.	Gender	subTAS	subDis	subBS	subES	Const
Average Implied Daily Risk Summed Across All Markets	Feb.	104/89	Est	0.048**	-0.003	-0.020	0.033	-0.010	-0.008	-0.001	-0.020	0.047
			T-Stat	2.135	-0.594	-0.394	1.052	-0.533	-0.584	-0.073	-1.037	0.762
			(Prob.)	(0.035)	(0.554)	0.695	(0.296)	(0.595)	(0.561)	(0.942)	(0.303)	(0.448)
	Mar.	156/137	Est	0.017	0.002	0.020	0.041	0.008	0.016	-0.013	0.009	-0.056
			T-Stat	0.619	0.384	0.390	1.407	0.460	1.145	-0.607	0.518	-1.000
			(Prob.)	(0.537)	(0.701)	(0.697)	0.162	0.646	(0.254)	(0.545)	(0.606)	0.319
	Apr.	134/122	Est	0.082**	0.002	-0.073	0.086**	0.004	0.002	-0.032	0.042**	-0.134**
			T-Stat	2.714	0.185	-1.642	2.762	0.226	0.153	-1.462	2.525	-2.074
			(Prob.)	(0.008)	(0.854)	0.103	(0.007)	(0.821)	(0.878)	(0.146)	(0.013)	(0.040)
	May	109/98	Est	0.163*	-0.012	-0.040	0.154	-0.038	-0.006	0.004	0.040	-0.066
			T-Stat	1.857	-0.405	-0.348	1.464	-0.602	-0.119	0.068	0.452	-0.306
			(Prob.)	(0.066)	(0.686)	(0.728)	(0.147)	(0.548)	(0.905)	(0.946)	(0.652)	(0.761)
Average Implied Risk to Liquidation Summed Across All Markets	Feb.	108/89	Est	0.650	-0.059	0.469	0.832	-0.753	-0.219	0.461	-0.040	2.205
			T-Stat	0.752	-0.282	0.325	0.673	-1.035	-0.415	0.537	-0.075	1.055
			(Prob.)	(0.454)	(0.778)	(0.746)	(0.503)	(0.304)	(0.679)	(0.593)	(0.941)	(0.294)
	Mar.	165/137	Est	1.255**	-0.066	0.830	1.501**	-0.209	-0.084	-0.548	0.508	0.710
			T-Stat	2.017	-0.703	1.117	2.488	-0.611	-0.322	-0.944	1.327	0.686
			(Prob.)	(0.045)	(0.483)	(0.266)	(0.014)	(0.542)	(0.748)	(0.347)	(0.187)	(0.494)
	Apr.	139/122	Est	2.012**	0.093	-0.245	1.493	0.227	0.105	-0.088	1.016	-1.570
			T-Stat	2.347	0.430	-0.234	1.642	0.384	0.212	-0.113	1.815	-0.925
			(Prob.)	(0.020)	(0.668)	(0.816)	(0.103)	(0.702)	(0.832)	(0.910)	(0.072)	(0.357)
	May	116/98	Est	3.631	-0.264	1.648	3.318	-1.288	0.168	-0.911	1.159	1.874
			T-Stat	1.559	-0.449	0.489	1.094	-0.472	0.105	-0.402	0.548	0.265
			(Prob.)	(0.122)	(0.654)	(0.626)	(0.277)	(0.638)	(0.917)	(0.689)	(0.585)	(0.791)

Table 11: Bootstrapped MAD Regression Estimates for Portfolio Characteristics and Zuckerman Subset Scores

Characteristic	Month	No of Obs (Total/Subscale Regressions)	Stat	Total Subset Regression Coefficients			Subscale Regression Coefficients					
				Gender	subTot	Const.	Gender	subTAS	subDis	subBS	subES	Const
Ratio of Average Implied Risk to Average Portfolio Value	Feb.	108/89	Est	0.050**	-0.000	0.000	0.037	-0.024	-0.003	-0.003	0.007	0.059
			T-Stat	2.331	-0.009	0.013	1.613	-1.591	-0.282	-0.234	0.562	1.299
			(Prob.)	0.022	(0.993)	(0.990)	(0.110)	(0.115)	(0.778)	(0.815)	(0.576)	(0.198)
	Mar.	165/137	Est	0.031	-0.008	0.108**	0.067	0.011	-0.007	-0.024	0.003	0.038
			T-Stat	1.187	-1.848	2.778	1.781	0.497	-0.420	-0.872	0.173	0.731
			(Prob.)	(0.237)	(0.067)	(0.006)	(0.077)	(0.620)	(0.675)	(0.385)	(0.863)	(0.466)
	Apr.	139/122	Est	0.107**	0.016	-0.036	0.115	0.039	0.011	0.017	0.076**	-0.165
			T-Stat	2.094	0.998	-0.533	1.972	1.291	0.377	0.354	2.205	-1.732
			(Prob.)	(0.038)	(0.320)	(0.595)	(0.051)	(0.199)	(0.707)	(0.724)	(0.029)	(0.086)
	May	116/98	Est	0.179**	-0.000	0.030	0.156	-0.059	0.075	-0.040	0.072	0.009
			T-Stat	3.104	-0.009	0.335	1.665	-1.102	1.340	-0.625	1.036	0.054
			(Prob.)	(0.002)	(0.993)	(0.738)	(0.099)	(0.273)	(0.184)	(0.534)	(0.303)	(0.957)

*Significant at the 95% level of confidence.

Appendix

Demographic Survey

Introductory Text

Demographic Survey

We would like you to answer a few (10) questions about your demographic characteristics.

