A PACKAGE OF BUSINESS RELATED RISK MEASURES: DEVELOPMENT AND EMPIRICAL STUDY

by

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ABSTRACT

Risk taking propensity is defined as the willingness of an individual to take risks. Although previous research has suggested that this construct is multidimensional, the primary purpose of this thesis is to develop a package of measures relevant to one dimension of risk: business risk. The package includes measures adopted and revised from ones used previously and measures constructed for this study.

Thirty-five Masters Students in Business Administration were administered the following package of measures: Choice Dilemma, Extremity Confidence in Judgment, In-Basket, Utility Items, Stock Price Wagers, a Personal Record Questionnaire, and a personality questionnaire concerning Internal External Control and Sensation Seeking.

The results of the study show that some of the intercorrelations among measures are insignificant. Several factor analytical methods were tried but the extracted factors were neither identifiable nor expected. The study examined the relationship between risk taking and some selected variables like Salary, amount of asset, amount of liability, years of working experience, and number of dependents. Choice Dilemma was found to be a function of a greater number of variables, namely average age of the dependents, working years, salary, face value of insurance and liabilities. Extremity confidence in judgment is related to number of working years and salary. The In-Basket Memo

score is related to IE Control, average age of dependents, working years and salary.

The thesis has been able to pinpoint areas of weakness in the items themselves and indicate which measures should be subject to revision or elimination. It has also been able to narrow down the definition of business risk taking. In this regard, it has provided insights into what a final package of Business-related risk measures should contain.

The study suggests more interesting areas to look at and serves as a pivot for future research of this kind.

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My Fraternity Brother

Who Died for Peace,

Brotherhood and

the Upsilon Sigma Phi

CHAPTER 1

INTRODUCTION

> If you can make a heap of all your winnings
> And risk it on one turn of pitch and toss
> and lose and start again at your beginnings
> and never breathe a word about your loss . . .
>
> Rudyard Kipling, IF

Although we may not agree fundamentally with Kipling's definition of a man in his poem IF, we can be quite sure that he's talking about a special kind of man--the risk-taker--a much admired prototype that has been perceived to be endowed with all the proper superlatives of masculinity--the best of courage, daring and strength of character.

Yet, risk-taking is not really a phenomenon--or a talent common only to historical figures who have performed mighty deeds. Any activity having an uncertain outcome involves an element of risk. Who is to say that a man crossing the street or accepting a blind date is not taking any risks? The fundamental difference is, of course, in terms of degree. Kipling's man is definitely a great risk-taker, while the ordinary man attempting to win at chess may be less of a risk-taker. Atheists, according to the Catholic dogmatists, are taking the greatest risks--the chance of eternal damnation.

Decisions in the real world involve uncertainty. In fact, the definition of decision, according to Shackle (1961), imposes a condition of "bounded uncertainty." "To have perfect foresight

is to render all decisions empty" (Shackle, 1961). The notion of bounded uncertainty may be deduced from Shackle's quote, "Decision is choice but not choice in face of perfect foreknowledge, nor choice in face of complete ignorance." This definition we have to accept as we must accept Shackle's idea that "the ultimate nature of the cosmos is not one whose history is predestinate" or one "behaving in every detail in a manner settled and determined from the start." (It also means the Maker makes empty decisions while we mortals do not because we are not know-it-all--as an aside to Shackle.)

"Chance is but an expression of man's ignorance," Laplace once declared. Not being perfect (neither perfectly ignorant nor perfectly knowledgeable), man is condemned to face risks--though he tries, with some amount of effort, to contain uncertainty by increasing his store of knowledge or reduce his environment into something that he could control. After all, prophets are so rare.

But then, what is risk? And what is uncertainty? When are the two terms similar and where lies the difference of the two?

Without going into the semantics (and the various images that spring up by mentioning the terms), we have the following definitions and explanations from Science.

Risk and Uncertainty:

Doubt and uncertainty seem to be synonymous in most philosophical essays. Jeremy Bentham (Keynes 1921) once suggested

that witnesses should indicate their state of mind on a scale of certainty, something like Gibbon's Theological Barometer of doubt (Cohen 1960). In Kipling's lines, "risk" is "in one turn of pitch and toss," suggesting the 'uncertainty' inherent in gambling. Hertz (1964) and Grayson (1960) implicitly place the two terms as substitutes for one another.

Uncertainty is defined as the state of mind that exists when more than one outcome is judged possible on the basis of existing information when an individual is considering the outcome of a given act. The origin of uncertainty is unpredictability. In the case of an investment decision, uncertainty exists when an attempt is being made to predict the outcomes of accepting or rejecting a given proposal.

Risk is defined as "the chance of . . . loss" in The Concise Oxford Dictionary. The loss is possibly an opportunity loss, defined by Schlaiffer (1959) as "the difference between the cost or profit actually realized under that decision and the cost or profit which would have been realized if the decision had been the best one possible for the event which actually occurred." In investment decisions, this connotation recognizes that a loss may be incurred by either rejecting or accepting an investment proposal--two risks being incurred: that the project may not realize the minimum return required by the firm and that if the return is less than was projected the decision may not be optimal in that other alternatives or proposals would have greater benefit in actual fact.

Another definition of risk runs as follows: take the framework of a certainty continuum that extends from a believed absolute certainty of the future outcome of a present decision or act where the probability distribution collapses into one single outcome with a probability of unity to the other extreme of complete uncertainty as to both outcomes and to the probabilities of these outcomes. In the case of complete uncertainty, it is possible that decision theory might dictate the use of the principle of insufficient reason (equi-probable states of nature) (Savage, 1954, 4.9) but it is also possible that we permit sufficient knowledge to come up with ex-ante subjective probabilities.

Between the two extremes of complete certainty and complete ignorance lies the area in which we have some basis for belief in some finite range of multiple mutually exclusive possible outcomes with some probability distribution over it. This is the case of risk (Knight, 1921), which could be termed the case of significant knowledge or belief.

The Knight distinction is that risk is "measurable uncertainty" which may be represented by numerical probabilities and that uncertainty is "unmeasurable uncertainty, where the decision-maker is ignorant of the statistical frequencies of events relevant to his decision," or where "a priori calculations are impossible, or when an important, once and for all decision is concerned" (Knight, 1921). However, some economists have come to question the usefulness of such a distinction. Arrow (1951) said, "In brief, Knight's uncertainties

seem to have surprisingly many of the properties of ordinary probabilities, and it is not clear as to how much is gained by the distinction. . . . Actually, his uncertainties produce about the same reactions in individuals as other writers ascribe to risks."

Shackle (1955) concluded that in the real world, most decisions were in situations of uncertainty. But, he not only rejected numerical probabilities for representing the uncertainty in situations but maintained that in situations where all potential outcomes seemed perfectly possible, it was impossible to distinguish meaningfully between the relative likelihoods of these outcomes. This was forwarded as the notion of "potential surprise." This notion seems questionable, however, when it is interpreted to mean that people would be indifferent between tossing a coin and drawing a particular kind from a deck of cards!

In his introduction to the IEA Conference on Risk and Uncertainty, Borch (1968) said that the Knight distinction "no longer serves any useful purpose." Ramsey (1926) implied that for a "rational" man all uncertainties can be reduced to risks. (We shall not go any further into what is meant by "rational".)

In this thesis, risk is treated as a situation where 'ambiguity' does not exist and where a probability distribution--whether objective, subjective, or necessary--is provided (for the definitions of these terms, please see Savage 1954).

Components of Risk

Risk is composed of the following elements:

1. Outcomes - existence of at least two mutually exclusive outcomes arising from an act and from events outside the act.
2. Actions - existence of at least two independent courses of action, at least one of which must be uncertain as to outcome.
3. Meaningfulness - existence of values that the decision maker attaches to the consequences of the outcomes.

Also the amount of risk involved depends upon the decision maker's perception--i.e., he must be able to realize that something of value to him is at stake in the decision process. In addition, degrees of belief may vary among decision-makers. Thus, faced with the same situation, it is possible that two decision-makers perceive different levels of risk. Because of this differential perception, risk is really subjective--i.e., risk to one individual may not be risk to another.

In order to examine risk-taking among individuals, the situations in which decisions by these individuals are to be made should be perceived similarly by these persons--i.e., the value at stake and their degrees of belief must be similar (i.e., provision of objective probabilities), and other variables must also be mitigated in their effects.

Purpose of the Thesis

The primary objective of the thesis is to develop a package of risk-taking propensity measures whose main emphasis is on business-economic risk-taking and monetary risk taking. The development will involve a review of some of the more well-known measures that exist for assessing risk taking attitudes, subsequent refinements or modifications of past measures that have been found to be appropriate for our purpose, and original construction of measures. The package of measures will be given to volunteers from the graduate programme of the U.B.C. Faculty of Commerce. A statistical analysis of their responses will be presented in the thesis. The rationale behind the package of measures will be discussed in the conclusion of this thesis.

Organization of the thesis

The study is divided into eight chapters. Chapter 1 is an introductory chapter concerning the definition of risk and uncertainty and the components of risk. Chapter 2 deals with the economic foundation of risk-taking researches with a brief background on some aspects of the theories of risk bearing and a study of the use of utility functions. Chapter 3 presents the psychological background of the risk-taking measures developed or adopted by this thesis. Chapter 4 provides a brief description of the package developed in this study and the various alternatives considered in the process. Chapter 5 deals with the design for using the package on our selected group.

Chapter 6 presents the analyses of the measures and the items contained in the package. Chapter 7 discusses the overall analysis of the measures, their correlations with one another and the factor analyses of these measures. Chapter 8 contains a summary and conclusion of the study.

CHAPTER 2

THE ECONOMIC BACKGROUND OF RISK TAKING PROPENSITY MEASUREMENT

Introduction

Theories, both descriptive and prescriptive, have been formulated by economists to explain and dictate behavior under uncertainty. Decision-making models have been proposed and claimed to be predictively adequate and normatively superior.

The assumption that individuals act with subjective certainty has long ceased to explain the existence of certain observed phenomena, like insurance (Arrow, p. 11, 1965). For a while, economists implied that individuals maximized expected value (mathematical expectation) among choices. D. Bernoulli, in 1738, in his resolution of the St. Petersburg paradox, said the contrary (Bernoulli 1954). The problem was equivalent to the following:

> John tosses a coin in the air repeatedly until it falls head up. If this occurs on the first throw, he pays Paul \$1.00; if this occurs first on the second throw, he pays Paul \$2.00; on the third throw, \$4.00; on the fourth throw, \$8.00 and on the nth throw, $\$2.00^{n-1}$. What is the maximum amount that Paul should pay for this game?

Its paradoxical nature is easily explained: The probability of a head on the first throw is 1/2, so the expected winning from the first throw is 1/2 times \$1.00 or \$0.50. The probability of a first head on the second throw is 1/4 (1/2 of tails on the first throw times 1/2 of heads on the second) so the expected winning is 1/4 times \$2.00 or \$0.50. The probability

of a first head on the nth throw is $(1/2)^n$ so the expected winnings are $(1/2)^n$ times $\$2.00^{n-1}$, or \$0.50. Since these probabilities are mutually exclusive, we add them to obtain the expected winnings from the game, which are \$0.50 times the infinite possible number of throws. The expected winnings of Paul are infinite. But it would seem inconceivable that anyone would pay an infinite amount for the said game. In Bernoulli's solution, the diminishing marginal utility of money was taken into account. A distinction was made between mathematical expectation and "moral expectation"--"moral expectation" defined as the sum of the products of the various advantages accruing from various sums of money times their respective probabilities. Here was the expected utility hypothesis stated in a different way. In Von Neumann and Morgenstern's terms (1953), "D. Bernoulli's well-known suggestion to 'solve' the St. Petersburg Paradox by the use of the so-called 'moral expectation' means defining the utility numerically or the logarithm of one's monetary possessions." Karl Menger (1934) said that it required the boundedness of the utility function, not the mere presence of risk aversion, to resolve the paradox. Savage (1954) later completed the demonstration of the expected utility theorem.

Utility Theory and the Measurement of Risk Taking

According to Fisher (1918), the term "utility" is a heritage of Bentham and his principle of morals and legislation. The concept of utility in economics may be traced even to Adam Smith in his quote "Value in use cannot be measured by any known standard; it is differently estimated by different persons" (Stigler,

1950). This idea of utility, considered as a quantitative expression of the amount of satisfaction derived from consumption, is thus a very basic notion in economics. Pareto, Jevons, and Marshall had incorporated utility in their work (Stigler, 1950).

The idea that the curvature of a utility function reflects its owner's attitude towards risk arose out of Von Neumann and Morgenstern's monumental work, The Theory of Games and Economic Behavior (1953). In it, axioms relating to utility curves were discussed; also, Von Neumann and Morgenstern stated that the utility scale, which must be consistent, did not have any natural origin.

Friedmann and Savage (1948) followed up on Von Neumann and Morgenstern with their hypothesis of a consumer unit behaving as if it maximizes utility. From the observation that people both buy insurance and lottery tickets (lotteries having multiple prizes) they derived a double inflected utility function, convex for low wealth levels, concave for intermediate levels and convex for higher values of wealth. Concavity of the utility function over an interval implies risk aversion of the decision-maker--i.e., he would not pay as much as the lottery's expected monetary value for the ticket. Markowitz later (1952 b) suggested that another concave segment be added to the left end of the utility function.

Mosteller and Nogee (1951) tested the descriptive validity of the expected utility theorem in experimental settings, and concluded that expected utility theory is not descriptive (i.e.,

people do not behave as if they maximize utility).

Pratt (1964) and Arrow (1965) independently formulated the most specific definition to date of risk attitude in terms of the shape of the utility function. They defined $r_a(x) = u''(x)/u'(x)$ as absolute risk aversion and $r_r(x) = xu''(x)/u'(x)$ as relative risk aversion--both measures are local in that they may vary as x (income, wealth, etc.) varies.

Empirical Studies of Utility Curves

Grayson's (1960) Decisions Under Uncertainty is perhaps one of the earlier applications of utility theory to situations of uncertainty. Based on Von Neumann and Morgenstern, he devised a method of deriving utility curves. Oil and gas operators, as well as members of their organization, were given a series of hypothetical ventures. The subjects were asked to either accept or reject a venture on the basis of information concerning the investment, its pay-offs and its probability of success. A table of indifference probabilities was derived for each individual. By setting zero $ amount as zero in utility and -$10,000 as -1.00 in utility, he constructed utility curves for his subjects. From the shape and slope of these curves, he deduced the risk preferences of the individuals.

Some difficulties were encountered with the experiment. One was the probabilities involved. Some operators (Grayson, 1960, pp. 313-314) did not always think of probabilities as being objective. Thus, there was the danger of introducing a subjective "correction" (similar to what Fellner (1961) has

observed as the slanting tendency) into the probabilities. However, when the probabilities used in the experiment dropped into ranges with which the operators had experience, these odds were credible and found to be satisfactory. Thus, the curves can only be said to be very close "approximations" of true utility functions. However, Grayson believed that the subjective probability element was small and while this did not fit well with the descriptive part of utility theory, it still can be very useful, in a normative sense, as a guide to action. His suggestion was to try to remove any possibility of introducing subjective probabilities by: (1) holding probabilities constant (say at 50-50) and (2) allowing the pay-offs to fluctuate. The experiment has indicated that more time should be spent with the subjects in explaining the use of objective probabilities and moreover, the pay-offs should be constructed so that they were in the realm of experience of the subjects.

Swalm (1966) conducted another utility study. He defined utility as "a measurable preference among various choices available in risk situations." Relative utilities were measurable while absolute utilities were not. Following the proposition that if a person was indifferent between two alternatives, the expected utility of the alternative was the same, he set up a series of questions, each offering two alternatives--one certain and one uncertain (with 50-50 odds for the two outcomes).

His research approach was as follows: he introduced utility theory to the businessmen (one to two hours per man) and varied the construction of the questions based on the experience of

the person involved. Because of the possible confounding of utility and subjective probabilities, risk was limited to 50-50 since they understood this to be a flip of a coin. The maximum single amount that the subject might recommend be spent in any one year was used as a basis for setting what Swalm called the "planning horizon," which was twice this amount. He believed that utility was a function of the corporate planning horizon. Thus the series of questions that ensued in the interview was based on this "planning horizon."

The method of getting points on the utility curve was as follows: Suppose a person said his "maximum amount" (mentioned above) was $20,000. $40,000 would be his planning horizon. The utility of 0 dollars would be set at zero and the utility of the planning horizon set at 1. The first question asked would be something like this: "Suppose you are faced with two alternatives. One is to go into an investment where there is a 50-50 chance at getting $40,000 (net present value of profit) and a 50-50 chance at getting zero. The other alternative is to use the same amount of money for cost-saving investment which will net you some certain amount. How small will the certain amount have to be before you are indifferent between the two alternatives?" Once the subject answered this, he would be getting three initial points on the curve. Suppose X was the answer. Thus we would have the following calculation:

.50 (utility of 40,000) + .50 (utility of zero) = utility (X)

.50 (1) + .50(0) = utility X.

utility of X = .5 ,

The next question would be based on the first one where we could have two alternatives: "one is an investment where there is a 50-50 chance at getting X amount and 50-50 chance at getting $40,000; another is a certain investment that will net you Y amount." Once Y was determined, the calculation would be as follows:

.50 (util. of $40,000) + .50 (utility of X) = utility (Y)

.50 (1) + .50(.5) = utility (Y)

utility of Y = .75

In this manner a series of questions was constructed. A consistency check could be built in as a last question so that inconsistency could be weeded out.

Swalm's result was that sharp slopes were found in the negative quadrants. By looking at the shape of the curve, he inferred whether the person is a risk-taker or not.

Swalm's conclusions were: (1) businessmen do not attempt to optimize the expected dollar outcome in risk situations involving what to them are large amounts; (2) Cardinal utility theory offers a reasonable basis for judging the internal consistency of a series of decisions made by an executive dealing with risks and can be an aid in increasing the consistency of such decision; (3) the theory offers a relatively simple way of classifying many types of industrial decision makers; and (4) utility is a function of the individual's "planning horizon."

Spetzler (1968) interviewed 36 corporate executives by asking them to make decisions in each of 40 hypothetical investment situations. The 40 situations included 20 questions

at either of two investment levels, $3 million and $50 million. Like Grayson, a number of indifference probabilities were secured. To help the interviewees in understanding probability statements, a reference chart, which was a circular chart so designed that a simple twist increased the red area while reducing the green area, was used, where the respondents visualized the chart spinning rapidly with the throw of a single dart determining the outcome. The next thing Spetzler undertook was to find a mathematical form for utility functions. Essentially, he was looking for a function whose parameters could be determined by minimizing the sum of the squares of the deviations, i.e.:

$$[U(\$0) - (P_s U(X_s) + (1-P_s)\ U\ (X_f))]^2 = \text{minimum},$$

where U(X) = the utility of $X present value, s stands for success and f stands for failure and P_s stands for the probability of success and $(1-P_s)$ = probability of failure.

Seventeen Scandinavian shipowners were used in a utility experiment by Lorange and Norman (1971). Certainty equivalences were derived for each respondent in a series of 11 independent hypothetical choices, each one involving a new building contract, but with varying outcomes and/or probabilities of success. Seven of the 11 choices involved 50-50 odds variety while the rest concerned changing probabilities where the pay-offs were held constant. They responded to these 11 hypothetical choices under two liquidity positions--a satisfactory and an unsatisfactory liquidity position. Also, two normative questions were asked: one concerning the time horizon of the respondents'

chartering policy and changes over time, and two, whether their risk attitudes would be different or not assuming that they were 15 years younger. From the subjects' responses, Lorange and Norman tried fitting the utility curves using several functions--i.e., logarithmic, exponential and quadratic functions.

As part of the package for elementary decision analysis, a series of programs that enable the respondent to interact with the computer in order to derive risk aversion index has been developed by Schlaiffer (1971). The complete package is called Manecon and is available at a price from Harvard. These risk-aversion-indices programs are the results of Schlaiffer's studies on utility functions. Essentially, these programs print out the Arrow-Pratt indices depending upon how the user specifies his risk aversion (i.e., whether it is constant, constantly proportional, decreasing, etc.).

Utility: Problems and Difficulties

Utility-type questions are easy to construct. Swalm's approach, being quite straight forward and simple, may be used in constructing utility questions. Some difficulties, however, may be encountered.

Firstly, one must be able to determine what equivalents one is after. A mistake one could commit is to confound the various types of equivalent in the utility questions.

Toda and MacCrimmon, in an unpublished paper, classified certainty equivalents as either selling, gift, or buying equivalents. They believed that, if the utility questions were to

be valid as risk-taking measure questions, one must be consistent with the equivalents sought--i.e., the different types of equivalents should not be mixed up in the same questionnaire.

For instance, a utility-type question might run as follows: "Suppose you are faced with a situation where, if successful, you will net K dollars and if not successful, you will net X dollars. The probability of success is .50. How much would you pay in order to get this investment?" This is a buying equivalent. Whereas, if a question is as follows, "Suppose you are faced with two alternatives--one certain, one uncertain. The uncertain alternative is as follows--if you took it and you were successful, you gain K dollars, but if you took it and failed, you stand to lose X dollars. The probability of success is .50. The second alternative is certain--if you take it, you are sure to net Y amount. How small would Y have to be before you are indifferent between the two alternatives?" This is a gift equivalent. An example of a selling equivalent runs as follows: "Suppose you have an investment in a venture that is uncertain as to outcomes. If the venture was successful, you gain K dollars but if it failed, you stand to lose X dollars. Your possible investment is about M dollars. The probability of success is .50. If you could sell this entire investment to someone else, how much would you ask for it?"

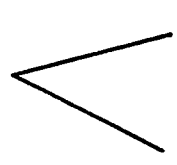
Toda and MacCrimmon presented a mathematic proof that these equivalents were not the same.

Thus, if we are interested in getting utility responses under net terminal wealth situations, we must have the same net

terminal wealth situation throughout the questionnaire. Or, if the utility responses we seek concern <u>increments to wealth</u>, the questions in the entire questionnaire should be concerned with increments to wealth.