You may skip any question by pressing **Enter** before typing a response to the question. And you may cancel the survey at any time by pressing "Esc".

If you are willing to answer this survey now, enter **Y**; otherwise, enter **N**. If you enter N, you will be given up to two more chances to respond in later sessions.

Questions:

1. In which state do you currently reside?

2. What is your gender? (1=Female, 2=Male)

3. What is your race?
    1. White, not of Hispanic origin
    2. Black, not of Hispanic origin
    3. Hispanic
    4. Asian or Pacific Islander
    5. American Indian or Alaskan native
    6. Other

4. In which country do you hold citizenship?

5. How old are you?

6. What is your best estimate of your family's annual income?
    1. Less than $20,000 per year.
    2. Between $20,000 and $35,000 per year.
    3. Between $35,000 and $50,000 per year.
    4. More than $50,000 per year.
    5. Don't know.

6. What is the highest educational degree you have achieved?
    1. High School
    2. Bachelor's
    3. Master's
    4. Doctorate
    5. Other

8. What is your current university status?
    1. Freshman
    2. Sophomore
    3. Junior
    4. Senior
    5. MA/MBA candidate
    6. Law or Medical student
    7. Ph.D. candidate
    8. Faculty
    9. Staff
    10. Other

9. If you are a student, what is your major?
    1. Business
    2. Social Science
    3. Humanities
    4. Natural Science
    5. Mathematics or Engineering
    6. Other
    7. Not a student

10. If you are a student, were you required to participate in these markets as part of a class?
    1. Yes
    2. No
    3. Not a student

Zuckerman SSS Subscale

Introductory Text

Self-Description Survey

We would like you to answer a few (14) questions to help us better understand aspects of people's decision making in the IEM.

Once you begin the survey, you may cancel it at any time by pressing "Esc".

If you are willing to answer this survey now, enter **Y**; otherwise, enter **N**. If you enter N, you will be given up to four more chances to respond in later sessions.

Instructions

Each of the following questions contains pairs of choices.

Please pick the choice that most describes your likes or the way you feel. You may find questions in which both choices describe your likes or feelings. Please choose the one that better describes your likes or feelings.

There are no right or wrong answers.

Do you understand these instructions? (Enter "Y" or "N")

Questions:

1. Which choice most describes your likes or the way you feel?
   1. There are some movies I enjoy seeing a second or even a third time.
   2. I can't stand watching a movie that I've seen before.

2. Which choice most describes your likes or the way you feel?
   1. I often wish I could be a mountain climber.
   2. I can't understand people who risk their necks climbing mountains.

3. Which choice most describes your likes or the way you feel?
   1. I like to explore a strange city or section of town by myself, even if it means getting lost.
   2. I prefer a guide when I am in a place I don't know well.

4. Which choice most describes your likes or the way you feel?
   1. A sensible person avoids activities that are dangerous.
   2. I sometimes like to do things that are a little frightening.

5. Which choice most describes your likes or the way you feel?
   1. I like to try new foods that I have never tasted before.
   2. I order the dishes with which I am familiar, so as to avoid disappointment and unpleasantness.

6. Which choice most describes your likes or the way you feel?
   1. I prefer friends who are excitingly unpredictable.
   2. I prefer friends who are reliable and predictable.

7. Which choice most describes your likes or the way you feel?*
   1. The essence of good art is in its clarity, symmetry of form and harmony of colours.
   2. I often find beauty in the clashing of colours and irregular forms of modern paintings.

8. Which choice most describes your likes or the way you feel?
    1. I enjoy spending time in the familiar surroundings of home.
    2. I get very restless if I have to stay around home for any length of time.

9. Which choice most describes your likes or the way you feel?
    1. I like to dive off the high board.
    2. I don't like the feeling I get standing on the high board (or I don't go near it at all).

10. Which choice most describes your likes or the way you feel?
    1. I like to date members of the opposite sex who are physically exciting.
    2. I like to date members of the opposite sex who share my values.

11. Which choice most describes your likes or the way you feel?
    1. Even if I had the money I would not care to associate with flighty rich people like those in the jet-set.
    2. I could conceive of myself seeking pleasures around the world with the jet-set.

12. Which choice most describes your likes or the way you feel?
    1. I feel best after taking a couple of drinks.
    2. Something is wrong with people who need liquor to feel good.

13. If you are a student, were you required to participate in these markets as part of a class?
    1. Yes
    2. No
    3. Not a student

14. What is your gender?
    1. Female
    2. Male

IEM SSS Subset Question Correspondence to Zuckerman SSS-V and Scoring Key

Subset Question Number	SSS-V Question Number	Standard SSS-V Subscale	Score +1 If Resp. is:	Subset Question Number	SSS-V Question Number	Standard SSS-V Subscale	Score +1 If Resp. is:
1	2	BS	2	7	26	ES	2
2	3	TAS	1	8	27	BS	2
3	6	ES	1	9	28	TAS	1
4	11	TAS	2	10	29	Dis	1
5	14	ES	1	11	33	Dis	2
6	24	BS	1	12	36	Dis	1

IEM PROSPECTUS: WINNER-TAKES-ALL RETURNS CONTRACTS

This document describes generic winner-takes-all returns contracts available on the IEM. Except as specified in this prospectus, trading rules for these contracts are the same as those specified in the Trader's Manual for the Iowa Electronic Market. Information about specific winner-takes-all returns contracts can be accessed through the IEM information windows.

CONTRACTS--Contracts in winner-takes-all rate of return markets have liquidation values determined by relative rates of return measured over a horizon specified by the contracts. Typically, returns for several companies stocks and one or more stock indices are compared to each other over the horizon. Generally, returns for companies will be dividend adjusted common stock returns while returns for indices will consist only of capital gains returns as specified below. The contract corresponding to the company or index with the highest return over the horizon receives a positive payoff. All other securities have zero payoffs. (See note 1 below.)

Contracts are designated by ticker symbols and other unique identifying items if necessary. A typical set of contracts will be

Contract	Underlying Fundamental	Liquidation Value
ABC	ABC Corp. Stock	$1.00 if ABC return is highest
XYZ	XYZ Corp. Stock	$1.00 if XYZ return is highest
SP500	S&P 500 Market Index	$1.00 if SP500 return is highest

COMPUTING RETURNS--For contracts corresponding to companies, we will compute the dividend adjusted rate of return based on closing stock prices of the underlying listed firm over the horizon. For these purposes, we will use closing prices as reported in the Midwest edition of the Wall Street Journal.

The Dividend Adjusted Rate of Return is calculated as follows: First, we compute the raw return on the underlying stock (the closing price at the beginning of the horizon minus the closing price at the end of the horizon plus any dividends on ex-dividend dates). Then, we divide the raw return by the closing stock price at the beginning of the horizon to arrive at the dividend adjusted rate of return.

For market indices, we compute the capital gains rate of return by subtracting the closing index value at the end of the horizon from the closing index value at the beginning of the horizon and then dividing by the closing index value at the beginning of the horizon.

CONTRACT LIQUIDATION--Existing contracts will be liquidated by the IEM shortly after the end of the horizon. The Midwest Edition of the Wall Street Journal will be the official source of closing prices. If one of the companies is de-listed, the last available closing price will be used as the closing price for determining liquidation values. If one of the companies undergoes a stock split during the trading period, the closing price of its stock used to calculate payoffs will be adjusted to take account of this split. Specifically if each existing share is split into M shares, then the closing price used to calculate payoffs will be multiplied by M since this represents the value of one pre-split share in the company. Stock dividends will be treated in the same manner.

Contracts may be moved across and within market display windows to facilitate access. However, once trading commences in any contract, it will remain listed until the liquidation value is determined.

UNIT PORTFOLIOS--For set of contracts, unit portfolios consisting of bundles of contracts whose payoff is guaranteed to be $1.00 and can be purchased from or sold to the IEM system at any time. The price of each unit portfolio is $1.00. Use the "Purchase" option from the TRADING MENU and enter the bundle name as the contract name to buy unit portfolios. Use the "Sell" option from the TRADING MENU, with the bundle name, to sell unit portfolios. Purchases will be charged to your cash account and sales will be credited to your cash account.

Portfolios may also be purchased and sold at current market prices. To buy a market portfolio at current ASK prices, use the “Purchase” option as above but enter the appropriate market portfolio name as the contract name. To sell this portfolio at current BID prices, use the “Sell” options as above but enter the appropriate market portfolio name as the contract name.

ACCESS--Current and newly enrolled IEM traders with academic affiliations will automatically be given access rights to the winner-takes-all returns markets. Access to the contracts is achieved via the "Market Selection" option on any of the menus. Funds in a trader's cash account are fungible across all contracts so new investment deposits are not required. Additional investments up to the maximum of $500 can be made at any time. With five days' advance notice, funds may be withdrawn on the 15th of any month.

Note 1: If two or more contracts tie for the highest return, the $1.00 will be divided as evenly as possible among the tied contracts with any residual $0.001's allocated in order of the highest to lowest final values.

IEM PROSPECTUS
PRICE LEVEL MARKETS
Winner-takes-all Market

This document describes generic winner-takes-all price level contracts available on the IEM. Except as specified in this prospectus, trading rules for these contracts are the same as those specified in the Trader's Manual for the Iowa Electronic Market. Information about specific winner-takes-all price level contracts can be accessed through the IEM information windows.

CONTRACTS--Contracts in winner-takes-all price level markets have liquidation values will determined by closing stock price levels at the end of a trading horizon for a given company or market index. Initially, contracts are issued in pairs. Contract names specify a company, a "cutoff" price level, other unique identifying items and a designation of either "H" or "L."

Typical initial contracts are "ABCxxxH" and "ABCxxxL," where “xxx” corresponds to a “cutoff” price of $xxx. The payoff for the "H" contract will equal $1.00 if the Wall Street Journal closing price for ABC Company Common Stock at the end of the horizon exceeds $xxx. It will equal $0.00 otherwise. The payoff for the "L" contract will equal $1.00 if the Wall Street Journal closing price for ABC Company Common Stock at the end of the horizon is less than or equal to $xxx. It will equal $0.00 otherwise.

Thus, typical initial contracts are:

Contract	Underlying Fundamental	Liquidation Value
ABCxxxH	ABC Company Common Stock	$1.00 if ABC closing price>$xxx
ABCxxxL	ABC Company Common Stock	$1.00 if ABC closing price<=$xxx

CONTRACT SPLITS--If the trading price of a particular contract becomes unusually high, the Directors of the IEM may authorize a contract split. The decision to split a contract will be announced at least two days in advance of the split, and the new contract names and the timing of the split will be included in the announcement. This announcement will appear as a News Bulletin on your screen. When a split occurs, the original contract will be split into two contracts.