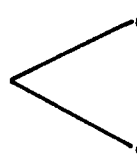
The <u>chaining</u> method of eliciting equivalents is easier in construction terms than the indifference probability method used by Grayson and Spetzler. In the plotting of the utility curves, chaining can help the experimenter by making the time for plotting shorter. We shall illustrate here how chaining works. Suppose we have determined the planning horizon as X and we use 50-50 for probability assignment, the series of questions may be diagrammed this way:

Question 1: Y to be determined



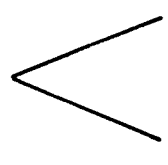
(If we let u(X) = util[1] and u(0) = 0 util, <u>u(Y) = .5)</u>

Question 2: Z to be determined



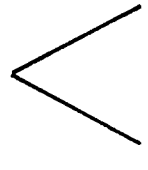
(thus, u(Z) = .75)

Question 3: R to be determined



(thus, u(R) = .25)

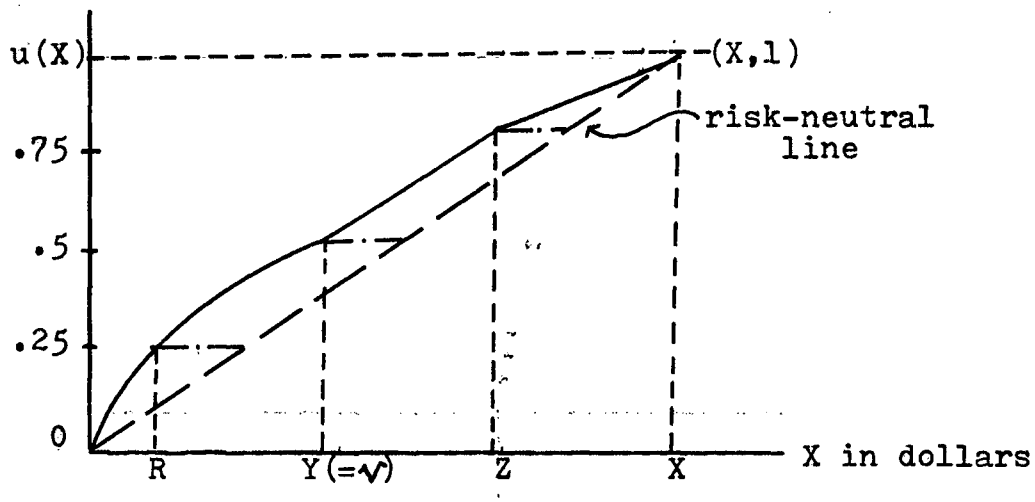
Question 4: to be determined



(thus, u(ν) = .5)

Question 4 is supposed to be a consistency check question. If the person follows the Von-Neumann-Morgenstern axioms, he ought to have $\sqrt{} = Y$. Before we go into the consistency issue, we will present here the plot of the sample equivalents.

FIGURE 2.1: Example of a Utility Curve



Probability learning is perhaps the greatest difficulty encountered by past researchers (Grayson, Spetzler, etc.). The failure to see the probabilities as objective ones causes "incorrect" or untrue responses. Spetzler's reference chart aims at giving the subjects a feel of what the underlying probabilities mean. Even Swalm, who thought that his 50-50 was able to remove all subjective perception, had some subjects who said 50-50 to them was not real. Also, the pay-offs involved are often summarized pay-offs in monetary terms. It is possible that the subjects might fail to grasp the "consequences" of the pay-offs, because some of them think in percentage terms. Net Present Value is often used as an expression of the pay-offs

but this is a condensed figure whose meaning some subjects may not readily grasp. Usually, investment-type questions are employed but the question as to how the pay-offs should be phrased is sometimes not asked of the subjects. The objective of the utility questions is to make the situations as real as possible in order to elicit responses that are meaningful. However, because of the simplicity of the pay-offs, realism is sacrificed. Net present value includes in its calculation the discounting rate but the subjects sometimes have difficulty evaluating the constraints that the investment (and commitment) might mean to future opportunities. The experimenter wants the questions to be responded to as if they were "independent" questions--i.e., the response to Question 1 should not in any way be taken into account by the respondent in answering subsequent questions. Also, there is the danger of respondents giving expected value as certainty equivalents (even if, in reality, they do not use expected value as a decision rule). Motivational elements thus must be incorporated together with the questions so that the responses given are "true" responses rather than what the respondents think they ought to give.

As to consistency, Grayson, Spetzler, and Swalm found that there were in fact answers that did not conform to the axioms of Von Neumann and Morgenstern.

The responses by the subjects to the consistency check question should thus be examined. If the responses are outside a specified range (i.e., the range being $\pm 10\%$ of the amounts on which the check is applied), we must conclude that the axioms

are not followed and the subjects' responses are considered dubious.

The Arrow-Pratt index of risk aversion assumes that one could derive a utility function for each utility curve. However, the form of the function is difficult to determine. Researchers in the past, like Spetzler, Norman and Lorange, suggested what the form of the utility function was. The various functional forms suggested were different from one researcher to the next (i.e., Spetzler's functions were not the same as those of Norman and Lorange). Also, if the functions are to be determined, much curve-fitting work would have to be done and the parameters of the functions would also have to be derived. This is definitely a difficult activity to undertake.

A simpler way, from an experimenter's computational point of view, is to measure the horizontal deviations from the risk neutral line (see Figure 2.1) and average these deviations. Bassler (1972) employed this method for computing risk aversion indices.

Discussion

Utility theory, as we have said, has its possibilities in measuring an individual's risk taking attitude. Difficulties with operational utility measurement have been pointed out. Normatively, utility theory offers the economic man an approach in making decisions under uncertainty. A corporate risk policy can be derived by the application of utility (Spetzler). With the utility functions of the key managers plotted out, delegation

of decision-making can be facilitated (Grayson). Howard (1968) likewise suggested the construction of various utility functions based on independent variables like market shares, profit, etc. to be incorporated in statistical decision theory to maximize utility.

Another economic-based instrument that could be used for the assessment of risk-taking propensity is the Indifference Curve approach. MacCrimmon and Toda (1969) give a method of plotting the individual's indifference curves in situations of trade-offs (between two commodities). The slope of the indifference curve at any point shows the marginal rate at which one attribute is substituted for another. A polynomial utility function of each object considered has been derived from the indifference curves obtained by MacCrimmon and Toda. Thus, questions concerning utility functions may also be raised against the indifference curve method, which can be considered the indirect way of arriving at utility functions. Discussion on the methods of determining indifference curves and the derivation of utility functions from these will not be undertaken here.

However, alternatives to risk-taking measurement are confined not only to economics but may be extended to the field of psychology. In the next chapter, we will present some of the psychological measures that have been found to have validity for our purposes.

CHAPTER 3

THE PSYCHOLOGICAL BACKGROUND OF RISK TAKING PROPENSITY MEASUREMENT

An Overview

Risk taking propensity has been hypothesized to be a general personality disposition. Many devices have been proposed by psychologists for use in its assessment. However, previous studies revealed that there was a considerable lack of agreement among measures that were supposed to be investigating the same general characteristic. The controversy surrounding all these risk-taking propensity measures surfaces partially with the following questions: (1) Is risk taking propensity a general personality disposition? (2) What are the personality correlates of risk-taking attitudes? (3) Can we identify the dimensions of the broader construct called risk-taking? (4) How reasonable are these measures (i.e. in terms of face validity)? and (5) What about the convergent validity of these instruments?

Slovic (1962) attempted to provide evidence about the convergent validity by determining whether intercorrelations among several risk-taking measures were significantly different from zero and sufficiently large to encourage further examination. Eighty-two subjects were administered a battery of Response Set (Dot Estimation Test, Word Meanings Test for Category Width and Test Risk for gambling on guesses), Questionnaire (Life Experience Inventory of Torrance and Ziller and a Job Preference

Inventory), experimental gambling (Bet Preference Test and Self Crediting Test) and peer rating measures of risk taking tendencies. The intercorrelations among these measures were generally not significant (ranging from -.35 to .34).

Bassler (1972), in his doctoral dissertation tested various measures (e.g., variance, negative semi-variance, skewness, kurtosis, etc.) derived from an exercise on stock decision situations (called the Investment Experiment as a Group) in a consistency check with the choice dilemma questionnaire of Kogan and Wallach (1964) and utility functions. The highest correlation he found existed only between two situations which had money pay-offs ($p < .005$ and $r = -.55$).

Kogan and Wallach, in their 1964 study, intercorrelated the following measures: Choice Dilemma; Pure Chance Betting (Actual) Situations; Brim and Hoff Extremity in Judgment and Confidence; Category Width; Choices among different lotteries based on motor skill tasks with monetary pay-offs; Number-guessing games with monetary pay-offs and information available for purchase; Problem-Solving Tasks with up to eight clues available, each at the cost of a decrement in the monetary reward for a correct solution; and a final all or nothing chance lottery. They found no evidence of generality based on their results, i.e., no pattern of high correlations among measures. The published results of other similar studies (Maehr and Videbeck (1968), Weinstein and Martin (1969)) indicated poor convergent validity. Alderfer and Bierman (1970), using a three outcome lottery, showed that opposite patterns of relationship existed between

choice dilemma and investment risk-taking. Slovic (1971) found that under two different evaluation modes (preference or selling price), there was a lack of consistency between the two gambling measures employed.

Slovic (1964) said that "What is needed, therefore, is a systematic investigation of the factors responsible for this lack of convergent validity." The explanation for this lack could be found in the following: multidimensionality of risk, subjectivity of risk, and emotional arousal involved in risk.

Kogan and Wallach (1967) summarized the various determinants of risk taking, an interesting part being the situational influences on risk taking, which can be interpreted to agree with Slovic's multidimensionality-subjectivity issue.

Also, several personality variables are likely to affect one's emotional arousal and thus influence risk-taking. The following have been maintained to be of major importance:

(1) I-E Control (from Rotter 1966) (e.g., Liverant and Scodel 1960, Lefcourt and Steffy 1970).

(2) Defensiveness (using the Marlowe-Crowne Social Desirability Scale) (e.g., Martuza 1970).

(3) Field Dependence-Independence (Kogan and Wallach 1964)

(4) Need Achievement-Fear of Failure (as measured by TAT or the "French Test for Insight") (Atkinson, Bastian, Earl and Litwin 1960; Scodel, Minas and Ratoosh 1959; McClelland 1958; Morris 1966; Weinstein 1969).

(5) Test Anxiety (Kogan and Wallach 1964).

(6) Intelligence and Skill (Kogan and Wallach 1964; Jellison and Riskind 1970).

(7) Autonomy (using the EPPS) (Cameron and Myers 1966).

(8) Sensation Seeking (of Zuckermann, et al. 1964) (suggested by Slovic).

(9) Suspiciousness vs. Trust (Shure and Meeker 1967).

(10) Cautiousness (using Gordon P I Scale) (Phelan 1962).

Other types of studies in the investigation of the personality correlates of risk-taking are in existence (e.g., Rim 1964; Cameron and Myers 1966).

The Sensation Seeking, mentioned above, is what psychologists referred to as the construct "optimal stimulation level." One school of thought proposes that the individual is constantly seeking some optimal level of internal excitement. Risk is courted in order to raise the amount of excitation when it drops below the optimal level and avoided when the excitation level becomes excessive. Thus, the initial hypothesis is that a person with a higher sensation seeking tendency would exhibit higher risk-taking.

Internal-External Control refers to "the extent to which an individual in a specific situation or class of situations believes that what has happened, is happening or will happen is directly related to what he has done." Liverant and Scodel (1960) demonstrated a relationship between risk-taking and I-E where the risk situation involved gambling choices, with their assertion that "a penchant for internal control evidently contributed to lower levels of risk-taking and to less variability in the choice of decision alternatives where the setting involved chance--in other words, when in fact no internal control was possible."

Both of these measures are Likert-type (to remove social desirability bias) measures, each item consisting of pair of alternatives for the subject to select. The scoring method employed for these measures is simplified and "objective" (i.e., there is no requirement for validated judges to review the responses, as in TAT).

Atkinson (1957) was one of those who pioneered the expectancy theory. Atkinson et al. (1960) found support for their model of Resultant Motivation with the shuffleboard game (as a risk device). The resultant motivation function derived from empirical testing demonstrated that a person with high M_s (Motivation to succeed) preferred moderate risk while a person with high M_f (motivation to avoid failure) preferred extremely risky or extremely conservative alternatives or choices. However, Weinstein (1969), using the French Test of Insight (a test for need achievement) and other (n Ach) need Achievement tests (e.g., TAT) tried to determine the relationship between level of need achievement and 12 measures of risk preferences and found low non-significant correlation among traditional n Ach measures and low convergence across risk preferences.

From the numerous studies reported in the literature, it seems that researches into the personality correlates of risk-taking have not been fruitful. Two things may have been wrong with the studies:

(1) the measurement of the other personality variables has not been accurate because of the nature of the instruments used;

(2) the risk-taking measurement has been based on instrument(s) whose construction has been faulty.

Criticism of the past researches into risk-taking is directed towards two major areas: (1) the instrument itself is weak--in terms of the inability to distinguish factors, perceptual differences, and (2) the way the studies have been conducted--failure to eliminate variables that tend to invalidate the results (boredom-inducing effects); inability to separate chance and skill effects, lack of meaningfulness of the consequences of the decisions made in response to the measures, and insignificant value of potential loss (dime-nickel chance situations, for example). Also, different procedures designed to assess the same attitudes may lead to quite different placement of the individuals (Cook and Selltiz 1964). Moreover, the assertion of non-convergence of the various measures is somewhat weakened by the questionable measures of risk-taking used (e.g., Slovic 1962).

Search is always a series of generation and elimination. Criteria must be set up by which we select our instruments. In Chapter 4, we will present these criteria together with the description of the final package.

Instruments considered weak (by our set of criteria) will be omitted from further consideration. For instance, the instruments that have been constructed based on examination questions for high school students (labelled as the "Gambling Set" by Slovic) where a gambling index (Swineford 1938, 1941) is used as a measure of risk-taking tendency are clearly out of

the question for business risk-taking propensity research. Moreover, instruments with inadequate control of extraneous variables (e.g., betting choices where subjects are provided with money to play with, ignoring effects of gains and losses on subsequent betting behavior) are highly undesirable.

What will be presented here are measures that have been found to possess certain properties compatible with our criteria. For a complete listing of the various measures employed in earlier research, refer to Slovic (1964).

Judgmental Measure

Brim and Hoff (1957) designed the Desire for Certainty Test (renamed Extremity-Confidence in Judgment by Kogan and Wallach 1964), an instrument based on the notion that greater extremity in judgment affords the possibility of a greater magnitude of error and judgmental confidence, which might indicate an individual's characteristic biases in perceiving probabilities of success and failure. Subjects are asked to complete sentences of the form "The Chances that such and such an event will occur are about ___ in 100." After making his probability estimate, the subject is asked to rate his confidence in that estimate--ranging from very sure to not sure at all. Scores obtained are the mean confidence rating and mean deviation from the most conservative probability estimate (which is 50%).

An example of the items given runs as follows:

"The chances that a U.S. household will have an extension phone to a regular phone are about ____ in 100.

Very Sure	Quite Sure	Moderately Sure	Slightly Sure	Not Sure At All"

The Confidence Score derived is based on the following code: 1 for Very Sure, 2 for Quite Sure, 3 for Moderately Sure, 4 for Slightly Sure and 5 for Not Sure at All.

The basic criticism that has come out so far is the accuracy of the assumption behind its construction. It is assumed that the individuals answering the items do not know the answers and are therefore making guesses. The existence of statistical data, which can be used as basis for assigning estimates (or probability), if known to the individuals, may confound the interpretation--e.g., an individual assigning an extreme number or proportion may be expressing his knowledge of the matter rather than being extreme in his judgments. Thus, one would not be able to distinguish between extremity of judgment and the amount of knowledge the person possesses. However, the way to get around this is to make sure that the questions asked are general questions whose answers are not known to the subjects.

The Confidence Score reveals how sure the subjects are of their answers. It is hypothesized that individuals will be more extreme in their judgment when they are highly confident, and less extreme when they have low confidence.

Kogan and Wallach (1964) employed this instrument as part of their study on risk-taking. Sex differences were found in their analysis, confirming their previous study (Wallach and Kogan 1959) in its conclusion that women were highly certain less frequently than men but that when they were certain, they were more willing to take large risks.

Dilemma of Choice Questionnaire

Wallach and Kogan (1959) developed a questionnaire to obtain probability preferences in everyday life situations. On this test, a subject is presented with 12 hypothetical situations, each requiring a choice between a safe alternative and a more attractive but risky one. The subject, acting as advisor to the protagonist in each situation, is to indicate the probability of success which would be sufficient for him to select the risky alternative.

A brief description of three of these situations follows:

1. Mr. A., an electrical engineer, has the choice of staying with his present job at a modest, though adequate salary or of moving on to another job offering more money but no long-term security.

2. Mr. B., who has developed a severe heart ailment, has the choice of changing many of his strongest life habits or of undergoing a delicate medical operation which might succeed or might prove fatal.

3. Mr. C., a man of moderate means, has the choice of investing a sum of recently inherited money in secure "blue-chip" stocks and bonds or in more risky securities offering the possibility of large gains.

Response categories and instructions for their use for item 2 are as follows:

> Imagine that you are advising Mr. B. Listed below are several probabilities or odds that the operation will prove successful. Please check the lower probability that you would consider acceptable for the operation to be performed.
>
> .....Place a check here if you think Mr. B. should not have the operation, no matter what the probabilities.
>
> .....The chances are 9 in 10 that the operation will be a success.
>
> .....The chances are 7 in 10 that the operation will be a success.

.....The chances are 5 in 10 that the operation will be a success.

.....The chances are 3 in 10 that the operation will be a success.

.....The chances are 1 in 10 that the operation will be a success.

The response categories were reversed in order for every other item; that is, they were arrayed from 1 in 10 upward for the odd items and from high levels down to 1 in 10 for the even items.

Actual Betting Instruments

Various researchers believe that risk-taking may be more accurately measured in situations where the outcomes are real rather than hypothetical. Mosteller and Nogee (1951) presented subjects with sets of wagers and then actually played out the subject's choices, with real money changing hands.

Edwards (1953, 1954a, 1954b) employed betting instruments in studying probability preferences. He also found that risk taking attitudes under real gambling situations were significantly different from those under imaginary gambling situations.

Coombs and Pruitt (1960) used gambles of zero expected value in studying variance preferences among students.

Suydam and Myer (1962) offered their subjects choices of either gambles or sure amounts, the sure amounts being sometimes losses and sometimes wins.

Scodel, Minas and Ratoosh (1959) also used real gambling in their attempt to relate probability preferences to achievement motivation and other selected personality variables such as intelligence.

Criticisms of the betting studies are usually directed towards the way the experiments were carried out. Subjects were generally provided with the initial stakes for gambling. The Coombs and Pruitt study (1960) has been criticized on the zero expected value and the trivial stakes involved (Alderfer and Bierman 1970).

Certain amendments must be made in the construction or design of the betting instrument. One would be to make the stakes significant enough for the subjects. Also, the subjects should not be given the original amount to play with. The effects of gain and loss on subsequent betting behavior should also be controlled.

Other Possibilities

The Semantic Differential technique, a method developed by Osgood and Succi (1969) for the evaluation of meanings, may be applied in risk-taking measurement. In the past, the Semantic Differential technique (Kogan and Wallach 1964) has been employed for the study of people's views of risk-laden concepts like earthquakes, quicksand, and the stock market. But these studies have not been quite successful because they have been unable to take multidimensionality of risk into account. One possibility is to employ a semantic differential scale to which the subjects respond in their rating of hypothetical risk-takers in the dimension of risk we so specified. An example of a subset of differential is:

"Independent _____ _____ _____ _____ _____ Dependent"

where independent is a favorable adjective and dependent, the

unfavorable. Relying on the notion that persons would adhere to the idea of rating someone favorably if this someone had characteristics similar to their own, the Semantic Differential Technique would give us an indication of a person's risk-taking attitude by the way he perceives risk-takers.

One caution that should be taken in mind is that the Semantic Differential is not unidimensional and what we should only employ is the "evaluative" dimension. Osgood and Succi (1969) have a good discussion of the dimensions of Semantic Differential. This discussion will not be repeated here.

The interview technique employed in most social psychology studies or as part of the "projective" technique in psychoanalysis offers another possibility from which one could derive a risk-taking measure. This would involve questions about how the subjects handle situations of risk in his real life--i.e., the kinds of activities they undertake, which give one an indication of the amount of risk they are willing to take. If risk is subjective (according to Slovic 1964), what then is considered risky and why is it considered risky by the individual? Interviews provide the answers to these questions.

Of course, the difficulty with the interview method, as with other "projective" techniques, used rather loosely, occurs when one wants to score the responses. Some amount of "personal judgment" comes into play during the interpretation of responses.

A variant of the interview method is the rating method. This has been used by Slovic (called the risk rating scheme) in 1962. The subjects were asked to rate their fellow fraternity

brothers on a bipolar trait of general willingness to take risks. This kind of a rating system rests on the assumption that a person close to the individual being rated knows enough about the latter's risk-taking disposition to make a judgment. The danger here is that it is highly possible that the rater employs his own value on risk as a gauge through which he measures other people. Thus, we must know something about the attributes and weights he uses in the judging. The simplified rating method employed by Slovic (1962) must be extended to include questions on the subjects' reasons behind the rating (e.g., what decisions did he (the person being rated) recently take that seem to indicate his risk-taking disposition? or why do you suppose he is that kind of a risk-taker?).

Discussion

There are other alternatives for measuring risk-taking propensities, which may be considered as outgrowths of psychology or which may be labelled inter-disciplinary. Some of these are games which are dynamic enough to include some amount of complexity and realism. Management games may be modified to serve as risk-taking propensity measures. Although nowadays these are considered largely part of Management, a distinct discipline, they may be considered derivations of games employed by psychologists (e.g. Prisoner Dilemma Game, War Strategy Games of Streuffert (1965) called A Tactical Negotiations Game). The In-Basket, for instance (from Frederiksen 1962; Hemphill, et al. 1962), may be modified to become a risk-taking propensity measure.

Personnel Selection Games, where the attributes considered are largely those related to risk-taking, are another example.

A cumulative body of materials can be derived by studying some instruments and designs used by others. However, modifications must be made on instruments used in the past. A fallacy can be committed in research by merely lifting an instrument from the past and applying it based on a design specified by other researchers without considering the circumstances of the research.

If a "superior" measure of RT propensity can be constructed, inquiry into the personality correlates of risk-taking may be done with a greater amount of success.

Chapter 4 will start with a brief discussion of the decision making environment as an overview, and then will describe the final package by dividing it into its subsets of instruments with explanations and illustrations.

CHAPTER 4

A PACKAGE OF RT INSTRUMENTS AND RELATED MEASURES

An Overview

Decision making is defined as primarily dealing with evaluation and choice from a set of alternatives. Both thought and action are implied in such a definition. The main elements of decision making are a decision-maker and his decision environment. The main attributes of a decision-maker are his values, his beliefs, and his resources (MacCrimmon 1970). Judgment, being an important part of decision-making, derives its strength from the interaction of a decision-maker's attributes and the information on hand. Clearly, the decision-maker's risk taking propensity is part of his attributes and therefore influences decision making. Though the risk taking propensity of a decision maker is relevant only in situations of risk or uncertainty, most practical management decision situations however are characterized by considerable uncertainty--i.e., where only partial knowledge of relevant variables comes into play.

A decision maker who uses expected value as his decision rule implies that he is risk-neutral. This however may be considered as a special case of a risk taking attitude.

Outcomes and actions are two different things. Sometimes, a decision maker believes that the course of action he takes influences the outcomes of his decision; but the extent of such influence is, by and large, uncertain. The larger his pool of relevant information the better his evaluative capabilities.

However, he knows that, despite his knowledge, there is still such a thing as unexplained variation or area of doubt.

The whole topic of risk-taking really belongs to the domain of "Decision-making under uncertainty." The amount of risk one is willing to take is indeed a decision by itself. Because a decision-maker believes that it is results that count, he has to evaluate the likelihood of such results. Sometimes, the decision maker faces an alternative which is stochastically dominant; here, there is no question as to which alternative he is going to take. However when stochastic dominance is not clear-cut, he gets into a bind. He tries to estimate what risks he is willing to take. Since there is no clear cut way of estimating his attitude towards risk, he does this estimation intuitively. If a way is provided for the decision maker to measure his risk taking attitude, decision-making may be facilitated. Rather than estimating this risk-taking propensity every time he faces a decision problem, the measurement of his risk attitude is done only a few times. Also, by quantifying his risk attitudes, he can tell his subordinate what risks he is willing to take.

Oftentimes, decision-making is delegated, depending upon the degree of decentralization. Here, we are talking about higher-level decisions (or "decisions of higher quality")--e.g., investment decisions. Here, the delegation is often the granting of choice-making powers. However, there arises a basic question of whose risk taking propensity should be taken into consideration. Grayson (1960) suggested that the senior manager's

utility function should be used in deciding on the level of risk that the subordinate decision-maker should take in situations concerning the allocation of company resources for investment.

Also, if decision-making is to be delegated, who we want most depends upon, other things being equal, the risk taking attitude of our subordinate--once we are able to ascertain such an attitude. In this way, a person could delegate his decision-making authority to someone whose risk-taking propensity is similar to his own--other qualifications being equal to the rest of the candidates. From the business organization's point of view, a high risk-taker is not necessarily good, nor is he bad; it is more a question of acceptance or willingness on the part of the organization to accept the level of risk that he might choose in the future. Also, there is a question of the stability of his risk-taking attitude over time. Thus, knowing something about the risk-taking attitudes of people in the organization or of those who are to be considered soon as members of the organization helps clarify certain issues. Of course, there are situations where an extremely risk-averse individual becomes a somewhat poor decision-maker--especially when he has continued seeking information even though the cost of information-gathering is much, much greater than the "expected value of perfect information."

The idea of risk taking propensity as it relates to decision making is not new. In his classroom discussion, Dr. MacCrimmon has illustrated how risk taking propensity interacts with the various variables in the decision making process.

In order to clarify what we have said, we have constructed a diagram showing the relationship of risk taking propensity with other decision-making variables. This is illustrated as a schema in Figure 4.1.

Some explanation concerning this schema must be given. The Person brings with him at the post-problem definition stage several things: his personality characteristics (e.g. I-E Control) and his demographic characteristics; wealth is defined here as the resources he or the organization has. Moreover, his level of aspiration, among other things, interacts with certain situational effects to produce a certain level of emotional arousal. His previous risk experiences would affect his "wealth" and therefore himself. Subjective probability, loosely phrased here, would mean his tendency to inject certain subjective elements in probability assignment. Also, information (as shown by the double-arrowed line) is sought and may be possessed by the individual, which will influence his perception of the alternative environment--which could be defined as the set of feasible alternatives that exist (with or without the individual's knowledge of their existence). Perception, thus, is a bit broad to include search behavior--i.e., recognition, whether a given possible action is an alternative or not. Associated with each alternative, there are possible consequences that could arise. The severity of the consequences definitely depends upon how his perception is affected by the influences we so cited. Objective probability, in this case, may be "existent" or "non-existent"--depending upon the problem. However, let us make

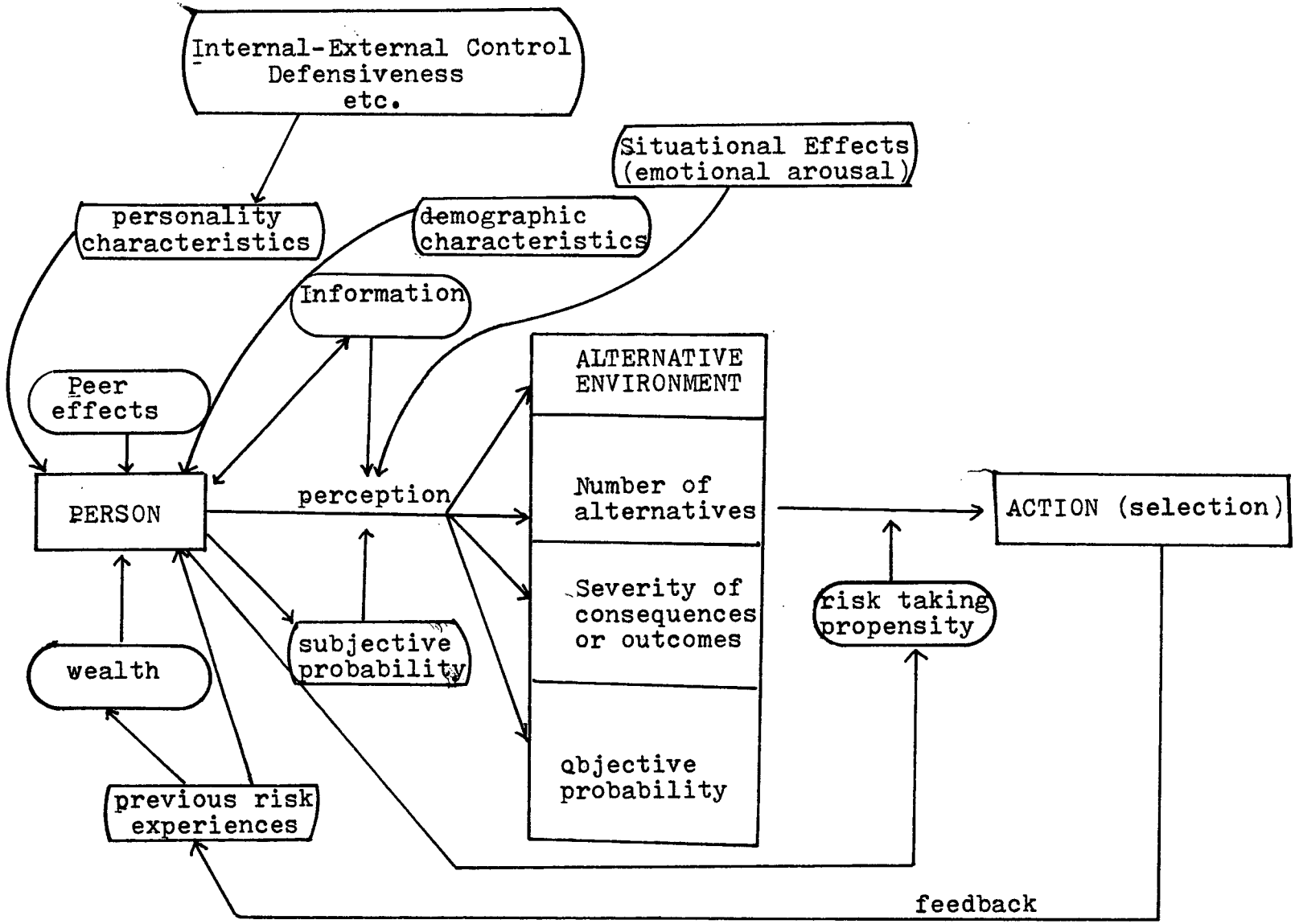


FIGURE 4.1 The Risk Environment in Decision Making for an Individual

the assumption that objective probabilities exist; whether he knows them to exist or not is another matter. After he has gathered the set of alternatives he thought feasible, his next move is choice. He looks back at the severity of consequences of each alternative, and the likelihoods of these consequences. Now his risk taking propensity focuses itself into major importance, and action follows--the selection of a course of action. The action will have certain consequences or outcomes and, depending upon the extent of the odds for or against favorable outcomes, the outcomes will be perceived and such perception will be added on to his pool of previous risk experiences.

Definitely, the schema we have constructed is too simplistic and needs further refinement. But we feel that relationships may be clarified by such presentation.

If we are interested in studying risk taking in business situations involving things like technological change, innovation, ownership and the like, we should utilize items that bear a close relationship to these situations (MacCrimmon and Kwong 1972). Because risk taking attitude is not unidimensional, the search should be focused on what we're interested in.

The following criteria have been set up as guidelines in search and development:

1. Appropriateness - The instrument must focus on business decision problems and top dimensions of risk relevant to the individual in business.

2. Motivation - One has to assume that there is a "true" attitude towards the object. It is believed that if the instrument possesses certain characteristics that sustain emotional arousal, "true" attitude has a greater likelihood of

surfacing. Part of this property is the ability of the instrument to elicit responses which apply to the individuals rather than responses which are merely socially acceptable alternatives (Gordon 1951). The items must be credible, interesting, diversified, involving and not too long (i.e., that it must not be boredom-inducing).

3. Discrimination - It must be able to place individuals into categories, i.e., identify the individuals on the basis of his responses and classify them into groups. Sufficient variability and consistency are part of this property.

4. Control - It must possess the ability to control the differential perceptions of the same risk to distinguish various situational effects.

5. Ease of Administration - It must be able to be administered with low supervision and the minimum of instructions, instructions which are highly understandable.

6. Analysis Ease - We refer here to scoring ease, ease of direct interpretation and the compatibility of the instrument with research design.

To facilitate classification of the instruments, the role situations in these may be broken down into:

- What would you advise X to do if he were confronted with situations S?
- What would you do if you were Z and were confronted with situations S?
- What would you do if you were confronted with situations S?

The measures presented in this chapter are: either completely new or past measures refined to suit our needs. The original package is contained in a working paper by MacCrimmon and Kwong (1972). What will be presented here is the final package. In order to facilitate selection and construction, the thesis has a "pilot" group in mind--a selected group of

U.B.C. Graduate Students in Business--who will be given the package as a preliminary study on risk taking attitudes.

In presenting these measures, we would like to point out that although the complete presentation of the instruments (item by item) will not be made, illustrations and descriptions are available for the benefit of those who would want to pursue further research into this field. The thesis writer feels that it is his prerogative to withhold publication of his instruments if he so desires.

The Package

Briefly, we can divide the package into two sets: one which requires the presence of the experimenter (stock price wagers, utility questions on several dimensions) and one which is self-explanatory, requiring no assistance or presence of experimenters (In-Basket; Choice Dilemma items; Extremity-Confidence in Judgment; Event Occurrence and Activity Interest Questionnaire; and the Personal Record Questionnaire). Also, the questionnaire called Event Occurrence and Activity Interest is not a standard RT propensity measure but a questionnaire consisting of Internal-External Control and Sensation-seeking items. We will commence the discussion on the second set first.

In-Basket Exercise

In its past form, the instrument is a collection of letters, memoranda, records of in-coming telephone calls and other materials that have supposedly collected in the in-basket of an administrative officer. The form of the In-Basket is attractive due

to its proximity with the real world. The factors experimenters looked at in the past were: imaginativeness, organizational change, concern with public relations, etc. The In-Basket contained in the package aims at measuring risk taking propensity by examining the responses to the various items it contains. It is composed of six letters and one memo, each of which contains two courses of action--one certain and another uncertain. Memo sheets are provided for the subjects to respond with.

The subject assumes the role of Bill Bickner, a divisional V.P. for Multinational Products, International, who just arrived at his job due to the untimely death of a former V.P. All information concerning the letters and memos are in the exercise itself and the subject is not supposed to ask for consultation. He is to go through the letters and memo, responding to them on memo sheets provided in outline form. Because Bickner must leave promptly to catch a plane for an important meeting and will not be back in one week's time, he must respond to the items with a specified time limit. After responding on the memo sheets, the subject is asked to answer a number of questions at the end of the exercise--a Semantic Differential set, where adjective pairs are provided for the subject to rate four correspondents, and a set of questions which asks him the probability of success he would accept before taking the uncertain alternative contained in each letter and memo.

The business letters have been created from situations recorded in case studies from International Business and Technological Change. Both implied and stated consequences have

been built into the items for the examinee to weigh. The letters and memos may be described briefly as follows:

(1) Letter from Donald Moore of their Canadian subsidiary concerning a possible suit by another company on charges of patent violation, where the alternatives are: go to court (the uncertain one), and settle out of court (the certain alternative). The recommendation by the writer of the letter is to pay the settlement amount.

(2) Letter from Frank Bickner, son of Bill, stating his intention to take up music (the uncertain alternative) and leave engineering (the certain alternative). This is a personal letter.

(3) Letter from Paul Royce, a close friend of Bill, asking Bill to join him in a venture in the Philippines concerning coconut oil extraction (uncertain) and leave Multinational Products (the certain alternative).

(4) Letter from Johnny Kaye, Project team director for Arizona, who recommends that investment in Arizona is attractive. Two courses of action are open to the company; go in alone (the uncertain alternative) or join forces (joint venture) with competitors (the certain alternative). Recommendation was to go it alone.

(5) Letter from John White of their Atlanta subsidiary where the continuation of a time and motion study (with a possible benefit of improving productivity by at least 25%) might start a general strike among the workers. White's recommendation was to have Anderson, the Time and Motion researcher, recalled to New York office.

(6) A memo from Annabel Johnson, the secretary, telling Bickner about Domier, a large buyer of their Quebec company's products, who sought to ban the Quebec company from selling to his competitor.

(7) A letter from Peter Taylor, the marketing manager of their New Jersey subsidiary, informing Bickner of his intention to resign if the local president insisted in marketing a new product, T-32, instead of continuing an old, established product. The certain alternative was to continue the old product while the uncertain alternative was to market the T-32.

An organizational chart outlining the line-staff relationships is included in the package to clarify Bickner's area of responsibility.

Choice Dilemma Items

The instrument consists of 10 items--5 from Kogan and Wallach and 5 constructed in the same format. In order to determine the severity of the consequences on the lives of the central persons involved, instructions are given to the subjects to rank the items in the order of greater impact.

We have mentioned the format of the choice Dilemma questions in Chapter Three and will enumerate the ten items contained in our instrument:

(1) Mr. A., an electrical engineer, has the choice of staying with his job at a modest, though adequate salary or moving on to another job offering more money but no long-term security (from K & W).

(2) Mr. K., the marketing manager of a firm, faces the choice of either investing $3 million in a new product which could mean 20% ROI or failure or investing the same amount to market an old, well-established product but with no return higher than 10% ROI (original).

(3) Mr. B., an accountant, with a severe heart ailment, has the choice of going through a delicate medical operation which could cure him completely or could be fatal, or to live out his days by changing many of his strongest life habits, reducing his work load, changing his diet and giving up favorite leisure-time pursuits (K & W).

(4) Mr. J., production supervisor, faces a dilemma: to go ahead or not to go ahead with some drastic changes to improve the company, which, if successful, would mean J's promotion as general manager and, if a failure, would mean J's termination. If he recommended no change, however, he would remain in his present job with no prospects of promotion or more than minor salary increases (original).

(5) Mr. C., man of moderate means, has the choice of investing a sum of recently inherited money in secure "blue-chip" stocks and bonds or in more risky securities offering the possibility of large gains (K & W).

(6) Mr. B.C., president of a subsidiary, has been arrested for alleged treason. MIK, the parent company, faces the choice of selling out at a reasonable, but low price or hanging on with the possibility of B.C. being convicted with the subsidiary being expropriated (original).

(7) Mr. E., president of an American corporation contemplating expansion, has the choice of building an additional plant in the U.S. with the expectation of a moderate return on the investment or of building in a foreign country with an unstable political history, where, however, returns would be considerably higher (K & W).

(8) Mr. T.D., sales manager of a U.S. subsidiary, has the choice of selling $500,000 worth of goods to a local politician who is definitely not going to pay or not selling the goods to him with the possibility that such refusal could incite anger and trouble from the politician (original).

(9) Mr. K., a successful businessman with a strong feeling of civic responsibility, has the choice of seeking or not seeking election to congress as a candidate of a minority party with limited funds (K & W).

(10) Mr. L., area manager of a U.S. firm in Southeast Asia, faces the choice of continuing production or not in the midst of a strike in the U.S. West Coast Docks which could last for 3 months or be settled immediately (original).

In the same vein as Kogan and Wallach, the response categories are reversed in order for every other item--i.e., they are arrayed from 1 in 10 upward for the odd items and from high levels down to 1 in 10 for the even items.

Extremity-Confidence in Judgment

Fifteen items following the Brim and Hoff format have been constructed based on the same assumptions forwarded by studies using this instrument. In order to remove the effect of knowledge that may contaminate the results, the items constructed here are mostly about facts which we feel the subjects have no knowledge of. For example, "The chances that an adult Japanese in Japan will know how to speak English are about ___ in 100," is an item whose exact answer may not be known or remembered by the subject.

Although this is not the standard risk measurement, it does reflect the "willingness of a person to take the risk of errors in judgments" and his confidence level.

The subjects are asked to indicate the chances that the event will occur and give their confidence by encircling the phrase that describes this confidence (i.e., Very Sure, Quite Sure, Moderately Sure, Not Sure at All).

Event Occurrence and Activity Interest Questionnaire

Following the belief that external-internal control and sensation seeking are two personality correlates of risk-taking, this instrument has been constructed by taking ten items from Rotter's I-E scale and ten from the Zuckerman, et al. Sensation Seeking Scale. The instrument has been renamed to disguise its intention.

The I-E items are interspersed with the Sensation Seeking items using the format of the originals. Two examples of items

contained in this instrument follow:

(1) a. Many of the unhappy things in people's lives are partly due to bad luck.
b. People's misfortunes result from the mistakes they make.

(2) a. I would like a job which would require a lot of travelling.
b. I would prefer a job in one location.

All the odd items are Rotter I-E type while all even items are sensation-seeking type. Also, the order of the internal control choice and the external control choice is reversed for every other odd item. The same is true of the sensation seeking items, in the case of even items.

Personal Records

In order to secure information on the demographic characteristics of the subject, this instrument, in the usual survey format, consists of questions concerning age (expressed in terms of year of birth), education level of the subject and his previous background, his assets and liabilities; his leisure habits (e.g., playing poker, etc.), his working experience, how he finances his education and the like.

The subjects' responses are values of various demographic variables that may be related to their risk taking attitudes. Some of these variables were suggested by Kogan and Wallach (1967) in their essay on the determinants of risk taking behavior. We intend to examine the risk taking measures and the subjects' responses on these questionnaires by relating the scores generated to the various demographic variables sought by the Personal Record.

Utility Type Questions

Each subject is asked four sets of questions by this instrument. Two of the sets concern questions to be answered by the subject in his business or professional role, which is provided for by a short scenario. Except for the Scale of Wager set, the questions seek to elicit certainty equivalences by using the method of chaining (see Chapter 2). The sets are composed of the following:

a. Personal Utility sets - two sets of items are given. The first is the Scale of Wager where the subject is asked questions about wagers in terms of their cash equivalences (buying) and of the decision to accept or reject the lotteries offered. The second is called the Compensation Utility Questionnaire where the first question is used as a basis for a "planning horizon"--i.e., his annual compensation in his first year of work (expected). The probabilities involved here are .80 and .20 for chances of success and failure respectively as contrasted with the 50-50 odds of the first set. Here, we are after the amount of the biggest pay-off in the case of the uncertain alternative, that would make him indifferent between the certain and uncertain alternatives.

b. Business Utility sets - two scenarios are given for the two sets contained in this section. One concerns the assumption by the subject of the role of a general manager of a small company and another tells the subject to assume the role of a division manager of a large international business. He is to answer the set pertaining to the scenario with the specified role in mind. Two types of utility questions are asked here--Net Profit Utility Questions and Rate of Return Questions. Equilibrating probability is solicited by each item in the case of Net Profit U. Questions while in the Rate of Return, the cash equivalents (or the Certainty Monetary Equivalents) of the uncertain alternatives are solicited, where the probabilities involved are 50-50.

In order to reduce the contamination of results that may be caused by learning effects, the personal utility and the Business

Utility sets are interchanged randomly. Also, for purposes of interpersonal comparison, the net profit and the rate-of-return utility questionnaires are interchanged randomly between scenario of the first type and of the second type.

The inclusion of the utility items in the interactive set stems from convenience. In order to facilitate the subjects, the entire package is divided into smaller lots. The utility items are thus included as part of the interactive set. Also, we feel the utility items may need more verbal clarifications--i.e., how to fill in the blanks, what variables should be considered constant, etc.