If the ABCxxxH contract is split, all traders holding an ABCxxxH contract will receive in its place a "new" ABCxxxH contract and an ABCyyyH contract where yyy is a new, higher cutoff price level. After the split, ABCxxxH contracts will pay $1.00 if the ABC closing price on the third Friday of the liquidation month is higher than $xxx and lower than or equal to $yyy. ABCyyyH contracts will pay $1.00 if the ABC closing price on the third Friday of the liquidation month is higher than $yyy. Thus, splits determine mutually exclusive ranges of prices over which each contract pays. Since the value of the two new contracts differ, outstanding bids and asks for ABCxxxH will be canceled at the time of the split. Since the payoffs to ABCxxxL are unaffected by the split, bids and offers for this contract will remain.

If the ABCxxxL contract is split, all traders holding an ABCxxxL contract will receive in its place a "new" ABCxxxL contract and a ABCzzzL contract where zzz is a new, lower cutoff price level. Similar splits of any other "H" or "L" contracts may also occur. All other aspects of these splits and the payoffs from the resulting contracts are analogous to those described above. Again, splits determine mutually exclusive ranges of prices over which each contract pays.

CONTRACT LIQUIDATION--Existing contracts will be liquidated by the IEM shortly after the horizon. The Midwest Edition of the Wall Street Journal will be the official source of closing prices. If a company's stock is de-listed, the last available closing price will be used as the closing price for determining liquidation values. If a company's stock undergoes a stock split during the trading period, the closing price of its stock used to calculate payoffs will be adjusted to take account of this split. Specifically if each existing share is split into M shares, then the closing price used to calculate payoffs will be multiplied by M since this represents the value of one pre-split share in the company. Stock dividends will be treated in the same manner.

Contracts may be moved across and within market display windows to facilitate access. However, once trading commences in any contract, it will remain listed until the liquidation value is determined.

UNIT PORTFOLIOS--For each set of contracts, unit portfolios consisting of bundles of contracts whose payoff is guaranteed to be $1.00 and can be purchased from or sold to the IEM system at any time. The price of each unit portfolio is $1.00. Use the "Purchase" option from the TRADING MENU and enter the bundle name as the contract name to buy unit portfolios. Use the "Sell" option from the TRADING MENU, with the bundle name, to sell unit portfolios. Purchases will be charged to your cash account and sales will be credited to your cash account.

Portfolios may also be purchased and sold at current market prices. To buy a market portfolio at current ASK prices, use the “Purchase” option as above but enter the appropriate market portfolio name as the contract name. To sell this portfolio at current BID prices, use the “Sell” options as above but enter the appropriate market portfolio name as the contract name.

ACCESS--Current and newly enrolled IEM traders with academic affiliation will automatically be given access rights to the winner-takes-all price level markets. Access to the contracts is achieved via the "Market Selection" option on any of the menus. Funds in a trader's cash account are fungible across all contracts so new investment deposits are not required. Additional investments up to the maximum of $500 can be made at any time. With five days' advance notice, funds may be withdrawn on the 15th of any month.

IEM PROSPECTUS
1998 CONGRESSIONAL CONTROL MARKET

At noon (C.S.T.), Wednesday, January 21, 1998, the Iowa Electronic Market (IEM) will open trading in a market based on the composition of the two houses of Congress following the November 1998 U.S. elections. This document describes that market and should be viewed as a supplement to the Trader's Manual. Except as specified in this prospectus, trading rules for this market are the same as those specified in the Trader's Manual for the Iowa Electronic Market.

Contract liquidation values in this 1998 Congressional Control market will be determined by whether the Republican Party holds an absolute majority of seats in each house of Congress after the November election. (Absolute majority requires 218 or more seats in the House and 51 or more in the Senate.) There are four contracts in this market representing four possible unique outcomes. The liquidation value of the contract which represents the actual outcome of the election will be $1.00. All other contracts will have a value of zero.

CONTRACTS -- The financial contracts traded in this market are:

Symbol	Contract Name
RhRs	Republican House, Republican Senate
RhNs	Republican House, Non-Republican Senate
NhRs	Non-Republican House, Republican Senate
NhNs	Non-Republican House, Non-Republican Senate

The first two letters of the contract symbol represent the net effect of the U.S. House of Representative elections: Rh means that Republicans hold 218 or more of the 435 seats in the House; Nh means that Democrats together with any other non-Republicans hold 218 or more seats in the House. The last two letters in the symbol represent the net effect of the U.S. Senate elections: Rs means that Republicans hold 51 or more of the 100 seats in the Senate; Ns means that Democrats together with other non-Republicans hold 50 or more seats in the Senate. Note that an even split of seats in the Senate is resolved in favor of the Ns contract.

All references to "House seats" in this document are to voting seats in the House of Representatives and specifically exclude those non-voting seats held by Representatives from American Samoa, Guam, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia.

DETERMINATION OF LIQUIDATION VALUES -- This is a winner-takes-all market. The contract that denotes the actual outcome of the election will have a liquidation value of $1.00; all others will have values of $0.00. For example, if the number of House seats won by Republicans in the November 1998 election is 217 and the number of Senate seats won by Republicans plus the number of seats held by incumbent Republican Senators not up for re-election is 51, the contract NhRs will have a value of $1.00 and the other three contracts will have values of zero.

The New York Times and Congressional Quarterly Weekly Report will be the official sources for election results and party affiliations of continuing Senators, respectively. For purposes of determining payoffs, we will use the composition of the House and Senate for the 106th Congress as determined by each member's declared party affiliation at the time of the election. For Representatives and newly elected Senators, this will be their party affiliations as shown on the election ballot. For Senators not standing for re-election, this will be their party affiliations as reported in the most recent Congressional Quarterly Weekly Report at the time of the election.

Liquidation formulas can be viewed on the IEM trading screen by first selecting **D**isplay Options and then choosing **L**iquidation Formulas.

MARKET CLOSING -- This market will close at noon, November 4, 1998, the Wednesday of election week. At that time, or as soon thereafter as official election returns are announced, liquidation values will be declared and funds credited to the cash accounts of market participants.

UNIT PORTFOLIOS -- Unit portfolios consisting of one share of each of the four contracts in this market can be purchased from or sold to the IEM system at any time. The price of each unit portfolio is $1.00. Since exactly one of the four represented Congressional compositions will result from the election, the total payoff from holding a unit portfolio until the market closes is $1.00.

To buy unit portfolios from the system, use the "Purchase" option from the TRADING MENU and enter 1$ as the contract name. To sell unit portfolios to the system, use the "Sell" option from the TRADING MENU and enter 1$ as the contract name. Purchases will be charged to your cash account and sales will be credited to your cash account.

Unit portfolios may also be purchased from and sold to other traders at current market prices. Use the Purchase and Sell options as above but enter MKT as the contract name. The price charged for market portfolio purchases will be determined as the sum of current ask prices, and the price received for market portfolio sales will be the sum of current bid prices. Should no corresponding bid or ask be present for one of the contracts, that contract will be excluded from the portfolio; otherwise the number of units purchased or sold will be the same in each contract.

MARKET ACCESS -- Current and newly enrolled IEM traders will automatically be given access rights to the 1998 Congressional Control market. Access to this market is achieved via the "Market Selection" option on the Login, Market, and other Menus. Funds in a trader's cash account are fungible across all markets so new investment deposits are not required. Additional investments up to the maximum of $500 can be made at any time. With five days' advance notice, funds may be withdrawn on the 15th of any month.

IEM PROSPECTUS
1998 HOUSE CONTROL MARKET

At noon (C.S.T.), Monday, January 21, 1998, the Iowa Electronic Market (IEM) will open trading in a market based on the composition of the US House of Representatives after the November 1998 U.S. elections. This document describes that market and should be viewed as a supplement to the Trader's Manual. Except as specified in this prospectus, trading rules for this market are the same as those specified in the Trader's Manual for the Iowa Electronic Market.

Contract liquidation values in this winner-takes-all House Control Market will be determined by whether the Republicans increase the number of seats they hold in the House, maintain an absolute majority but do not increase their lead, or lose the absolute majority. The contract that represents the actual outcome of the election will have a liquidation value of $1.00. All other contracts will expire worthless. The baseline number of seats held is that resulting from the November 1996 elections as reported by the Clerk of the House of Representatives. As a result of that November 1996 election, Republicans held 226 seats in the U.S. House of Representatives.

CONTRACTS -- The financial contracts traded in this market are:

Code	Contract Name
RH.gain	Republicans win more than 226 House seats
RH.hold	Republicans win more than 217 but no more than 226 House seats
RH.lose	Republicans win 217 or fewer House seats

The contract RH.gain represents the outcome that Republicans increase the number of seats from the 105th to the 106th Congress; that is, Republicans win more than 226 House seats in the November 1998 election. The contract RH.hold represents the outcome that Republicans maintain an absolute majority in the House, but do not increase their control; that is, Republicans win more than 217 but no more than 226 House seats in the November 1998 election. The contract RH.lose represents the outcome that Republicans lose an absolute majority in the House; that is, they win 217 or fewer House seats in the November 1998 election.

All references to "seats" in this document are to voting seats in the House of Representatives and specifically exclude those non-voting seats held by Representatives from American Samoa, Guam, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia.

DETERMINATION OF LIQUIDATION VALUES -- This is a winner-takes-all market. The contract that denotes the actual outcome of the election will have a $1.00 liquidation value; all others will expire worthless. For example, if Republicans win 220 House seats in the November 3, 1998 elections, the contract RH.hold will pay off $1.00 and the contracts RH.gain and RH.lose will each expire worthless.

The New York Times will be the official source of election results. For purposes of determining payoffs, we will use the composition of the House for the 106th Congress as determined by each member's declared party affiliation on the election ballot.

Liquidation formulas can be viewed on the IEM trading screen by first selecting **D**isplay Options and then choosing **L**iquidation Formulas.

MARKET CLOSING -- This market will close at noon, Wednesday, November 4, 1998, the day after the election. As soon thereafter as official election returns are announced, liquidation values will be declared and funds credited to the cash accounts of the market participants.

UNIT PORTFOLIOS -- Unit portfolios consisting of one of each of the three contracts in the House Control Market can be purchased from or sold to the IEM system at any time. The price of each unit portfolio is $1.00. Since exactly one of the three listed outcomes will occur, the total payoff from holding a unit portfolio until the market closes is $1.00.

To buy unit portfolios from the system, use the "Purchase" option from the TRADING MENU and enter 1$ as the contract name. To sell unit portfolios to the system, use the "Sell" option from the TRADING MENU and enter 1$ as the contract name. Purchases will be charged to your cash account and sales will be credited to your cash account.

Unit portfolios in the House Control Market may also be purchased from and sold to other traders at current market prices. Use the Purchase and Sell options as above but enter MKT as the contract name. The price charged for market portfolio purchases will be determined as the sum of current ask prices, and the price received for market portfolio sales will be the sum of current bid prices. Should no corresponding bid or ask be present for one of the contracts, that contract will be excluded from the portfolio; otherwise the number of contracts purchased or sold will be the same in each contract.