Stock Price Wagers

The subjects are presented with five sets of wagers in which the pay-offs are real rather than hypothetical as compared to the other measures. Although the subjects have a chance of gaining actual money, only one of the chosen wagers, selected randomly, will be played out. In each set, one of the options is not a wager at all since if selected, the subject is entitled to $2.00 for sure. The rest of the wagers differ in the amount of win or loss, the probabilities involved and, in two sets, the expected winnings. Information concerning the amount of win or loss, the probability of winning and the expected winnings is provided. These wagers are based on the fractional part of the prices of five stocks selected randomly from a list of 100 stocks heavily traded on the New York Stock Exchange. Set A and B contain options whose expected winnings are $2.00 while

Set C starts out with a $2.00 sure amount option, followed by items whose expected winnings increase by 10% of the previous item's EV as the variance of the wager increases. Set D is the reverse of Set C where the expected winnings decrease as the variance increases. In Set E, the probability of winning is fixed at 62% with the amounts of win and loss varying, all with expected winnings of $2.00.

A list of 100 stocks under $50 is attached to the instrument. The subject wins if the fractional amount of a stock's price is 1/8, 3/8 or 5/8; he loses if the fractional amount is 1/4, 1/2, 3/4, 7/8 or a whole number. Generally, the options of wagers are of the form:

> "You will receive $_____(amount of win) if at least_____ (number) of the 5 stocks has (have) a fractional price(s) of 1/8, 3/8, or 5/8.
>
> However, you must pay $_____(amount of loss) if only_____ (number) of the five stocks has/have one of these fractional prices.
>
> Chance of winning_____ Expected winning_____"

Method of Scoring the Items

The following scores will be used as input to analysis:

1. Choice Dilemma Scores - each item will have as a response a number out of 10 that the subject accepts as the odds of success. The ten numbers from the ten items will be averaged for each subject and will constitute a total score on this set. In addition, rank responses (ranking by subjects in order of the gravity of the consequences of the items on the lives of the central persons involved) will be used for studying the

rank correlations of high risk takers and low risk takers as determined by their total score for the set.

2. In-Basket Scores - Several scores will be derived from the exercise.

(a) Note/Wire Response Set - the verbal responses will be given ranks (of risk aversion) by the examiner based on the strategies the subjects have adopted. Rank 1 will imply the greatest risk-taking.

(b) Ranks - each item will be ranked by the subject in the order of importance.

(c) Grades - the subject is asked to assign grades based on his perception of the importance of the consequences to him as a businessman. There will be 7 grades for each subject with the item he deemed as most important graded as 100 (i.e., maximum is 100).

(d) Score for Part A (after-Exercise Questionnaire) An average is derived from the odds the subject assigned to each item.

(e) Semantic Differential Score - the subject is asked to rate the persons named by the questionnaire with the adjective-pairs (10 in all) provided. The adjectives are identified as favorable or unfavorable and the scales run from +5, +3, 0 to -3 and -5. These are added for the ten adjective pairs and represent his score for the Semantic Differential on that particular person. A total score can be derived by adding these individual scores together.

3. Event Occurrence and Activity Interest Scores - two scores are derived--one, the number of internal control alternatives the subject selected and two, the number of sensation-seeking alternatives he chose.

4. Extremity-Confidence Scores - The confidence score for each item will be added up to derive a confidence rating (with Very Sure as 1, Quite Sure as 2, Moderately Sure as 3, Slightly Sure as 4 and Not Sure at All as 5). The extremity score is derived by averaging the 15 squared deviations of the subject's chance assignments from .50 (considered as "conservative").

5. Personal Record "Scores" - The subject's age, amount of assets, amount of insurance, and liabilities are derived from the Personal Record Questionnaire. These are used as values for the demographic variables we are interested in. From the section on hobbies and leisure, we attempt to deduce the subject's risk taking attitude. Using a scale of 5--where 1 indicates high risk-taking, 2 moderate risk-taking, 3 relatively risk-neutral, 4 moderately risk averse and 5 highly risk averse.

6. Stock Price Wager Score - For each set the formula is the rank (derived by ordering the wagers from lowest to highest variance, where variance is $(1-p)p(a-b)^2$ with p as the probability of losing (-b amount) of the choice minus the product of the rank and the proportion of the variance of the choice to the variance largest in the set. A total score is derived by adding up these individual scores. In mathematical terms:

$$\text{Total Score} = \sum_{i-1}^{5} r_{ci}(1 - Vci/V_{Li})$$

where r_{ci} represents the rank of the option chosen in set i; Vci, the variance of the option chosen; and V_{Li}, the largest variance of set i.

7. Utility Scores - The scoring method employed essentially is similar to the one Bassler used in his dissertation (1972). The horizontal deviation between the certainty equivalents and the expected value is derived for each item. Then, this value is converted into percentage terms (i.e., as a percentage of Expected Value). The percentage deviations are summed and averaged. This scoring method is done for rate of return utility questions, net profit and compensation. As for the scale of wager, we have essentially the following to express the aggregate score:

$$\text{Score} = n \times \sum_{i=i}^{5} hd_i,$$

where n is the number of no answers to the wagers (i.e., that the subject will not take the wager), and hd_i is the horizontal deviation of the amount he would pay for the wager (i) from the expected value of wager (i).

Discussion

We have presented here the nature of the items used. The scoring convention, except in the case of Extremity score, is that higher scores reflect higher risk aversion.

In the next chapter, we will discuss the methodology involved in administering these instruments and the nature of the subjects involved.

Far from perfect, we feel that certain improvements may be made on the instruments. Some amount of attention has been taken in the construction of the package. We also hope that we have learned from the mistakes of the past researchers to come up with a reasonable package.

We are not asserting that this package contains all the alternatives to studying business-monetary risk taking. We are however confident that the instruments are useful in research of this nature.

The empirical study carried out is not for validating the package but is for an in-depth analysis of a particular group of individuals whose risk-taking tendencies we are interested in. Some attempts at item analyses will be made. But, considering the nature of our sample, these analyses must be read with care. Also, we would like to determine whether or not some of the conclusions concerning risk taking, drawn by past researchers, still hold for our group.

CHAPTER 5

THE DESIGN OF THE STUDY

Subjects Used

Thirty-five Graduate Students in Business Administration of the University of British Columbia completed the sets of instruments we have outlined in Chapter four. These subjects were solicited strictly on a voluntary basis with guarantee of anonymity. They were all Master's students with different options.

The original intention had been to secure at least forty subjects. Fifty copies of the first set, consisting of the choice dilemma, extremity-confidence and Activity Interest were handed out, and at least forty In-Basket questionnaires and personal records sheets were distributed. But because of the amount of time involved, only 35 completed the entire sets.

The subjects were drawn from three M.B.A. classes with the cooperation of the professors involved and from students who frequent the U.B.C. Commerce Graduate Reading Room. The three M.B.A. courses were: Organizational Behavior, Policy, and Decision Making.

Procedure Used

Because there is a possibility of subjects believing that risk taking is a value and therefore responding to the items in order to appear as risk takers, the design has been to disguise the various measures as some sort of a package of decision-making exercises.

The following information sheet accompanied the first set of instruments:

INFORMATION SHEET

A STUDY OF INDIVIDUAL DECISION MAKING BY

Alfred C. Kwong
Graduate student, Faculty of Commerce and Business Administration, University of B.C.

As part of a Master's Thesis on the development of a Descriptive Decision Making Theory, we are attempting to obtain volunteers for the study. Participation will involve responses to a series of decision-making exercises and questionnaires and all responses will be kept ANONYMOUS. The various research instruments have been approved by the University Screening Committee and we have obtained a Certificate of Approval for Procedures in Research and Other Studies Involving Human Subjects.

The entire study involves the development of a package of Business Decision Making measures intended for research into Decision Making styles, pattern recognition, implicit heuristics, strategy availability, and Decision Making personality correlates, and a preliminary application of these instruments on a smaller sample.

The package contains the following:

1. An individual questionnaire
2. A choice of wagers problem
3. An event occurrence and activity interest questionnaire.
4. Extremity-Confidence in Judgment Questions
5. An In-Basket Exercise
6. "Choice Dilemma" Questions
7. Utility Functions on a number of dimensions.

All individual results will be CONFIDENTIAL, although your own profile will be made available to you if you wish it. Since research instruments may be administered at different times, participants will be asked to select their own six digit code number and use this on all of the questionnaires, etc., so that we can assemble all materials for each respondent.

From the point of view of participants, going through the series of exercises and questionnaires will enable them to increase their understanding of their own decision making styles and profiles in situations of uncertainty and complexity. Also, as a lesser inducement, participants will

be given the opportunity to engage in an actual choice of wagers situations where expected winnings will be provided.

Thank you. We hope you find the series of questionnaires and exercises interesting.

We felt that the entire package, if given out all at once, could be viewed by our subjects as extremely time-consuming and difficult. Guided by this conjecture, the package was divided into three sets: two "take-home" packages and one "interactive" package. These are of the following:

Take Home Set 1:

1. Choice Dilemma Questionnaire
2. Activity Interest and Event Occurrence Q.
3. Extremity-Confidence in Judgment

Take Home Set 2:

1. In-Basket
2. Personal Records

Interactive Set 3:

1. Utility Measures
2. Stock Price Wagers

The verbal instruction was that they could fill out the questionnaires anytime they were free, not necessarily at one sitting. The interval between sets is at least one week, making sure that the subject has finished the prior set before going on to the next.

The interactive set is administered with the experimenter present because the stock price wagers must be played out. Because the last set requires both experimenter and subject, several sessions were held depending upon the availability of the subjects. The utility items are included in this set by convenience, as mentioned before.

Data-gathering had been difficult on the personal records questionnaire because some of the questions, as viewed by the subjects, were "too personal" and many feared that their anonymity was in jeopardy.

Instructions to the Subjects

Presented below are the instructions to the questionnaires we handed out (except for the utility items which were basically question-and-answer form with the heading Utility Questionnaire and the Personal Record Questionnaire).

1. Choice Dilemma Items

I.D. No._____

On the following pages you will find a series of situations that can occur in business. The central person in each situation is faced with a choice between alternative courses of action.

In these ten situations, the central person has two alternatives. The outcomes of one of the alternatives may be more attractive than those of the second; however, the realization of these outcomes is uncertain. For each of the ten situations you are asked to indicate the minimum chance of success you would demand before recommending that the uncertain alternative be chosen.

Read each situation carefully before giving your answer or judgment. Try to place yourself in the position of the central person in each situation. There are ten situations in all; please make your recommendations in all of them.

Also, please do the following task: Rank the items according to the impact of the consequences on the lives of the central persons involved (which means that, given a limited time schedule for advising, you would want to order your appointments for these persons in accordance with the effects of the decisions on their lives).

ITEM	RANK*
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

* Giving the one that would have the greatest impact 1, the next 2 and so forth down to the one having the least impact receiving a rank of 10.

II. Extremity Confidence in Judgment

This questionnaire will help us find out about people's opinions about various things. Each item in the questionnaire will decide a specific event. We want your opinion as to how likely each event is. All of the items in the test will be of the form in which you estimate the number of chances out of 100 that a specific event occurs. Thus, if you judge an event to be unlikely, you'd write a number clost to 0; if you judge an event to be likely, you would write a number close to 100; and if you judge an event to be about equally likely or unlikely, you would write a number close to 50.

We also want you to indicate how sure you are of your opinions. So, after you have decided how likely an event is we want you to indicate how confident you are of this judgment by circling one of the 5 categories below each question.

Please do not skip any questions.

III. Event Occurrence and Activity Interest Questionnaire:

This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair (and only one) which you more strongly believe to be true rather than one you think you should choose or the one you would like to be true.

This is a measure of personal beliefs: obviously, there are no right or wrong answers.

Please answer these items on this inventory carefully but do not spend too much time on any one item. Be sure to find an answer to every item.

In some cases, you may discover that you believe both statements or neither one to be true. In such cases, be sure to select the one you more strongly believe to be the case as far as you are concerned.

Also, try to respond to each item independently when making your choice; do not be influenced by previous choices.

IV. In Basket Exercise:

Please do this work in your room which will become your "private office" for forty minutes. You will work as if you were Bill Bickner, Vice-President, North American Operations of the Multinational Products International Co. You just arrived in this new job, having come from the Connecticut subsidiary where you were its president. Your predecessor, Mr. James Norton, died of a heart attack last week. You were notified very recently of this new assignment and have had little time to become acquainted with the job.

Today is Wednesday, May 14, 1972. You have just arrived in the office at 7:45 p.m. and must leave promptly at 8:25 p.m. to catch the 9:30 plane to Mexico City for an important meeting. You will not be back until Thursday, May 23, 1972.

The materials in the package were left in your in-basket on your desk by your secretary. You are to go through the entire packet of materials by reading them and taking whatever action you deem appropriate on each item. Since your assistant will take charge of the actual drafting of the letters and as there is little time for you to write these formally, every action you wish to take should be written down in note form or in wires, where appropriate, either to yourself, to your assistant or to the person concerned. Be sure to indicate in the notes and/or wires to whom they are addressed. Please write the note and/or wires on the enclosed Memo sheets.

You are to use your own experience as the basis of your action in assuming the role of Bill Bickner.

NOTE:
THE DAY IS WEDNESDAY, MAY 15, 1972. TIME: 7:45 P.M.
THE TELEPHONE SWITCHBOARD IS CLOSED.

WRITE DOWN EVERY ACTION YOU TAKE ON ANY ITEM. YOU CANNOT CALL ON ANYONE FOR ASSISTANCE. YOU MUST WORK WITH THE MATERIALS AT HAND. YOU WILL BE OUT OF OFFICE FROM 8:25 UNTIL NEXT THURSDAY MAY 23, 1972. YOU CANNOT TAKE ANY OF THE MATERIALS WITH YOU ON THE TRIP. BE SURE TO RECORD EVERY ACTION

Please do your work in the following order given below. You will have 40 minutes for question 1 and 10 minutes for questions 2, 3, and 4.

1. Please carefully read the correspondence and write your response to each of the 7 items on the enclosed Memo sheets.

2. After you have written a response to all 7 items, please turn to the Questionnaire form (blue cover page). The first question asks you to first rank the 7 items in terms of importance (i.e., the seriousness of the possible consequences). This can be done by sorting your written memos in order of importance.

Next you are asked to rate each of the items. This should be done by giving the most important item 100 points and then giving the other 6 items points on the basis of how they stand in relation to this. Please place this rating number on the top right-hand corner of each of the 7 memos.

3. After you have rated the 7 items, read Part B of the Questionnaire. This asks for the switch-over chance between alternatives for four of the items.

4. After Part B, read and complete Part C of the Questionnaire which asks for a description of some of the correspondents.

V. Wagers on Stock Prices

The printed instructions were as follows:

On the next few pages you will be presented with sets of options. The sets are labelled A, B, C, D and E. In each set there are 5 options and you will be asked to select the one option you most prefer in each set.

In each set one of the options is receiving $2 for sure, while the other four options are wagers and involve a chance of winning more than $2, but usually a chance of losing money too. The chance of winning is shown for each wager. In set A, B, and E each of the

options has expected winnings of $2. (This means that if any one was played a large number of times the winnings would average out to $2 per time.) In sets C and D, the expected winnings are different for each option and are shown there.

We want you to think through the options in each set and to select the one you most prefer. After you have done this for all the sets, we shall select a set at random and then play out the option you chose in that set. If the result is that you win money, we will pay you immediately, while if the result indicates that you lose money we expect immediate payment from you.

All the wagers are based on the fractional part of the prices of five stocks on the New York Stock Exchange. You win if the fractional amount of a stock's price is 1/8, 3/8 or 5/8 while you lose if the fractional amount is 1/4, 1/2, 3/4, 7/8 or a whole number. Studies of the stock market have shown that no one ending amount is more likely than any other for stocks in the price range we shall consider. The wagers in each set differ in the number of stocks out of the five that must have the winning fractional amounts. As the number increases from "at least 1 out of 5" to "at least 4 out of 5", the chances of winning get smaller while the payoffs get larger.

We have a page listing 100 stocks actively traded on the New York Stock Exchange. They were chosen randomly from stocks under $50. The five stocks to be used in determining the payoffs will be selected randomly. The fractional price we shall use is the one for these stocks at the close of trading on September 8, 1972.

Because there were certain research questions we wanted to clarify, verbal instructions amended the printed questionnaire instructions and were as follows:

"Instead of selecting just one option in each set, please rank the <u>options</u> in the sets according to your preference. Also after you've done that for all the sets, rank the <u>sets</u> now according to your preference. The method of selecting the set and the option will be based on your preference."

The last sentence had been left vague because there is a fear, on the experimenter's part, that once the subject made his first choice, he would rank the rest haphazardly. This last sentence would make the subject believe that the way he ranked his preferences would affect the way the option was selected.

In playing out the option, of course, the "top" choice would be used, except in the case where Set C (increasing expected winnings as probability of winning increases) was chosen as the first choice. The reason given was that "the experimenter stands to lose more if set C is played out."

Because some of the subjects knew the experimenter personally, it was felt that this could affect the way they chose their bets--i.e., that "they wouldn't want to 'win' that much from Alfred considering that he is using money from his own pocket." The only method to get this undesirable effect out of the way was to say that the money came from the research funds of the Industry, Trade & Commerce Department (see Acknowledgment). The money in the denomination of two's was placed in front of the subjects in order to give the session more authenticity.

Conclusion

The study was carried out over a five-week period.

The analysis that is to follow is based on these 35 subjects. On the whole, 35 is not such a large sample nor can one call the sampling random. However, given the amount of time needed to

read through the items and respond to the questionnaires, the sample of 35 subjects is not considered bad. Even though "random" sampling design was originally conceived, under practical circumstances, fruition of our idea was not possible due to the "voluntary" aspects of the study.

CHAPTER 6

AN ANALYSIS OF THE MEASURES AND ITEMS IN THE PACKAGE

Overview

Because of the number of questionnaires administered, a voluminous amount of analysis may be undertaken on the responses. However, brevity dictates that only analysis relating to centrally-important questions should be presented.

For the individual measures, the analysis in this chapter is presented with the following subsections:

A. Score(s) - reiterates how the score(s) of the questionnaire is/are derived.

B. Distribution(s) - shows the frequency distribution(s) of the score(s) computed in A, and the implications they carry.

C. Item Distribution(s) - presents the frequency distribution(s) of item(s) whose responses are distributed in an interesting way.

D. Item Analyses - discusses either the intercorrelations of items with each other or correlation(s) of the items with the aggregate score(s) and the reasons behind the results.

E. Issues concerning measures - examines some of the research questions posed by past researchers and the issues raised by the thesis.

F. Qualitative Analyses - presents some comments of the subjects in response to the measure. (Optional as this may not be relevant.)

Because of the uniqueness of the sample and the way the subjects were selected, generalization from the results of this study may not be possible. But, 'confirmation' and/or rejections

of the various conclusions posed by past researchers as they stand with our group are in themselves interesting.

In Basket

A. Three scores are derived from the questionnaire. The Memo score, which is the average of the 'strategy' score the subject receives in each item, may be generated in three ways. The minimum odds score, which is the mean of the minimum odds subjects assigned to the items, may be generated in two ways. The semantic differential score is just the sum of the four semantic differential sub-scores (see Chapter 4).

The codes for the strategies implied by the subjects' responses are: 1 for taking the risky alternative unconditionally, 2 for taking the risky alternative under certain circumstances, 3 for taking the conservative alternative if certain conditions were met, 4 for taking the conservative alternative unconditionally, 5 for gathering information and 6 for delay. A value of 9 is assigned to responses that are not risk relevant--i.e., organizational consideration, happiness, etc. In generating the three possible memo scores, all 9's are excluded. The difference of these three memo scores lies in the treatment of the 5's and 6's.

If delay and gathering more information are more risk-averse acts than taking the conservative alternative, then the memo score should include them as 5's and 6's. However, one can argue that delay and gathering information are more risk-prone strategies, and that they should lie between 2 and 3

(i.e., more risk-averse than taking the risky alternative conditionally and more risk-prone than taking the conditional conservative alternative). Another contention is that since we do not know about delay and more information gathering, and their risk taking implications, these strategies should be excluded from the calculation of the aggregate memo score.

Since we are not sure of where the delay and information gathering strategies lie in the risk taking continuum, an aggregate score which excludes them is relied upon as the memo score. However, as additional analysis inputs, two other memo scores are generated. One is to include these strategies as 5's and 6's; another is to treat them as 2.5's.

The minimum odds score may either be generated as a simple average of the odds subjects assigned in the items or an average of the odds using the grades assigned as weights. The former is relied upon as the score because the grades may not turn out to be reliable as weights. In the later subsections, we will discuss what scores are retained.

B. Figure 6-1 gives us a breakdown of the memo scores (5's and 6's excluded) and their frequency.

The mean of the memo scores implies that the subjects' strategy usually is between taking a risky alternative provided certain conditions are met and taking a conservative alternative if certain circumstances could be changed. However, the 2.35 result can be enterpreted as usually taking the conditional risky alternative if one considers the distance. Only one subject prefers the conservative alternative unconditionally throughout the items as indicated by the following figure.