MARKET ACCESS -- Current and newly enrolled IEM traders will automatically be given access rights to the 1998 House Control Market. Access to these market is achieved via the "Market Selection" option on the Login, Market, and other Menus. Funds in a trader's cash account are fungible across all markets so new investment deposits are not required. Additional investments up to the maximum of $500 can be made at any time. With five days' advance notice, funds may be withdrawn on the 15th of any month.

IEM PROSPECTUS
1998 SENATE CONTROL MARKET

At noon (C.S.T.), Wednesday, January 21, 1998, the Iowa Electronic Market (IEM) will open trading in a market based on the composition of the US Senate after the November 1998 U.S. elections. This document describes that market and should be viewed as a supplement to the Trader's Manual. Except as specified in this prospectus, trading rules for this market are the same as those specified in the Trader's Manual for the Iowa Electronic Market.

Contract liquidation values in this winner-takes-all Senate Control Market will be determined by whether the Republicans increase the number of seats they hold in the Senate, maintain an absolute majority but do not increase their lead, or lose the absolute majority. The contract that represents the actual outcome of the election will have a liquidation value of $1.00. All other contracts will expire worthless. The baseline number of seats held is that resulting from the November 1996 elections as reported by the Clerk of the House of Representatives. As a result of that November 1996 election, Republican held 55 seats in the U.S. Senate.

CONTRACTS -- The financial contracts traded in this market are:

Code	Contract Name
RS.gain	Republicans in more than 55 Senate seats
RS.hold	Republicans in more than 50 but no more than 55 Senate seats
RS.lose	Republicans in 50 or fewer Senate seats

The contract RS.gain represents the outcome that Republicans increase the number of seats from the 105th to the 106th Congress; that is, Republicans hold more than 55 Senate seats after the November 1998 election. The contract RS.hold represents the outcome that Republicans maintain an absolute majority in the Senate, but do not increase their control; that is, Republicans hold more than 50 but no more than 55 Senate seats after the November 1998 election. The contract RS.lose represents the outcome that Republicans lose an absolute majority in the Senate; that is, they hold 50 or fewer Senate seats after the November 1998 election.

DETERMINATION OF LIQUIDATION VALUES -- This is a winner-takes-all market. The contract that denotes the actual outcome of the election will have a $1.00 liquidation value; all others will expire worthless. For example, if the number of Senate seats won by Republicans in the November 3, 1998 elections plus the number of seats held by Republican Senators not up for re-election is 56, the contract RS.gain will pay off $1.00 and the contracts RS.hold and RS.lose will each expire worthless.

The New York Times and the Congressional Quarterly Weekly Report will be the official sources for election results and incumbent party affiliation, respectively. For purposes of determining payoffs, we will use the composition of the Senate for the 106th Congress as determined by each member's declared party affiliation at the time of the November election. For newly elected members, this will be their party affiliation as shown on the election ballot. For members not standing for re-election, this will be their party affiliation as reported in the most recent Congressional Quarterly Weekly Report at the time of the election.

Liquidation formulas can be viewed on the IEM trading screen by first selecting **D**isplay Options and then choosing **L**iquidation Formulas.

MARKET CLOSING -- This market will close at noon, Wednesday, November 4, 1998, the day after the election. As soon thereafter as official election returns are announced, liquidation values will be declared and funds credited to the cash accounts of the market participants.

UNIT PORTFOLIOS -- Unit portfolios consisting of one of each of the three contracts in the Senate Control Market can be purchased from or sold to the IEM system at any time. The price of each unit portfolio is $1.00. Since exactly one of the three listed outcomes will occur, the total payoff from holding a unit portfolio until the market closes is $1.00.

To buy unit portfolios from the system, use the "Purchase" option from the TRADING MENU and enter 1$ as

the contract name. To sell unit portfolios to the system, use the "Sell" option from the TRADING MENU and enter 1$ as the contract name. Purchases will be charged to your cash account and sales will be credited to your cash account.

Unit portfolios in the Senate Control Market may also be purchased from and sold to other traders at current market prices. Use the Purchase and Sell options as above but enter MKT as the contract name. The price charged for market portfolio purchases will be determined as the sum of current ask prices, and the price received for market portfolio sales will be the sum of current bid prices. Should no corresponding bid or ask be present for one of the contracts, that contract will be excluded from the portfolio; otherwise the number of contracts purchased or sold will be the same in each contract.

MARKET ACCESS -- Current and newly enrolled IEM traders will automatically be given access rights to the 1998 Senate Control Market. Access to these market is achieved via the "Market Selection" option on the Login, Market, and other Menus. Funds in a trader's cash account are fungible across all markets so new investment deposits are not required. Additional investments up to the maximum of $500 can be made at any time. With five days' advance notice, funds may be withdrawn on the 15th of any month.

IEM PROSPECTUS
1998 EMU Membership
Winner-Takes-All Market

On Tuesday, March 3, 1998, the Iowa Electronic Market (IEM) will open trading in contracts based on whether specific European countries are selected before July 1,1998, as eligible for participation in the third stage of Economic and Monetary Union (EMU) on January 1, 1999 – the adoption of a single currency. This document describes those contracts, and should be viewed as a supplement to the Trader's Manual. Except as specified in this prospectus, trading rules for this market are the same as those specified in the Trader's Manual for the Iowa Electronic Market.

Under the terms of the 1992 Maastricht treaty, the leaders of the member states of the European Union (the European Council) must decide before July 1, 1998 which member states are eligible to participate in the third stage of the EMU. That third stage initially involves irrevocable fixing of countries= currencies against a new currency, the Aeuro,@ as of January 1, 1999. By 2002, their currencies will be fully replaced by this new currency. Other countries not initially selected as eligible for adoption of the euro may qualify later.

Payoffs in the EMU Membership Market will be determined by which countries are initially selected by the European Council as eligible to join the EMU as of January 1, 1999. Each contract that represents an actual outcome of that initial selection will have a liquidation value of $1.00; all others will expire worthless. Contract liquidation values depend only on the initial selection list of the European Council and will be unaffected by whether that list changes subsequent to the initial announcement or whether countries qualify at a later date.

CONTRACTS--Contracts are listed in pairs, each pair related to whether a specific country is on the initial list of countries selected by the European Council for membership on January 1, 1999. Initially, contracts related to two counties, Italy and Spain, will be traded. These contracts are:

Symbol	**Contract Description**
IT.in	Italy on Initial Selection List
IT.out	Italy not on Initial Selection List
SP.in	Spain on Initial Selection List
SP.out	Spain not on Initial Selection List

For instance, the contract IT.in represents the outcome that Italy is included in the list of countries initially selected by the European Council as eligible for EMU membership, with irrevocably fixed exchange rates against the euro as of January 1, 1999. The contract IT.out represents any other outcome; for example, that Italy is not among the initial list of countries or that the list is not released by July 1, 1998. Contract specifications for Spain are similar.

The IEM reserves the right to introduce new contracts, and to move price quotations to alternate trading screens should it become necessary. Once a contract is listed, it will remain listed until liquidation.

DETERMINATION OF LIQUIDATION VALUES--These are winner-takes-all contracts based upon the first official declaration by the European Council of the list of member European countries that fulfil the necessary conditions for the adoption of a single currency starting on January 1, 1999. That declaration is currently expected to be made at the European Council summit meeting scheduled for May 2, 1998.

For each country, the contract that denotes the actual outcome of the European Council=s official declaration will have a $1.00 liquidation value; the alternate contract will expire worthless. For example, if Italy is included in the list of countries initially declared eligible by the European Council (the Initial Selection List), the EMU membership contract, IT.in, will pay off $1.00 and the non-membership contract, IT.out, will expire worthless. If Italy is not included in the Initial Selection List, the contract IT.out will pay off $1.00 and the contract IT.in will expire worthless.

Should the European Council fail to make a official declaration before July 1, 1998 for any reason, or should the starting date at which a country=s currency will be irrevocably fixed against the euro be later than January

1, 1999, the non-membership contract for that country will pay off $1.00 and the membership contract will expire worthless.

The press releases of the European Council as reported in the Financial Times and New York Times will be the official sources for EMU membership. The judgment of the IEM Governors will be final in resolving questions with regard to liquidation values.

Liquidation formulas can be viewed on the IEM trading screen by first selecting Display Options and then choosing Liquidation Formulas.

MARKET CLOSING--The EMU Membership Markets will close shortly after an official declaration of EMU membership is made by the European Council, provided that such a declaration is made before July 1, 1998. If for any reason no official declaration is made before July 1, 1998, the market will close on noon, July 1, 1998 and all non-membership contracts will pay off $1. Liquidation values will be declared and funds credited to the cash accounts of the market participants following market closing.

UNIT PORTFOLIOS--Country-specific unit portfolios consisting of one of each of the country's two contracts in the EMU Membership Market can be purchased from or sold to the IEM system at any time. The price of each unit portfolio is $1.00. Since exactly one of the two listed outcomes will occur, the total payoff from holding a unit portfolio until the market closes is $1.00.

To buy Italy unit portfolios (1 share of IT.in and 1 share of IT.out) from the system, use the "Purchase" option from the TRADING MENU and enter IT.1$ as the contract name. To sell unit portfolios to the system, use the "Sell" option from the TRADING MENU and enter IT.1$ as the contract name. Purchases and sales of Spain unit portfolios are made similarly, using the contract name SP.1$. Purchases will be charged to your cash account and sales will be credited to your cash account.

Country-specific unit portfolios in the EMU Membership Market may also be purchased from and sold to other traders at current market prices. Use the Purchase and Sell options as above but enter IT.MKT or SP.MKT as the contract name, depending on the country portfolio you wish to trade. The price charged for market portfolio purchases will be determined as the sum of current ask prices, and the price received for market portfolio sales will be the sum of current bid prices. Should no corresponding bid or ask be present for one of the two contracts in a particular country unit portfolio, that contract will be excluded from the portfolio. Otherwise the number of contracts purchased or sold will be the same in each contract.

MARKET ACCESS--Current and newly enrolled IEM traders will automatically be given access rights to the 1998 EMU Membership Market. Access to these markets is achieved via the "Market Selection" option on the Login, Market, and other Menus. Funds in a trader's cash account are fungible across all markets so new investment deposits are not required. Additional investments up to the maximum of $500 can be made at any time. With five days' advance notice, funds may be withdrawn on the 15th of any month.

IEM PROSPECTUS
MOVIE BOX OFFICE MARKET
WINNER-TAKES-ALL CONTRACTS

On Friday, March 27, 1998, the Iowa Electronic Market (IEM) will open trading in contracts based on Spring movie box office receipts. This document describes those contracts and should be viewed as a supplement to the Trader's Manual. Except as specified in this prospectus, trading rules for this market are the same as those specified in the Trader's Manual for the Iowa Electronic Market.

CONTRACTS--All contracts in this market are winner-takes-all contracts. Liquidation values for these contracts will be determined by box office receipts during the period April 3, 1998 to and including April 30, 1998. Two separate sets of contracts will be traded: contracts related to "Lost in Space" (New Line Cinema, expected opening: April 3, 1998) and contracts related to "Mercury Rising" (Universal, expected opening: April 3, 1998).