FIG. 6-1

Histogram, Aggregate Memo Scores

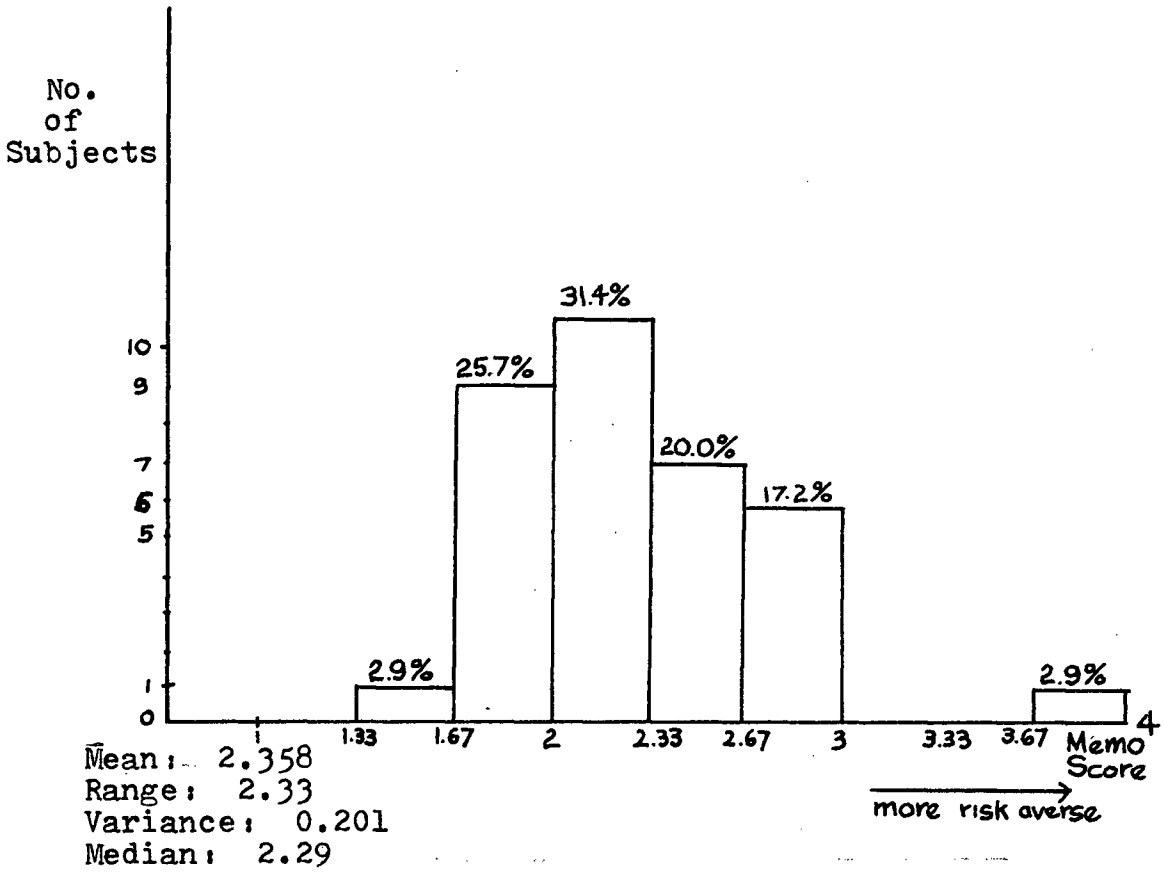


Fig. 6-2 illustrates how the aggregate minimum odds scores are distributed. The group would on the average accept the risky proposals if the minimum odds for success were 6 out of 10, a little better than the odds offered in a coin toss.

FIG. 6-2

Histogram, Minimum Odds Scores

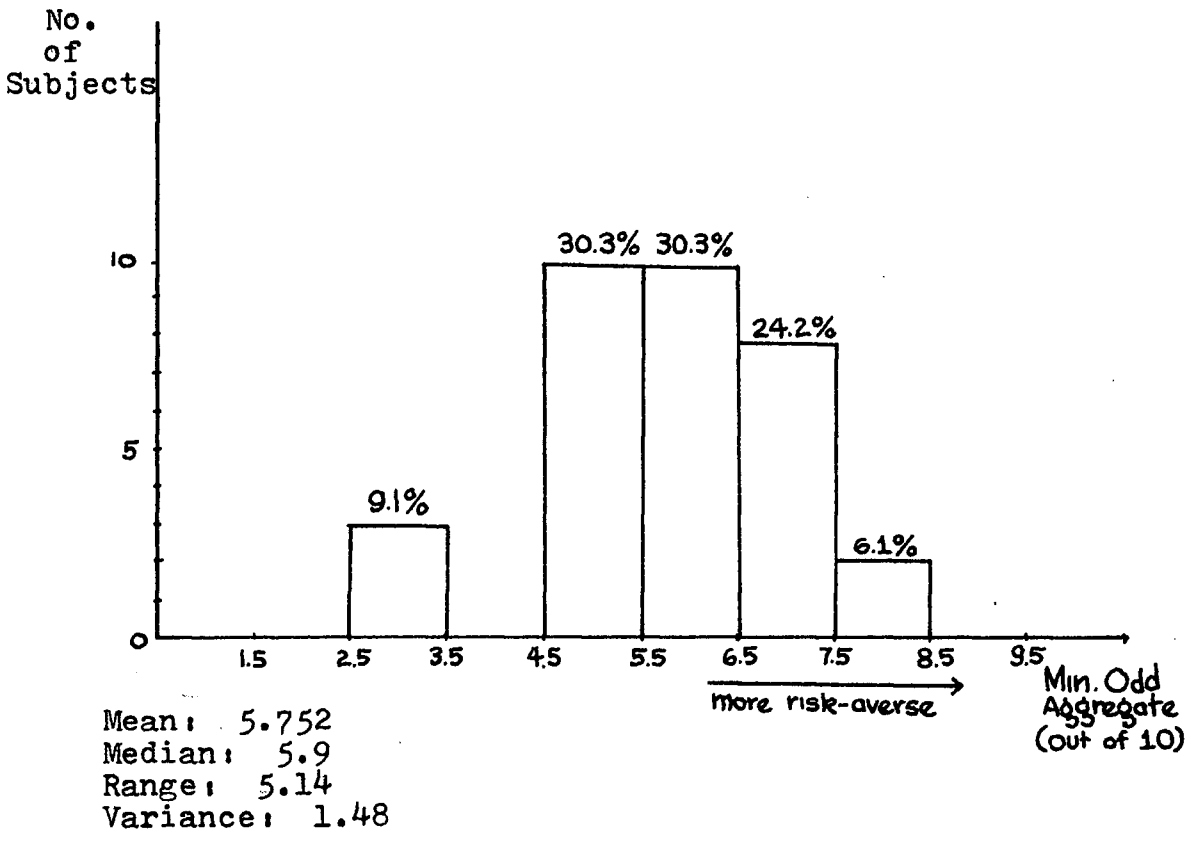
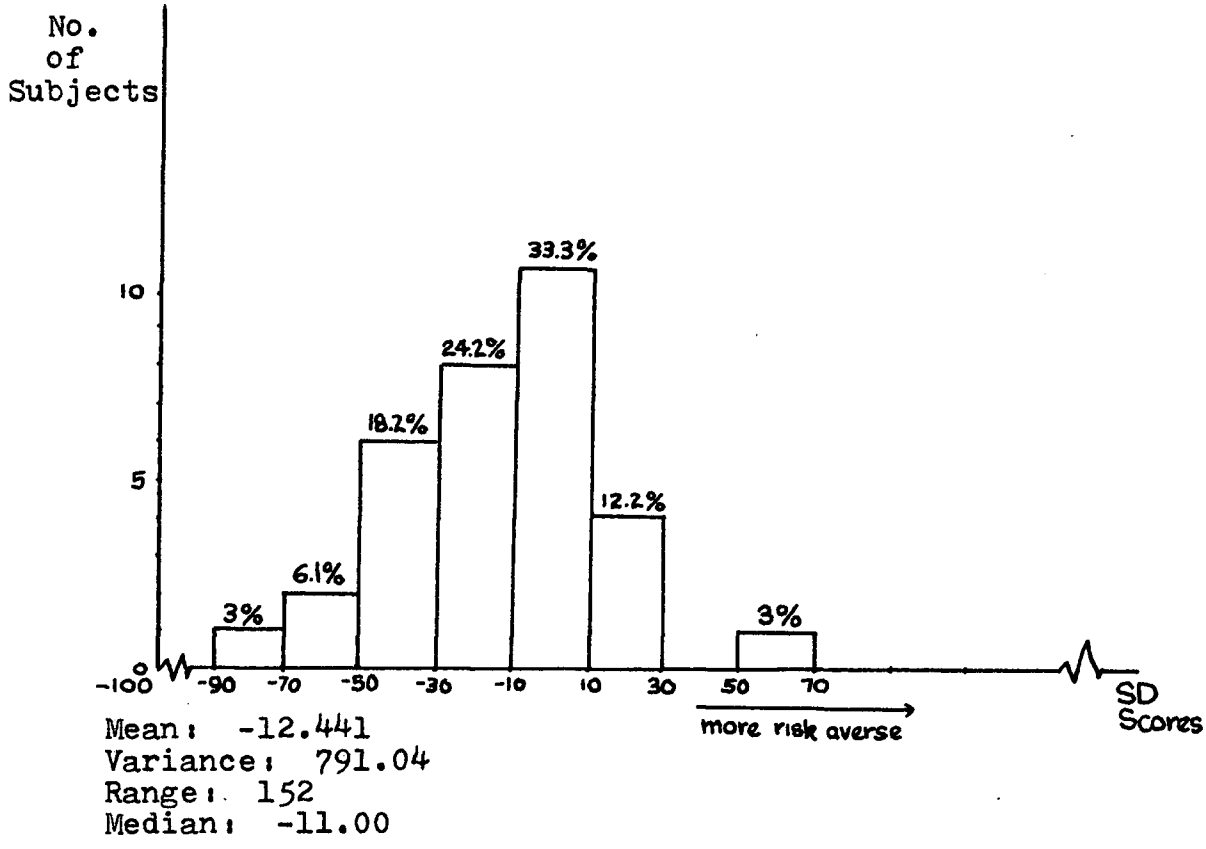


Figure 6-3 illustrates how the semantic differential (S.D.) scores are distributed. It should be noted that the S.D. score is the value assigned to a subject's perception of the risk averters in the items (where the risk takers are assigned as negative risk averters if they happen to be the hypothetical letter writers).

FIG. 6-3

Histogram, S.D. Scores

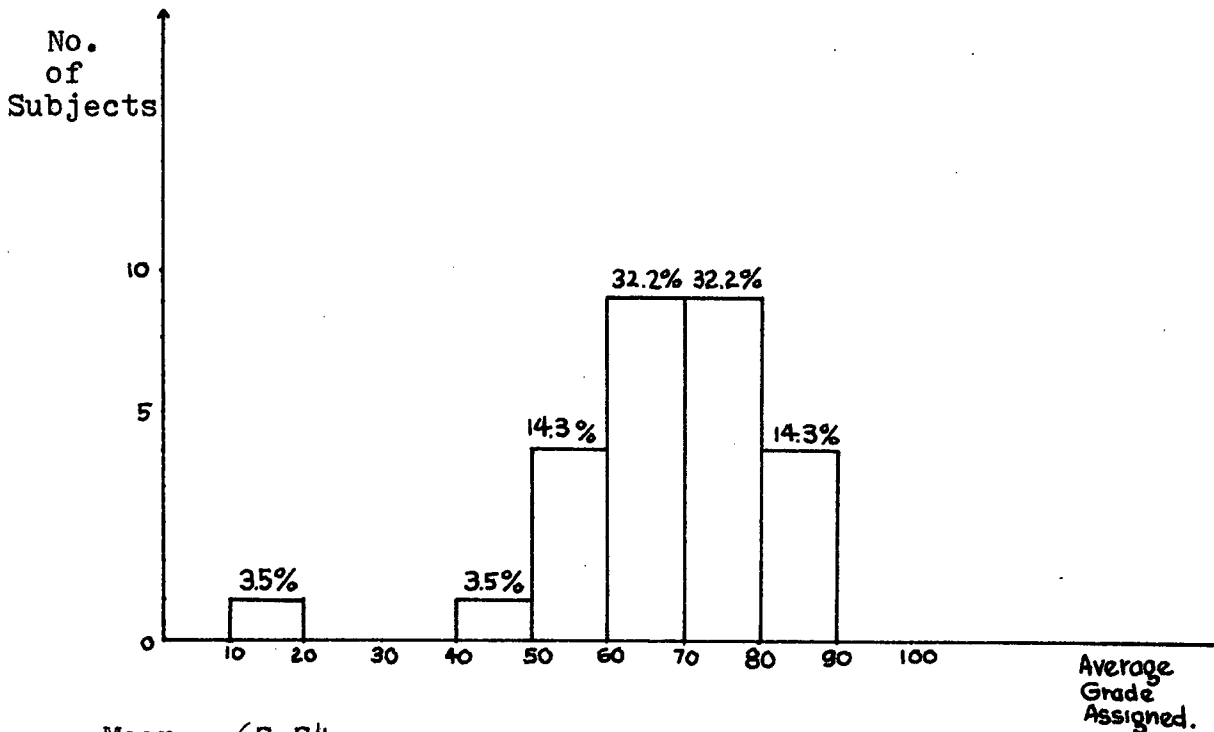


The mean S.D. score indicates that risk takers are perceived in a positive manner, or risk averters in a negative way. This is a rough confirmation of the risk-taking-as-a-value conclusion of the past. However, the spread of the distribution, if taken into account, indicates that the degree of favorable or unfavorable assessment of risk takers varies from one assessor to the other.

As indication of the seriousness of the consequences implied by the risky alternative in each item, the subjects assigned "grades" (numbers out of 100) to the items. An average grade assignment is generated and the distribution is shown in Fig. 6-4.

FIG. 6-4

Histogram, Average Grade Assigned to the Items



Mean: 67.74
Median: 69.8
Range: 65.7
Variance: 15.86

The occurrence of one score at the 10-20 level suggests that this subject failed to follow instructions when assigning

grades. The tightness of the distribution, excluding the extreme 10-20 one, indicates roughly that the subjects converge in severity perception.

C. Table I gives us a breakdown of strategy scores by items and the frequency of these scores.

TABLE I

Memo Scores
By Item, Relative Frequency and Median

Item No. / Value	1	2	3	4	5	6	7
	Rel. Freq.	R.F.	R.F.	R.F.	R.F.	R.F.	R.F.
1	45.7%	26.5%	48.6	17.1	5.7	51.4	37.1
2	17.1	14.7	11.4	28.6	2.9	8.6	2.9
3	0.0	0.0	5.7	17.1	5.7	0.0	5.7
4	22.9	17.6	20.0	17.1	74.3	5.7	34.3
5	11.4	2.9	5.7	11.4	8.6	20.0	8.6
6	2.9	0.0	5.7	0.0	0.0	0.0	0.0
9	0.0	38.2	2.9	8.6	2.9	14.3	11.4
Medians	1.875	3.750	1.625	2.75	3.981	1.472	3.625

If we are to infer risk taking attitudes from the strategies recommended, items that elicit non risk consideration should be subject to correction or elimination. Item 2, concerning the son's desire to enter into a risky career, elicited responses like "Do what you're happy in," "If that's what you want, go ahead," etc., and has the largest frequency of 9's among all the items.

Item 6, concerning the possibility of marketing a new product, has the lowest median and the largest frequency in the

risk-taking strategy score class. The inclination of the subjects is to open up markets for new products even though the risk is great.

As far as delay is concerned, only items 1 and 3 (the first item concerning a possible court suit and the latter, the possibility of not supplying a steady customer in preference of a new unstable buyer) elicited the delay strategy. Responses like "wait until I return" or "tell him I'll talk to him later" are coded as delay.

Items 6, 1, and 4 elicited gathering-information strategies. The table reveals this clearly. As we said before, item 6's median is the lowest among the other items; but some students feel that they should not try the new product out until more information can be secured. Item 1 also is deemed by some students (11.4%) to require more information before any action is taken. Eleven percent of the subjects also recommend getting more information before taking any action--either recalling the Time and Motion man who had offended the Union or continuing the study.

In item 5, Bickner is being asked by his friend to quit his job and join him in a risky venture. Here, the subjects feel that Bickner, being already secure in the company, should stay on. Thus, a majority of the subjects favor the conservative alternative.

D. As revealed by Table II, the inter-item correlations of the memo scores are very poor. This suggests that the strategy employed varies very much, and that the conversion of

strategy recommendations into scores may be inconsistent. This suggestion implies that the method of judging the risk taking attitudes of the subjects might have been inadequate.

Table III gives us an idea of the minimum odds assigned in each item and their relationships with the aggregate score. All items are correlated with the aggregate score but the inter-item correlations are very poor.

TABLE II

Correlation Matrix,
Memo Scores by Item

Item No.	1	2	3	4	5	6	7	Ag. Memo Sc.
1		(-.426)	-0.067	-.23	.22	-.27	-0.07	.254
2			-.08	.22	(-.44)	.32	.15	.247
3				-.13	-.12	-.29	.05	(.33)
4					(-.36)	.08	.20	(.424)
5						.15	-.29	.14
6							-.28	.08
7								(.51)
Ag. Memo Sc.								

Coefficients enclosed in parenthesis are significant ($p < 0.05$).

TABLE III

Correlation Matrix
Minimum Odds Scores by Item

Item No.	1	2	3	4	5	6	7	Ag. Score
1		(.46)	(.35)	-0.019	.12	.08	-.14	(.429)
2			(.37)	-.14	-.004	(.38)	-.20	(.471)
3				(.38)	-.013	(.48)	.12	(.758)
4					.05	(.33)	.24	(.616)
5						.03	.17	(.29)
6							.02	(.63)
7								(.37)

Coefficients enclosed in parenthesis are significant ($p < 0.05$).

Item 5 is by far the weakest in correlation with the aggregate score. Because it also failed to discriminate in the strategy responses (with 74% recommending taking the conservative action) this is an item that should be removed.

Table IV gives us the intercorrelations of the semantic differential scores. The Aggregate S.D. score correlates highly with each of the S.D. scores but the inter-number correlations turn out to be weak.

TABLE IV

Correlation Matrix
Semantic Differential Scores

Number	Moore	Paul	Taylor	Kaye	Ag. S.D. Score
Moore		-0.09	.17	(-.33)	(.437)
Paul			-.182	-.004	(.789)
Taylor				(.32)	(.615)
Kaye					(.382)
S.D. Score					

Coefficients enclosed in parenthesis are significant at 0.05 level.

The item analyses for the In-Basket reveal that the questionnaire should somehow be revised. The resulting weak inter-item correlations suggest that the validity of the items is questionable.

This questionnaire, we have to remember, requires the largest proportion of response time. Although we have created interesting situations in each of the items, the amount of time and effort involved might induce boredom.

The solution is to cut down the number of items and further systematize the strategy scoring method.

The memo scores we have generated have not been satisfactory. Its value as a risk measure is thus minimal. However, we are not rejecting the value of inferring risk taking attitudes from strategy; we are saying that there could be something wrong in our method of judging the memos.

E. In order to ascertain which of the memo scores (i.e., how the 5's and 6's should be treated), should be retained, the relationship of the three scores with the minimum odds score is examined. The memo score that excludes the 5's and 6's has the highest correlation (r = 0.186) with the minimum odd score (the r's of the second score which includes 5's and 6's and the third score which treats 5's and 6's as 2.5's are, respectively: -0.126 and 0.176). However, the correlation is not significant at the 0.05 level.

The weighted minimum odds score, which is generated by using the grades students assigned as weights, is deleted because of its weak correlation with the memo score (r = .103) and with the Aggregate Semantic Differential Score (r = .09). This score is also found to be unrelated to the other risk measures like Choice Dilemma (r = -0.015), Stock Price Wager Score (r = 0.08), and Compensation Utility Score (r = 0.012).

The Semantic Differential Score has no significant relationship with the other In-Basket risk measures. It has a 0.127 with the memo score and a 0.047 with the average odd score.

Item-wise, the Semantic Differential Score for Taylor (the marketing manager who didn't like pushing new, untried products)

is the lowest in mean (-0.206). This implies that the subjects find Taylor unfavorable and consider him weak, dependent, unsure and cautious. Johnny Kaye is viewed as independent, confident and strong. He is thus perceived in the most positive way (mean = 16.94).

However, from the results of the correlation of Semantic Differential Scores with other risk measures, we have to conclude that this score may not be considered as a risk taking score. There is no clear-cut indication that an individual who views risk takers in the most favorable way is himself a risk taker.

For each subject, the correlation between grade assignment and the average minimum odds is derived as a preliminary inquiry into the severity of consequences issue.

Because the subjects are asked to assign grades (out of a maximum of 100) to the items as indications of the gravity of the consequences, the hypothesis is that the higher the grade assigned, the higher would be the minimum acceptable chance before the uncertain alternative is undertaken.

Of the 28 subjects who have complete grade assignments, 10 have negative correlation coefficients (ranging from -0.44 to -0.07) and 18 have positive values (ranging from 0.85 to 0.056) but only 3 have significant r's ($r > 0.722$, $df = 6$, $p < 0.05$). Thus, for most people, the severity of consequence hypothesis does not hold.

The possibility that people assigning higher grades tend to require higher minimum odds is examined as an adjunct to the

severity of consequence issue. The correlation, although positive, is not significant at the 0.05 level ($r = 0.26$).

F. The comments subjects gave after the In-Basket was administered suggest that the length of time indicated on the questionnaire is not accurate. Some subjects mentioned that it took 2 hours to finish. Others felt that the 45 minutes indicated time pressure and if this time limit were complied with, they would not be able to give the questionnaire much thought.

On the whole, the subjects found the In-Basket extremely interesting but felt that the facts contained in it were too much to handle. According to the subjects the items should be trimmed.

As far as the memo responses were concerned, many felt that, although risk was taken into consideration, the idea of an ultimatum in item 3 compelled them to reject the conservative proposal. Others brought in antitrust consideration and thus confounded the risk-relevant strategy scores.

It is also difficult to decide how the strategy of 'gathering information' should be treated. On the one hand, this may be considered more risk averse than taking the conservative alternative immediately, since gathering information may be considered an intermediate strategy with no commitment to either risky or conservative alternative. Rather than outright commitment, they are hesitating by getting more information (possibly in order to 'reduce' the risk). On the other hand, gathering information is a riskier strategy than taking a conditional conservative alternative and is considered intermediate risk-taking in that the

subjects may perceive greater risk by gathering information since there is the possibility that after gathering more information both options (i.e., the risky alternative or the conservative alternative) may vanish or may not be open to them. These two contentions concerning gathering information cannot be resolved. The same may be said of the delay strategy.