The contracts related to Lost in Space (denoted LIS) are:

Code	Liquidation Value
LIS20L	$1.00 if Lost in Space's official box office receipts for the 4/3-4/30 period are lower than or equal to $20 million; zero otherwise
LIS30L	$1.00 if Lost in Space's official box office receipts for the 4/3-4/30 period are higher than $20 million and lower than or equal to $30 million; zero otherwise
LIS40L	$1.00 if Lost in Space's official box office receipts for the 4/3-4/30 period are higher than $30 million and lower than or equal to $40 million; zero otherwise
LIS40H	$1.00 if Lost in Space's official box office receipts for the 4/3-4/30 period are higher than $40 million

The contracts related to Mercury Rising (denoted MR) are:

Code	Liquidation Value
MR10L	$1.00 if Mercury Rising's official box office receipts for the 4/3-4/30 period are lower than or equal to $10 million; zero otherwise
MR20L	$1.00 if Mercury Rising's official box office receipts for the 4/3-4/30 period are higher than $10 million and lower than or equal to $20 million; zero otherwise
MR30L	$1.00 if Mercury Rising's official box office receipts for the 4/3-4/30 period are higher than $20 million and lower than or equal to $30 million; zero otherwise
MR30H	$1.00 if Mercury Rising's official box office receipts for the 4/3-4/30 period are higher than $30 million

The IEM reserves the right to introduce new contracts, and to move price quotations to alternate trading screens should it become necessary. Once a contract is listed, it will remain listed until liquidation.

DETERMINATION OF LIQUIDATION VALUES--The liquidation values for these contracts will be determined by box office receipts for the period April 3, 1998 to April 30, 1998 as published in Variety's Domestic Box Office Report under the heading "Cumulative Reported B.O." In the event that the movie is not listed in this report, we will use FILMSOURCE from AC Neilsen EDI, Inc. (www.entdata.com), the official source for the box office receipts reported in Variety, as our source. The judgment of the IEM Governors and Directors will be final in resolving questions of typographical or clerical errors in these reports. If a movie fails to open by the ending of the period, then the lowest denominated contracts for that movie will pay $1 and all others will pay $0. Liquidation formulas can be viewed on the IEM trading screen by first selecting Display Options and then choosing Liquidation Formulas.

CONTRACT SPIN-OFFS--If the trading price of a particular contract becomes unusually high, the Directors of the IEM may authorize a contract spin-off. When a contract spin-off occurs, the original contract will be replaced by two new contracts which divide the payoff range of the original contract into two intervals. For instance, if a contract spin-off is authorized for MR30L, each trader holding an MR30L contract would receive two new contracts in its place: MRxxL (that would pay off $1 if box office receipts were higher than $20 million, but lower than or equal to $xx million), and a new MR30L (that would pay off $1 if box office receipts were higher than

$xx million, but lower than or equal to $30 million). Note that these contracts split the original payoff range (higher than $20 million, and lower than or equal to $30 million) into two new intervals. Since the value of the two new contracts can differ from that of the old contract, all outstanding bids and asks for the original contract will be canceled at the time of the spin-off.

All decisions to spin-off a contract will be announced at least two days in advance of the spin-off, and the new contract names and the timing of the spin-off will be included in the announcement. This announcement will appear as a News Bulletin on your IEM screen.

MARKET CLOSING--The market will close at noon on Friday, May 1, 1998. At that time, liquidation values will be declared and funds will be credited to the cash accounts of the market participants following soon thereafter.

UNIT PORTFOLIOS--For each movie, unit portfolios consisting of bundles of contracts whose payoff is guaranteed to be $1.00 can be purchased from or sold to the IEM system at any time. The price of each unit portfolio is $1.00. Use the "Purchase" option from the TRADING MENU and enter the bundle name as the contract name to buy unit portfolios. Use the "Sell" option from the TRADING MENU, with the bundle name, to sell unit portfolios. Purchases will be charged to your cash account and sales will be credited to your cash account. Unit portfolios for Lost in Space are named LIS1$; unit portfolios for Mercury Rising are named MR1$.

To buy Lost in Space unit portfolios (1 share each of LIS20L, LIS30L, LIS40L and LIS40H) from the system, use the "Purchase" option from the TRADING MENU and enter LIS1$ as the contract name. To sell unit portfolios to the system, use the "Sell" option from the TRADING MENU and enter LIS1$ as the contract name. Purchases and sales of Mercury Rising unit portfolios are made similarly, using the contract name MR1$. Purchases will be charged to your cash account and sales will be credited to your cash account.

Movie-specific unit portfolios in the Spring Movie Box Office Market may also be purchased from and sold to other traders at current market prices. Use the Purchase and Sell options as above but enter LIS.MKT or MR.MKT as the contract name, depending on the movie portfolio you wish to trade. The price charged for market portfolio purchases will be determined as the sum of current ask prices, and the price received for market portfolio sales will be the sum of current bid prices. Should no corresponding bid or ask be present for one of the two contracts in a particular movie unit portfolio, that contract will be excluded from the portfolio. Otherwise the number of contracts purchased or sold will be the same in each contract.

MARKET ACCESS--Current and newly enrolled academic IEM traders will automatically be given access rights to the 1998 Spring Movie Box Office Market. Access to these markets is achieved via the "Market Selection" option on the Login, Market, and other Menus. Funds in a trader's cash account are fungible across all markets so new investment deposits are not required. Additional investments up to the maximum of $500 can be made at any time. With five days' advance notice, funds may be withdrawn on the 15th of any month.