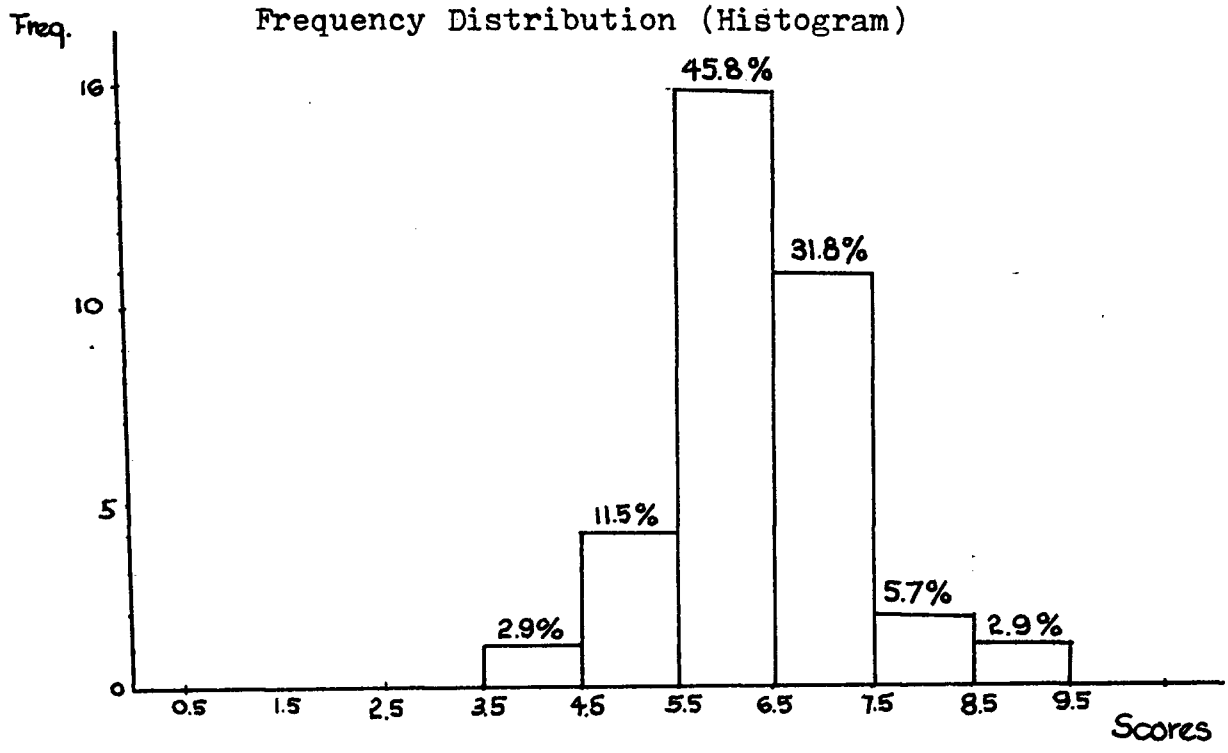
Choice Dilemma

A. The response of the subjects in each item is a number out of ten. An aggregate score is derived by averaging these responses. The rankings assigned by subjects to the items are used for the analysis in E.

B. The distribution of the aggregate scores is illustrated below.

FIGURE 6-5

Choice Dilemma Odds Score
Frequency Distribution (Histogram)



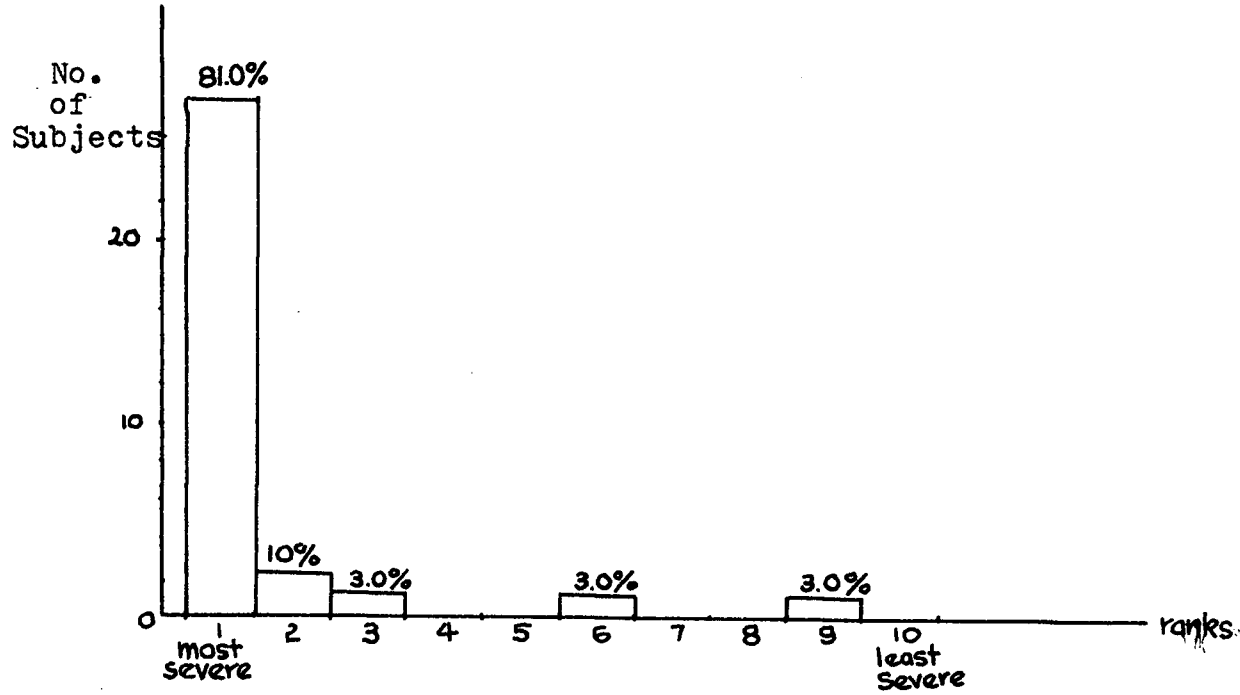
The mean of the group is 6.384 with a std. deviation of 0.886. Thus, on the average, the group would accept the risky alternative as posed by the questionnaire only if the minimum odds for success is greater than six out of ten, or if the odds are better than those of a coin toss. Also, the shape of the distribution suggests that the group is fairly homogeneous (the range is 4.6 with the minimum value at 4.0) in their responses.

C. Figure 6-6 gives us a picture of how item 3 is ranked in relation to other items. Because it involves a possibly fatal operation, the consequence of the uncertain alternative is perceived to be most severe eighty-one percent of the time.

Figure 6-7 implies that a majority of the subjects, perceiving this item to be most severe, recommend taking the risky alternative only when the minimum odd for success is high. The mode odd is set at 9.000 while the mean is 8.03. Also, no subject responded below a minimum odd of 5. Thus the most severe item elicited risk aversion from all the subjects.

FIGURE 6-6

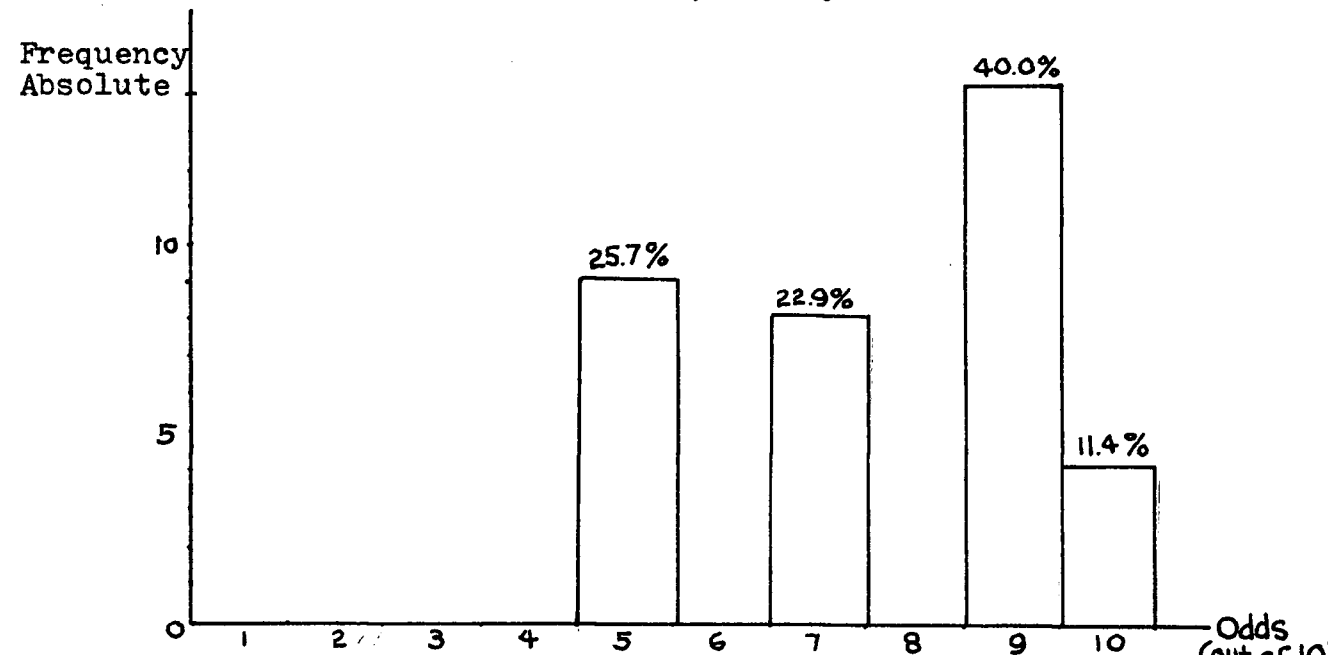
Choice Dilemma Rank, Item 3



Median: 1.111
Mode: 1.00
Variance: 4.377

FIGURE 6-7

Choice Dilemma Odd, Item 3



Median: 8.054
Mode: 9.000

D. The intercorrelations of the items with one another are presented in the table below.

Item 3 is the only one not significantly correlated with the aggregate score. This could be explained by the fact that it is the only item in the questionnaire that does not deal with business risk. Since this item concerns the possibility of a fatal operation, it may be treated as different from the rest.

Item 5 (concerning the possibility of investing a low-income man's inheritance in risky stocks) and item 6 (concerning the possibility of a man being convicted for treason) have the lowest significant correlations with the Aggregate Score. These two items correlate highly with one another. However, the mean severity ranks for these two are significantly different (9.8 for item 5 and 3.7 for item 6). The contents or situations in these two items are not similar; thus, there is no reason to expect that the two items should correlate only with one another.

Improving the measure as a 'business risk taking' measure will entail the elimination of items 3, 5 and 6.

The inter-item correlations presented in Table V show that items 8 and 9 (the first concerning a sales manager's decision to sell to a politician who might not pay his bills and the latter, a businessman's entry into politics as a candidate) are poorly correlated with the rest. These two items also require modification and may also be candidates for elimination.

TABLE V

Choice Dilemma Item Intercorrelations

Item No.	1	2	3	4	5	6	7	8	9	10	Ag. Score
1		(0.489)	-.236	(.483)	-.006	.172	(.365)	.07	.24	(.54)	(.702)
2			(.29)	(.29)	-.08	(-0.3)	.119	.05	-.26	(.36)	(.422)
3				.26	-.04	-.27	0.02	.06	-.17	-.19	0.13
4					.03	.22	-.06	-.06	.008	.10	(.47)
5						(.358)	.20	.03	.07	-.10	(.34)
6							-.03	.16	.14	-.13	(.325)
7								.27	.23	(.36)	(.57)
8									.07	-.08	(.42)
9										.15	(.39)
10											(.463)
Ag. Score											

Coefficients enclosed in parenthesis are significant at 0.05 level.

E. Kogan and Wallach (1967) asserted that the greater the severity of consequences, the more risk-averse the behavior. In order to examine the relationship between severity of consequences and risk taking, a Spearman rho between the subject's rankings of the ten items (as indication of the severity of item consequences--with 1 as the most serious to 10 as the least serious) and odds (converted into ordinal scale where rank 1 is used for the lowest minimum odds, etc.) is generated for each subject.

Because there are only ten items, for any correlation coefficient to be significant (at the 5% level), the value must be less than -0.648. The hypothesized correlation should be negative because of the way we order the odds and the ranks.

Of the 33 subjects who have complete answers to this measure, 30 have negative coefficients none of which are significant (the r's range from -.606 to -0.042). The remaining three have positive coefficients (r's: 0.164 to 0.025). Based on these results, one cannot say that perceived severity of consequence is related to risk taking.

Another way of looking at the severity of consequence issue is to compare the median ranks for the items with the mean odd. Table VI summarizes the mean odds of the group for each item, the mode rank, and the median rank. Again, there is no significant indication that the group assigns lower odds (or takes higher risk) to higher ranked (less severe) items.

TABLE VI

Mode Ranks of Items, Mean Odd of Items and Median Ranks[1]

Item No.	Mode Rank	Median Rank	Mean Odd	Variance Odd
1	4	4.11	5.34	4.87
2	4	3.85	5.24	4.84
3	1	1.11	7.42	3.35
4	2	3.5	6.78	3.18
5	10	8.86	5.7	5.17
6	2	4.85	7.63	4.4
7	8	6.37	7.79	3.03
8	6	5.81	5.54	5.9
9	7	7.38	5.63	6.11
10	10	8.25	4.26	4.11

[1] Analysis of variance, using F-distribution, reveals that the means of the items are significantly different from one another ($p < .001$). This implies that items are inherently different.

If we consider item 3 and item 10, these two being the most extreme in rankings, the mean odds are significantly different ($p < 0.05$, pooled std. deviation = 2.03). The relationship of severity and risk taking, based on the above statement, may really be 'discontinuous' in that the extreme items (the least and the most severe) are significantly different from one another in risk taking responses while the ones in the middle are not. There is of course the possibility that the ranking in the less extreme cases are not accurately reported by the subjects because of their inability to distinguish meaningfully among items whose degrees of severity are quite close. In this case, the rankings of these items become questionable.

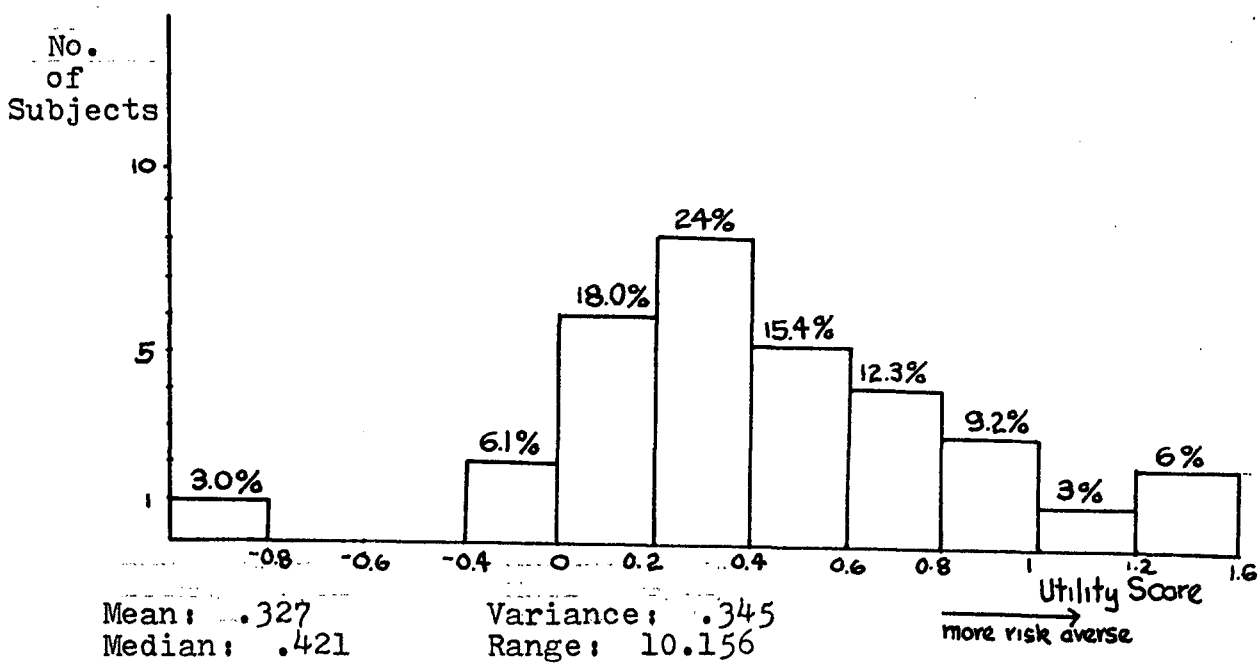
Utility Items

A. There are essentially three scores derived. The method of deriving the score is similar to what Bassler (1972) did in that the horizontal deviation of the equivalent from the expected value is taken, converted into percentage term (i.e., as a percentage of EV) and summed up. These three scores are: Compensation Utility score, Net Profit, and Rate of Return. The first is a gain equivalent score; the second is a buying equivalent score; the third involves equilibrating probabilities and the fourth, the usual certainty equivalent (Swalm).

B. The figures below illustrate how these utility scores are distributed.

FIGURE 6-8

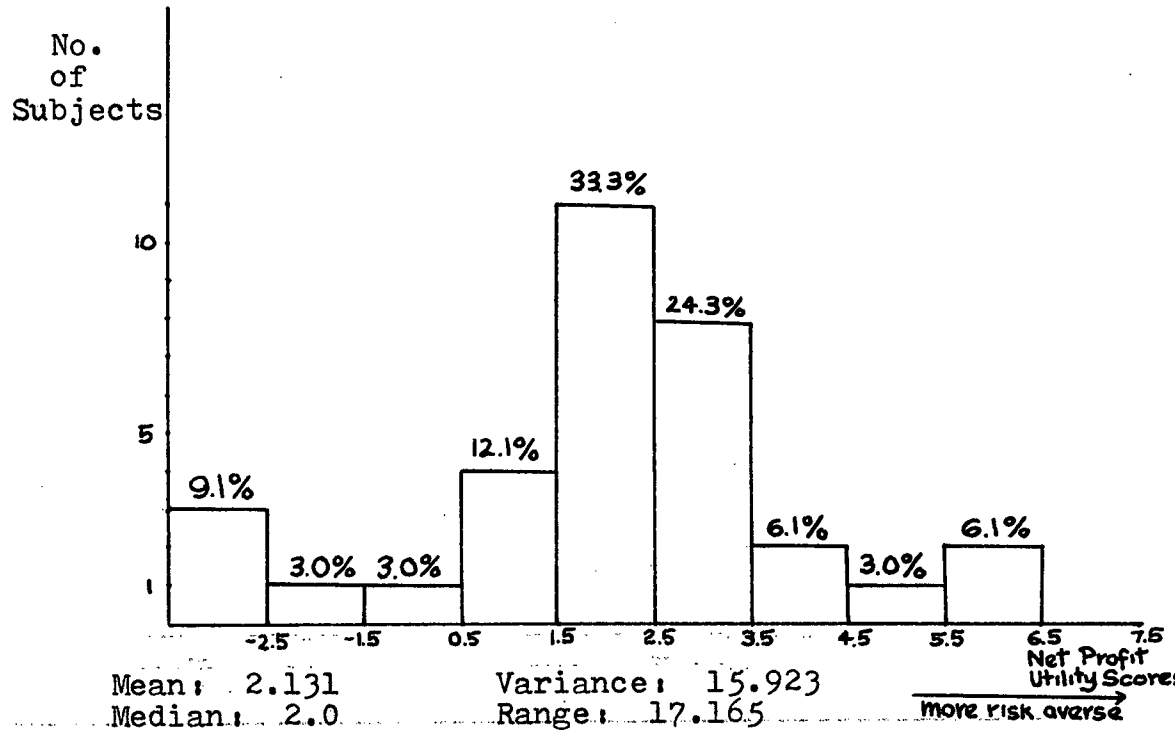
Histogram
Compensation Utility Scores



Mean: .327 Variance: .345
Median: .421 Range: 10.156

FIGURE 6-9

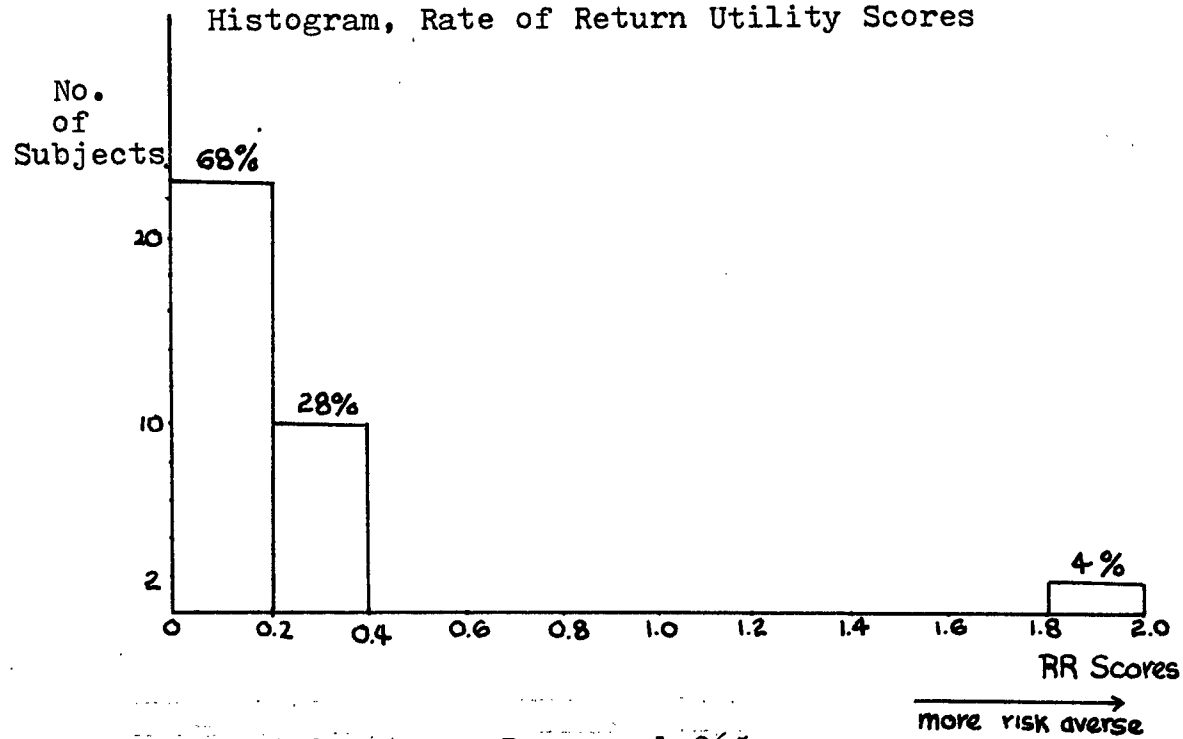
Histogram, Net Profit Utility Scores



Mean: 2.131 Variance: 15.923
Median: 2.0 Range: 17.165

FIGURE 6-10

Histogram, Rate of Return Utility Scores



Mean: .202 Range: 1.965
Variance: .104 Median: .162

The results of the Compensation Utility Score reveal that one subject has a very extreme value (-12.927). This implies that his total deviation from the expected values is -1200%. He has been inconsistent in that his certainty equivalents are larger than the maximums of the EV's ranges. In other words, given an uncertain alternative with 50% chance of gaining twice the amount of his current salary and 50% chance of receiving only one half of his current salary, he requires, in lieu of this uncertain alternative, a sure income greater than twice the current salary. Thus, this raises doubt on the accuracy of his answers. The rest of the responses seem reasonable in that the most risk averse subject has a total deviation of 160% from the expected values. (On average, given three certainty equivalents, his certainty amount deviates from the expected value by 53% approximately.)

The Net Profit Utility Score distribution as presented is not peculiar. However, there are two subjects whose total deviations are about 1200% to 970% of the expected values. The size of the variance reveals this. Four individual deviations are derived from the questionnaire, converted into percentage terms, and summed. Based on this calculation, the subjects with extreme value have, on the average, negative deviations of about 300% to 240%. For these two subjects, the possibility that they haven't thought the problems out well is great. On the positive side (indicating higher risk aversion), there are also two subjects with a 550% to 650% deviation from expected value. If these total deviations were divided by four, the result of 140%

to 160% reveals that these two subjects require (in lieu of the uncertain alternative) a sure amount that is more than twice the expected value. These results are acceptable.

As for the rate of return utility distribution, only one subject seems to be extremely out of line with the rest. The results indicate that a majority of the subjects (68%) are relatively neutral (range: 0.0 to 0.2 total deviations). Actually, five subjects have zero total deviations indicating that their certainty equivalents are equal to the respective expected values (or risk neutral as defined). Thus, none are risk takers in their responses.

In D, we will examine how these utility scores stand up in terms of credibility. One would expect that these four scores should correlate highly.

C. The Net Profit Utility Questionnaire asks for probability of success as a response. An examination of the answers (please see Appendix) reveals that only three subjects gave any extreme probability assignments to any item (p = 1.) while only two subjects are risk neutral (i.e., giving .33, .50, .50, and .33 as probabilities to the 4 items). The question still remains as to whether one should accept probability assignments of 1.0 as valid responses.

D. For each item, the subject's response is used to calculate the deviation ("premium") from the expected values. In this section, these deviations (in percentage terms) are used rather than the raw responses. Although the Compensation Utility Scores (aggregate) correlate significantly with the individual

items deviations, the deviations themselves are not significantly related as revealed by Table VII.

TABLE VII

Correlation Matrix (Pearson)
Compensation Utility "Deviations" and Scores

Item No.	1	2	3	Ag. Score
1	1.00	.172	.162	(.397)
2		1.00	-.123	(.741)
3			1.00	(.573)
Score (Ag.)				1.000

Coefficients enclosed in parenthesis are significant at 0.05 level.

TABLE VIII

Correlation Matrix (Pearson)
Rate of Return Utility Scores

Item No.	1	2	3	4	RR Score
1		(.81)	(.46)	.20	(.49)
2			.14	.17	(.43)
3				-.072	.123
4					(.95)
RR Score					

Coefficients enclosed in parenthesis are significant at .05 level.

TABLE IX

Correlation Matrix (Pearson)
Net Profit Utility Score

Item No.	1	2	3	4	Ag. Score
1		(.33)	.21	(.72)	(.60)
2			.16	(.49)	(.72)
3				.15	(.74)
4					(.64)
Ag. Score					

Coefficients enclosed in parenthesis are significant at .05 level.

From the tables above, we can look at the intercorrelation of the business risk premiums. The correlation of the consistency check deviation (4) and the one (1) for which this check is being done is not significant for the rate of return utility questions but is highly significant for the net profit one (items 1 and 4). Moreover, item 4 of the rate of return questionnaire stands out poorly. The retention of the ROI check in the future is not advisable due to these results. In fact, its negative correlation with item 3 places the item in much doubt.

The results of the intercorrelations of the Net Profit Utility items suggest that the items, except item 3, are fairly acceptable.

E. An examination of the computed risk premiums is undertaken for each subject to ascertain the nature of his marginal utility. These risk premiums, by the way, are expressed in percentage terms (please see A of Utility Items).

For Compensation Utility items, 10 subjects have decreasing risk premiums (i.e., percentage decreases as income increases) while 4 have increasing risk premiums. The rest change from decreasing risk premiums to increasing risk premiums. Thus the notion of constant risk aversion is not confirmed. For the business utility items, the marginal utility nature is also highly individualistic because of the mixture of increasing, decreasing or constant risk aversion.

The rate of return and net profit questionnaires have in each an item which serves as a consistency check (as discussed in Chapter 2). Using a "neighborhood" criterion of 10% (i.e.,

that the responses in this check item should not deviate more than 10% from the answers they gave in the previous item for which check is made), 25 subjects (71%) have inconsistency in their rate of return responses (10 in the more risk-taking direction and the rest in the more risk-averse direction). In the net profit check item, 32 have inconsistent responses (20 in the more risk averse direction and 12 in the less risk-averse).

A few subjects' utility curves are actually plotted out. Figure 6-11 gives us one subject's three utility curves. He is considered the 'most extreme' person in that his utility curves are extremely dissimilar. It is conceivable that compensation and the other two utility curves are dissimilar as they belong to different categories--one pertaining to personal and the other to business. But even the business utility curves do not seem to be of the same kind for this subject. But, as we said before, he is an extreme case.

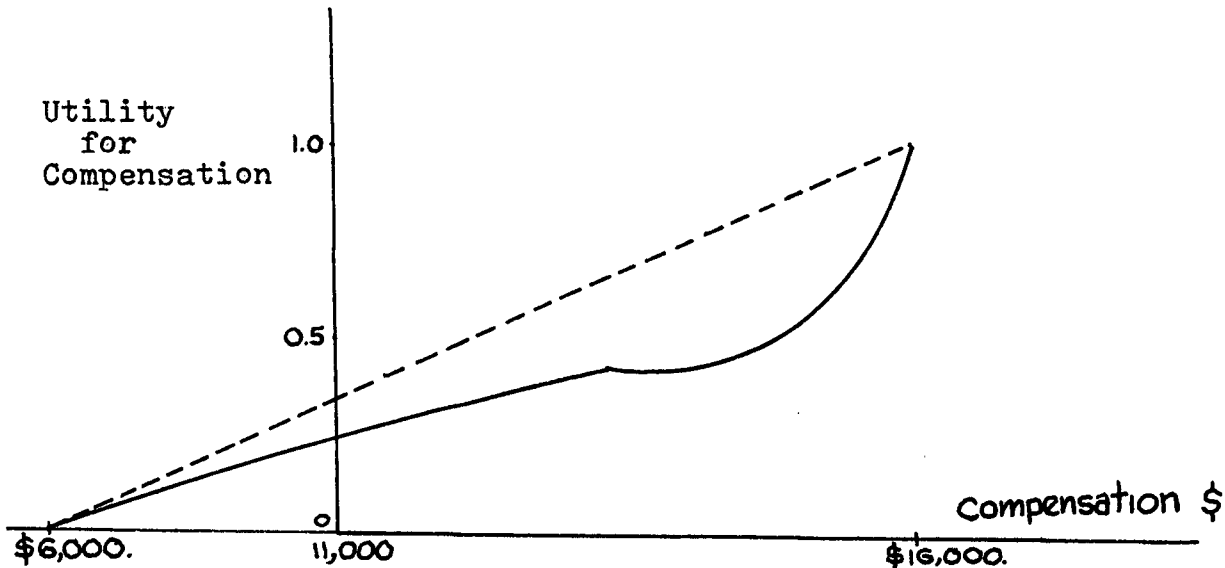


Figure 6-11(a)
One subject's three
Utility Curves

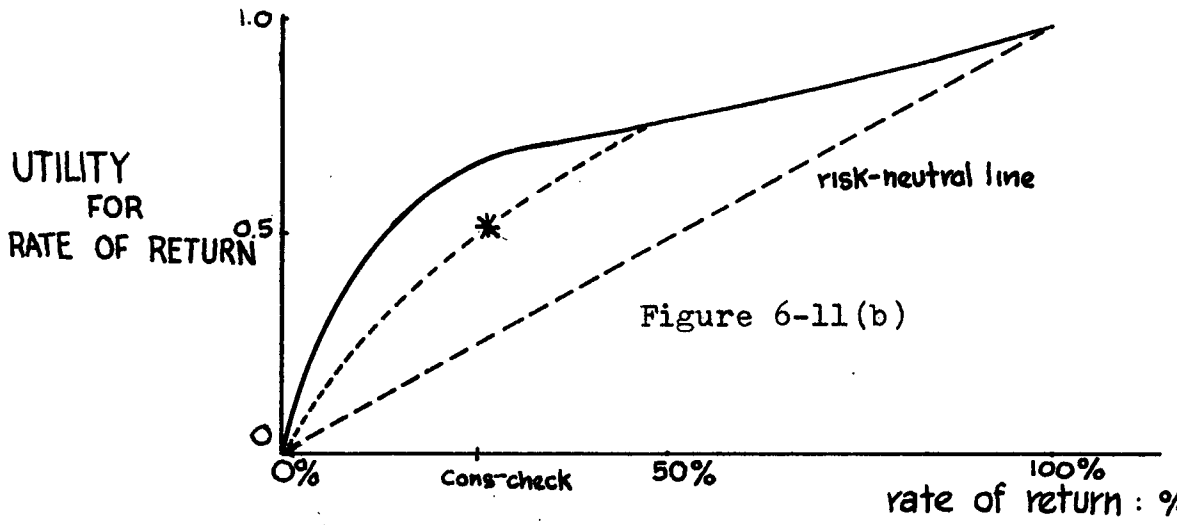


Figure 6-11(b)

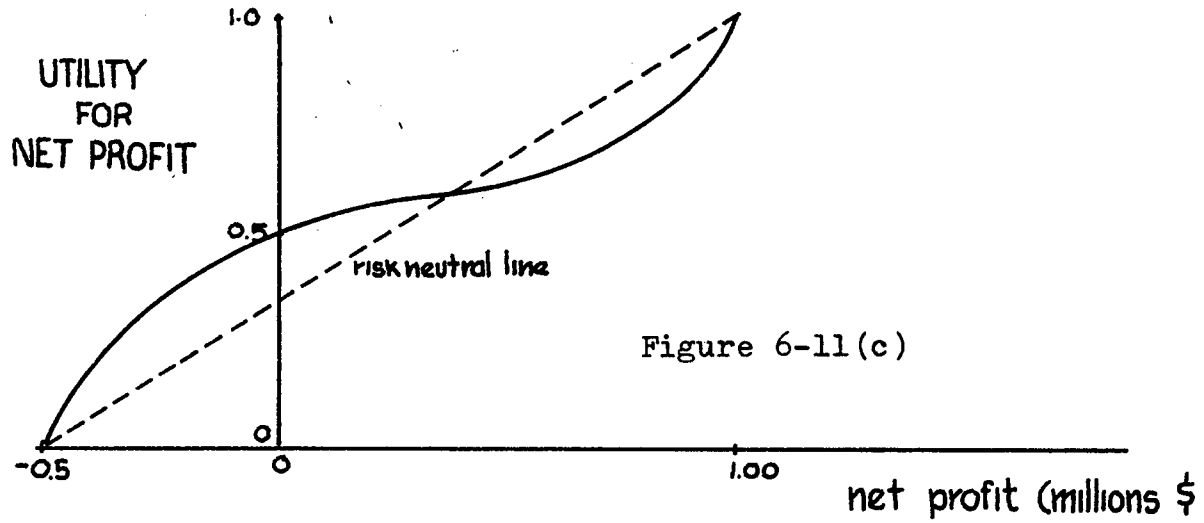


Figure 6-11(c)

Also, rate of return utility scores are compared under two conditions--under the large firm assumption and under the small firm assumption ($t = 1.0994$, $df = 33$, $p \sim 0.30$). The same comparison method is done for the net profit utility scores ($t = 1.98$, $p > 0.05$). It would not seem likely that the group has different risk taking propensity under the two conditions. This implies that the size of the firm does not affect resultant risk taking propensity.

We are primarily interested in how the subjects are placed as risk takers by these utility items. Ordinal scale in this case is as acceptable as the 'absolute' or interval scale. Thus, using the Kendall Tau rather than the Pearson's, the business utility scores correlate significantly (net profit and rate of return) with $r = 0.215$ ($p = 0.039$). However, the Pearson correlation is not significant at the 0.05 level. If we are to consider only placement of individuals in terms of rank, rather than looking at magnitudes, the Kendall tau suggests that the utility items in the business sections validate one another as risk taking measures.

Table X gives us an idea how these utility items relate with one another. The "personal" utility score (compensation) does not correlate significantly with the business utility scores.

TABLE X

CORRELATIONS OF UTILITY ITEMS[1]

	Compensation	Rate of Return	Net Profit
Compensation	1.000		
Rate of Return	---	1.000	
Net Profit	---	0.2948	1.000

[1] Missing means no significant correlations ($p > 0.05$). All correlation coefficients, $p < 0.039$.

Thus, we can say that there is no significant relationship (ordinal) between personal utility and business utility scores.

F. As we mentioned in previous chapters, the inclusion of the utility items as part of the face-to-face set is due to the fear that the items in the utility set may not be as clear as we initially thought. Because of the possibility of subjects' misunderstanding of the contents, these were presented in the experimenter's presence.

However, during administration, the subjects did not ask for any clarification. Thus, inclusion in the category set mentioned is after all not necessary.

There is also the initial fear that the subjects, because of their MBA training, will use the EV maximization criterion and result in risk neutral assessments. However, only a few subjects turned out to use the said criterion. Thus the fear is not warranted. One of these subjects even wrote on the side that the questionnaire was easily seen through (he thought this was some sort of a test on expected value).

Scale of Wager

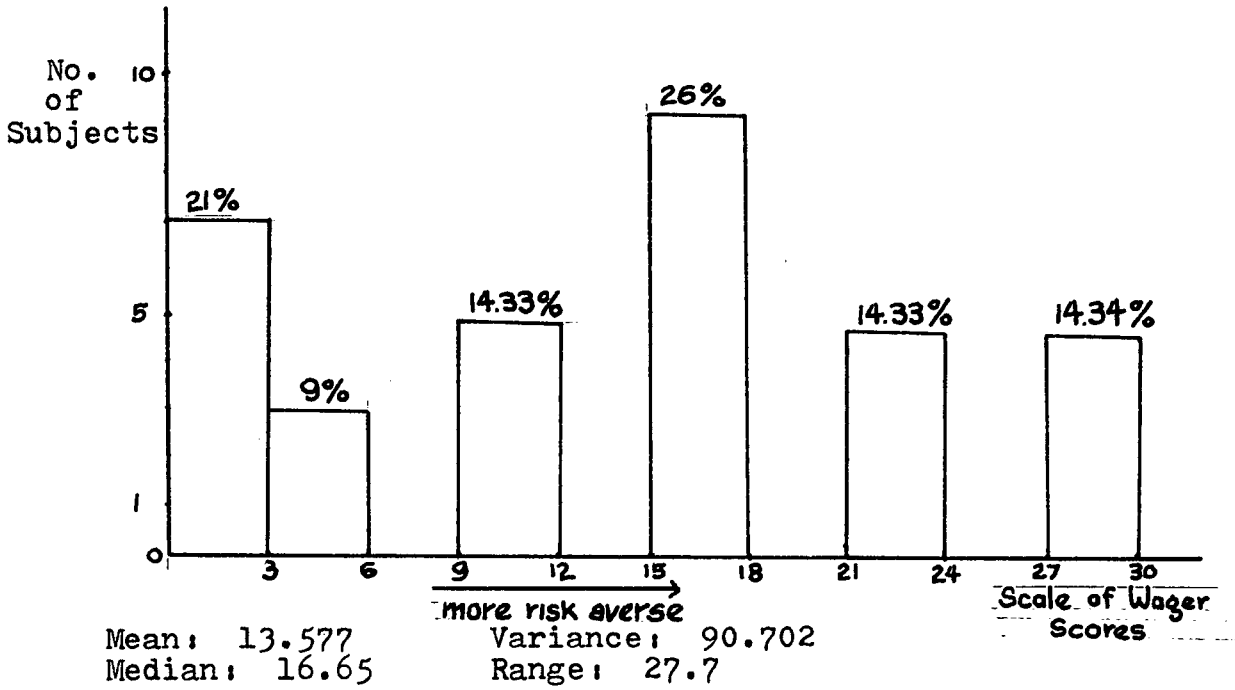
Although we have included this measure in the utility set and have discussed this questionnaire in the previous chapters as a utility one classified as personal utility, this is not a utility measure in that it differs from the utility measures in many respects. The form of the questions contained in it is different. Also, the score derived does not follow the convention of the utility ones. By convenience, this measure has been included with the utility set. In the analysis to follow, this questionnaire is considered distinct from the utility ones.

A. The Scale of Wager Score derived is a product of the number of no responses ('no' indicating that the subject would not play the game) and the deviations of the responses from the expected values. The deviation is derived by getting the difference between zero and the expected value of the gamble in each item (i.e., the buying price the subject offers is added to the loss amount and the expected value is computed).

B. The frequency distribution of the scale of wager scores is presented below.

FIGURE 6-12

Histogram, Scale of Wager Scores



Mean: 13.577 Variance: 90.702
Median: 16.65 Range: 27.7

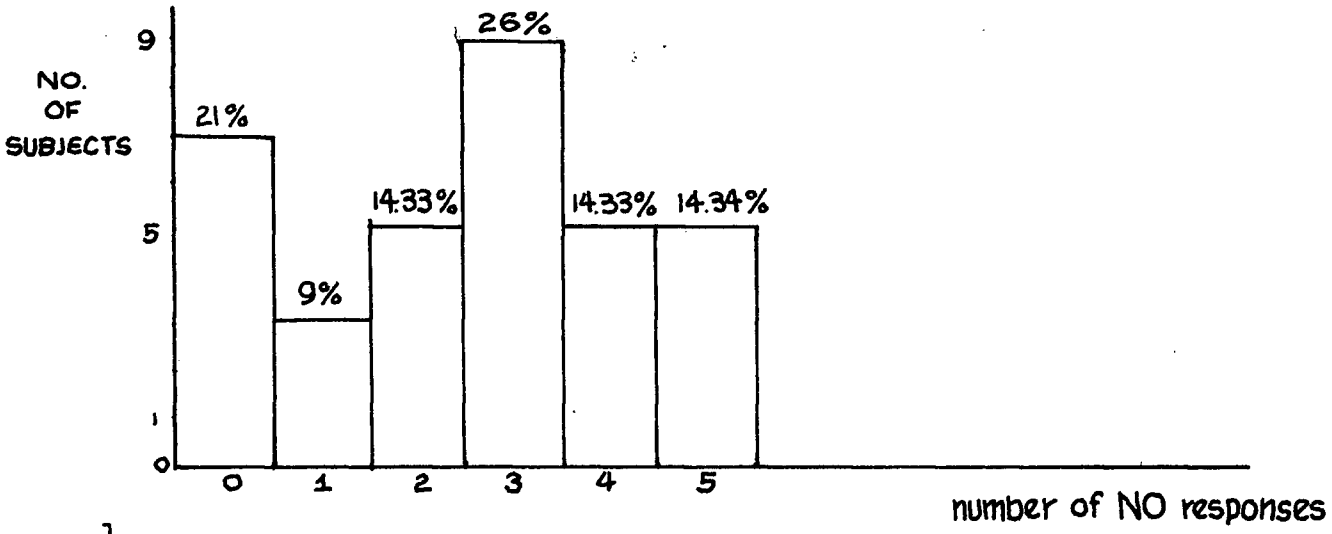
The apparent discontinuity of the frequency distribution of the scale of wager scores is a result of the method employed in calculating the score. Because the number of no responses is used as a weight, the multiplication of this with the total

deviations results in the peculiarity of the frequency distribution (the possible numbers of no responses are 0, 1, 2, 3, 4 and 5). Seven subjects have zero deviations indicating that here they either have zero no responses or use expected value as a criterion in responding (in that their buying equivalents result in zero expected values).

Figure 6-13 clarifies what the distribution of no responses is. Comparing this with Figure 6-12, we find that the frequencies fit in nicely, in that 21%, having zero scale of wager score in the previous figure, is also the percentage of people with zero no responses. A zero 'no responses' indicates that all the games are acceptable. The maximum possible loss if the five games were played, by the way, is $20,000.

FIGURE 6-13

Histogram, Number of No Responses[1]



[1] No indicates that the subjects will not play the wager even though they might have put down buying equivalents.

Mean: 2.32 Variance: 1.25
Median: 3 Range: 5.0

Again, there is some doubt as to whether the subjects who indicate their willingness to play are telling the truth.

C. Table XI and XII give us an idea of how subjects responded to items 4 and 5 of the Scale of Wager questionnaire. The former item refers to a gamble with a 50-50 chance of winning $2,000 or losing $1,000; and the latter concerns a 50-50 chance of gaining $20,000 or losing $10,000.

TABLE XI

Frequency Distribution, Buying Prices
Item 4, Scale of Wager

Buying Price	Relative Frequency	Absolute Frequency
$ 0.00	71%	25
100.00	6%	2
500.00	11%	4
1,000.00	6%	2
above 1,000.00	6%	2
	100%	35
Mean: 206.00		

TABLE XII

Frequency Distribution, Buying Prices
Item 5, Scale of Wager

Buying Price	Relative Frequency	Absolute Frequency
0.00	80%	28
500.00	2.9%	1
3,000.00	2.9%	1
5,000.00	5.6%	2
10,000.00	2.9%	1
above 10,000	5.7%	2
	100%	35
Mean: 1,471.00		

Even though the possible gain is very high in these two items, a majority of the subjects would not pay anything for

the game because of the size of the possible loss. For subjects who indicated that they would buy the wager at a high price, their responses might be a bit questionable because of the stake involved. Thus, the hypothetical nature of the game might have induced inaccurate answers in that the subjects at present do not have the amounts they indicated. The questionnaire assumes that the subjects take account of their present wealth level but does not explicitly tell the subjects to assume such.

For items 1, 2, and 3 the mean buying prices are: $.45 for item 1, 3.15 for item 2 and 20.28 for item 3. Here is a rough indication that the buying prices do not increase in the proportion similar to the proportion at which expected value increases.

D. The Scale of Wager deviations (if compared with Compensation utility items) shows much better 'cohesion' in that these are correlated significantly with one another. The aggregate score is highly correlated with the individual deviations. If the validity is based on item analyses alone, the Scale of Wager is superior to the 'other utility scores.' The table following fully verifies this.

TABLE XIII

Correlation Matrix
Scale of Wager Premiums and Scores

Item No.	1	2	3	4	5	Ag. Score
1		(.82)	(.69)	(.69)	(.64)	(.55)
2			(.81)	(.72)	(.80)	(.61)
3				(.86)	(.93)	(.69)
4					(.87)	(.65)
5						(.57)
Ag. Score						

However, these high correlations are not the only consideration. The discussion in (C) has given us an idea of the dubious nature of the subjects' responses.

E. Each subject's buying prices are examined. Although the size of the gambles increase from one item to the next in multiples of 10 (i.e., the possible win of item 2 is $20.00 while for item 1 it is 2.00), the buying prices of the subjects do not increase in the same proportion.

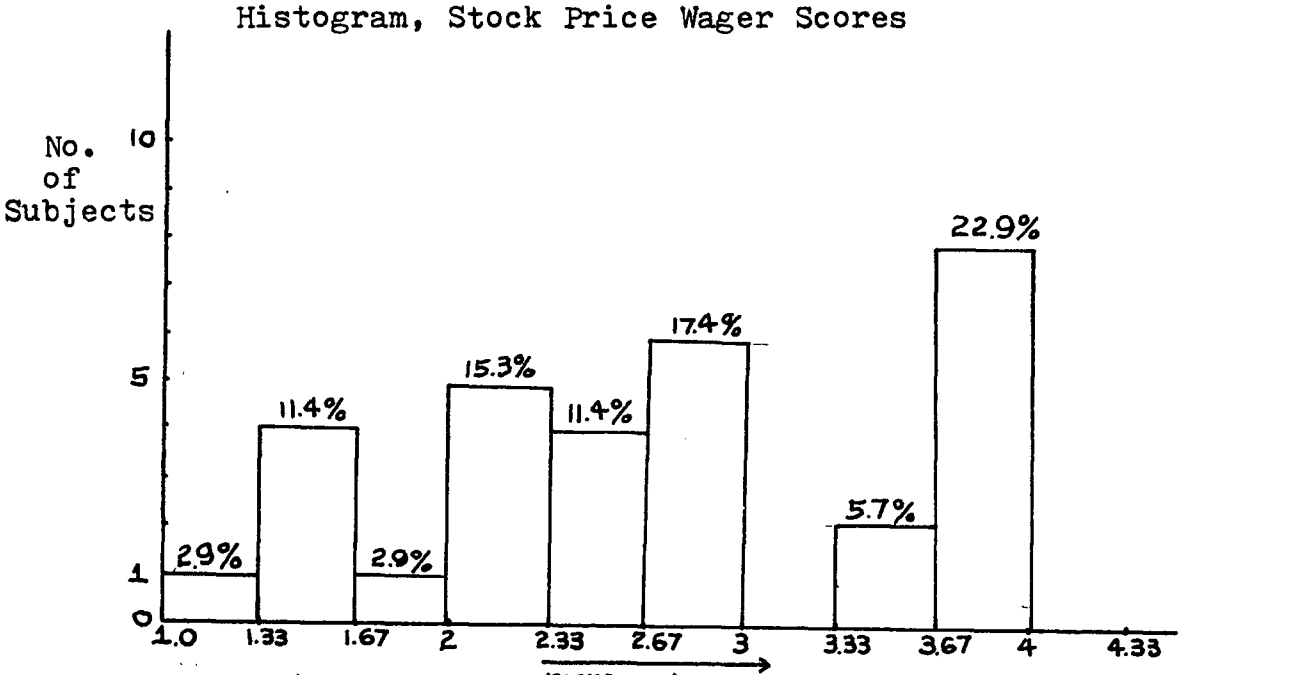
Stock Price Wagers

A. The subject's top choice (where he indicated rank one) is converted into the variance of the gamble chosen; this is made into a proportional form (as a proportion of the largest variance in the set), which is subtracted from one; and the proportion is multiplied by the rank of the item chosen (rank indicates order by size of variance where the largest variance is given a rank of 0). The Stock Price Wager is the sum of the "ranked proportions" from the five sets.

B. The distribution of stock price wager scores is illustrated in Figure 6-14. We can see that there are no zeros as scores. This implies that no one chose the gamble with the largest variance in all the sets. The mean of 2.74 (by breaking this down into the ranks and proportions) suggests that on the average the subjects chose the third-smallest-variance gamble. In all sets (except the one involving the 62% bets), this refers to the wager with a 62% chance of winning. However, whether this is an indication of general probability preference remains to

FIGURE 6-14

Histogram, Stock Price Wager Scores



Mean: 2.74
Mode: 4.000
Median: 2.57
Variance: 0.733
Range: 2.75

be justified (i.e., we cannot say that 62% is the "favourite" probability of the subjects). The mode of 4.000 (22.9%) suggests that there are 8 subjects who preferred the sure $2.00 throughout.

C. The subjects were asked to rank the five sets according to their desirability.

Table XIV gives an idea of how the subjects assign ranks to these five sets. Set C is chosen by the majority of the subjects as number 1. This can be explained by the fact that C is the only set in the Stock Price Wager questionnaire, which offers expected values greater than $2.00 (the expected value fixed for three sets).

TABLE XIV

Overall Set Rankings
Distribution

Set	RANK					
	1	2	3	4	5	Median
	Frequency Relative					
A	8.6	33.3	27.3	24.2	6.1	2.778
B	18.2	9.1	18.2	18.2	36.4	3.75
C	57.6	24.2	9.1	6.1	3.0	1.368
D	3.0	9.1	36.4	27.3	24.2	3.55
E	9.1	24.2	12.1	24.2	30.3	3.687

Based on the median, the least liked set seems to be Set B which offers a fixed expected value and possible gain but has an option with a possible loss of $70.00. On an overall basis, this result is a rough indication of loss minimization behavior. If one looks at how the rank 1's are distributed throughout the set, set D has the least number of 1's. This indicates that for the majority of subjects set D is not the top choice, in that they do not prefer the expected value to be less than $2.00 even though it increases as the probability of success increases.

In usual multiattribute choice making, there is a dominance rule which states that the choice, which has a more desirable value in one of its attributes while the rest of the attributes are similar in value to those of other choices, is chosen. In Set D, if the dominance rule follows, the initial hypothesis is that item 5 (sure amount of $2.00) should be chosen as top choice in the set because this choice dominates. This is drawn

from the notion that more certainty of gaining is preferred to less certainty of gaining (all other things being the same) and greater expected value is preferred over less expected value. Table XV indicates that the value of the median decreases from the first to the last item. Also, the mode ranks are 'in the reverse diagonal.' This confirms the belief that the subjects, in general, followed the rule. This shows the subjects really thought out their choices well.

TABLE XV

Set D
Distribution of Ranks

	Relative Frequency					
Item No. \ Value	1	2	3	4	5	Median
1	8.6	8.6	2.9	11.4	68.6	4.229
2	8.6	14.3	11.4	65.7	--	3.33
3	14.3	11.4	65.7	5.7	2.9	2.714
4	11.4	51.4	11.4	14.3	11.4	2.63
5	58.8	14.7	8.8	2.9	14.7	2.000

TABLE XVI

Set C
Distribution of Ranks

Item No. \ Rank	1	2	3	4	5	Median
1	28.6	20.0	20.0	8.6	22.9	2.771
2	14.3	20.0	14.3	22.9	28.6	3.314
3	20.0	14.3	40.0	25.7	--	2.714
4	17.1	20.0	22.9	37.1	2.9	2.88
5	20.0	25.7	2.9	5.7	45.7	3.314
		Relative Frequencies				

Table XVI gives us an idea of how Set C, the majority's favorite set, is responded to by the subjects. Only 20% of the subjects ranked the item(5) with the highest expected value as 1. The results of the above distribution reveal that the expected value criterion is not the sole criterion. We shall discuss the strategies individual subjects employed in E.

D. Table XVII gives us the results of the intercorrelations of the aggregate wager score and the five sets' top choice scores.

TABLE XVII

Correlation Matrix
Stock Price Wager Scores

Set	A	B	C	D	E	Ag. Score
A		(.37)	(.43)	(.55)	.18	(.708)
B			.07	.25	(.34)	(.551)
C				(.39)	(.52)	(.73)
D					.10	(.74)
E						(.53)
Ag. Score						

Coefficients enclosed in parenthesis are significant at .05 level.

Set B and Set C do not seem to be as highly 'desirable' as the rest in terms of the number of significant correlation coefficients.

The kind of analysis we just presented above is different from the way we conducted the analyses on the rest of the measures because instead of items, we used sets. This may be justified because the items in the set are so interrelated with one another that it would be senseless to talk about removing

items rather than sets.

The low correlation of Set E with the rest is understandable from the point of view that the different format of E's items may have induced such a result. This suggests that the items in Set E should be revised in such a way that it conforms with the format of the rest of the sets. As for Set B, the low correlation with Set C and D is unexpected. This suggests that some other considerations were incorporated in their responses to B as compared to the rest of the sets. These considerations cannot be isolated. The major difference of Set B with the rest of the sets lies in the size of the largest possible loss ($70.00). Whether this difference causes the results that we got or not cannot be ascertained.

E. The following strategies are examined:

(1) Choosing the alternative that would earn the most money.
(2) Choosing the alternative that would lose the least money.
(3) Choosing the alternative with the least probability of success.
(4) Choosing the alternative with the greatest variance.
(5) Choosing the alternative with the probability one likes.

A (1) strategy implies choosing the alternative with the largest amount of possible gain. The largest possible gain is in Set C (item 5 with a possible gain of $70.00). As we said before (see Table XXVI) 20% (or 7 subjects) chose this alternative.

Losing the least money may be interpreted as choosing the sure thing (possible loss = 0.0) or losing the $1.10 in the wager options of Set B. For the first interpretation, 9 chose

the sure thing most of the time (2 of these deviated in Set B in that they chose the 'both win' alternative--i.e., win of $10.00 or a win of $1.40). As for the second interpretation, this would mean choosing item 3 in Set B as rank 1. Nine subjects chose this alternative as their overall choice (which was not played out).

Strategy (3) suggests that the subjects would choose the 7% probability of success. Only 3 subjects chose this level most of the time (i.e., except for Set D and for the two sets whose losses were not constant throughout).

As for Strategy (4), no one consistently used this strategy in the sets. Five subjects chose the options with the largest variance in some sets. The option, among the rest, with the greatest variance is item 1 of Set B. No one has ranked this item as their first choice among the other options in the same set.

Probability preference is also examined. We indicated before that 62% could be the 'favorite' probability of the subjects. Ten subjects chose this level most of the time but five of these chose to minimize loss (sure thing or least loss) when the 'lose' amount varied from one item to another.

If expected value is the sole criterion employed for some subjects, their responses to Set C would indicate this (i.e., ranks for the respective items would be: 5, 4, 3, 2, 1). A Spearman rho coefficient is calculated for each subject but because of the number of items, we can only accept a rho of 1.0 as indication of EV maximizing. Only three subjects have rho's of 1.0.

Variance Preference (or some favorite variance level) is not observed in the group.

Variance Minimization is also examined--though a bit crude. The average variances of the gambles in each set is derived. The sets in turn are ranked according to the size of the average variance (where 1.0 is given to the lowest variance, 2.0 to the next and so on). This kind of ranking is in turn compared with the ranks generated by the subjects. The Spearman rho is computed. The rho's, in order to be significant, should be 1.0. None are found to be significant. However, 21 of the 33 completed set rankings, have negative rho's (ranging from -0.89 to -0.01) while 12 have positive correlation (ranging from 0.90 to 0.10).

Thus, from the results it seems that the strategy employed most of the time (30% of the subjects) is choosing the alternative with the favorite probability. However, based on the 30% who employed this strategy, this cannot be claimed to be general for the group.

Extremity Confidence in Judgment

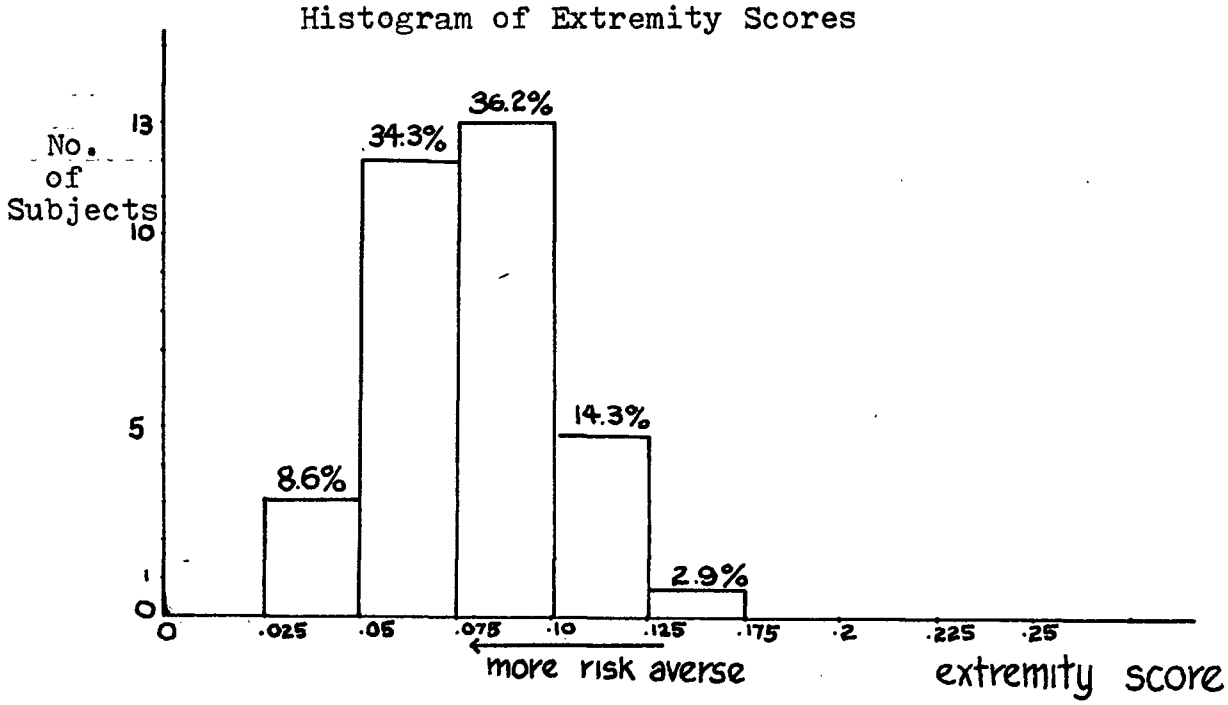
A. The aggregate extremity score for each subject is the average squared deviation of the item chances from fifty. The confidence score is the average confidence value subjects assigned to the fifteen items. (the code being 1 for Very Sure, 2 for Quite Sure, and so on).

B. Figure 6-15 gives us an idea of how the extremity scores are distributed, while Figure 6-16 summarizes the confidence score distribution.

The extremity score, on the average, is thus low as evidenced by the distribution. This implies that the subjects do not take high risks concerning knowledge. They are also moderately confident in their responses as revealed by the mean confidence score.

FIGURE 6-15

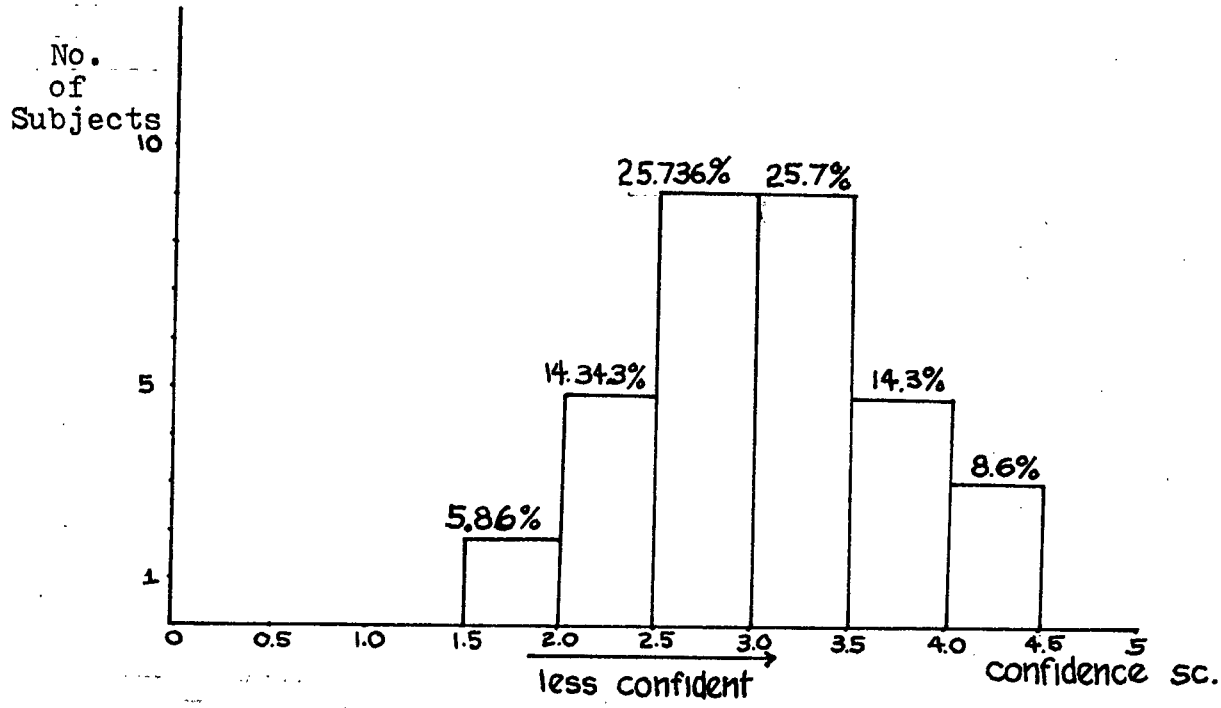
Histogram of Extremity Scores



Mean: 0.082
Variance: 0.001
Range: 0.128
Median: .078

FIGURE 6-16

Histogram, Confidence Scores

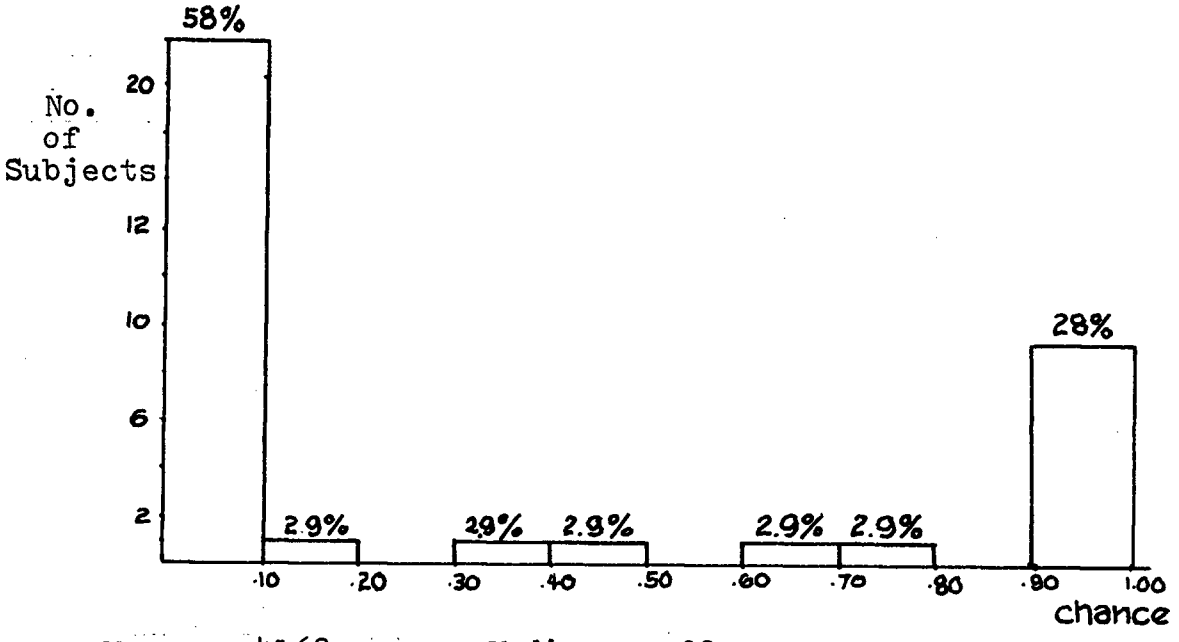


Mean: 3.05 Range: 2.6
Variance: 0.39 Median: 3.11

C. Item 13 concerns the assignment of the chances that an American motorist will have a severe car accident on the U.S. highway this Sunday. This is interestingly distributed as evidenced by Figure 6-17, which depicts the distribution of chance assignments, and by Figure 6-18, the resultant extremity score distribution of this item.

FIGURE 6-17

Histogram, Chance Assignment Distribution
Item 13



Mean: .4168 Median: .03
Variance: .1654 Range: 1.00

The strange distribution of the responses to Item 13 may be attributed to misinterpretation. Instead of reading the item as 'An American taken at random,' the interpretation has either been 'a particular American motorist' or 'one American motorist.' This item's ambiguity must be corrected by adding the phrase 'taken at random.'

FIGURE 6-18

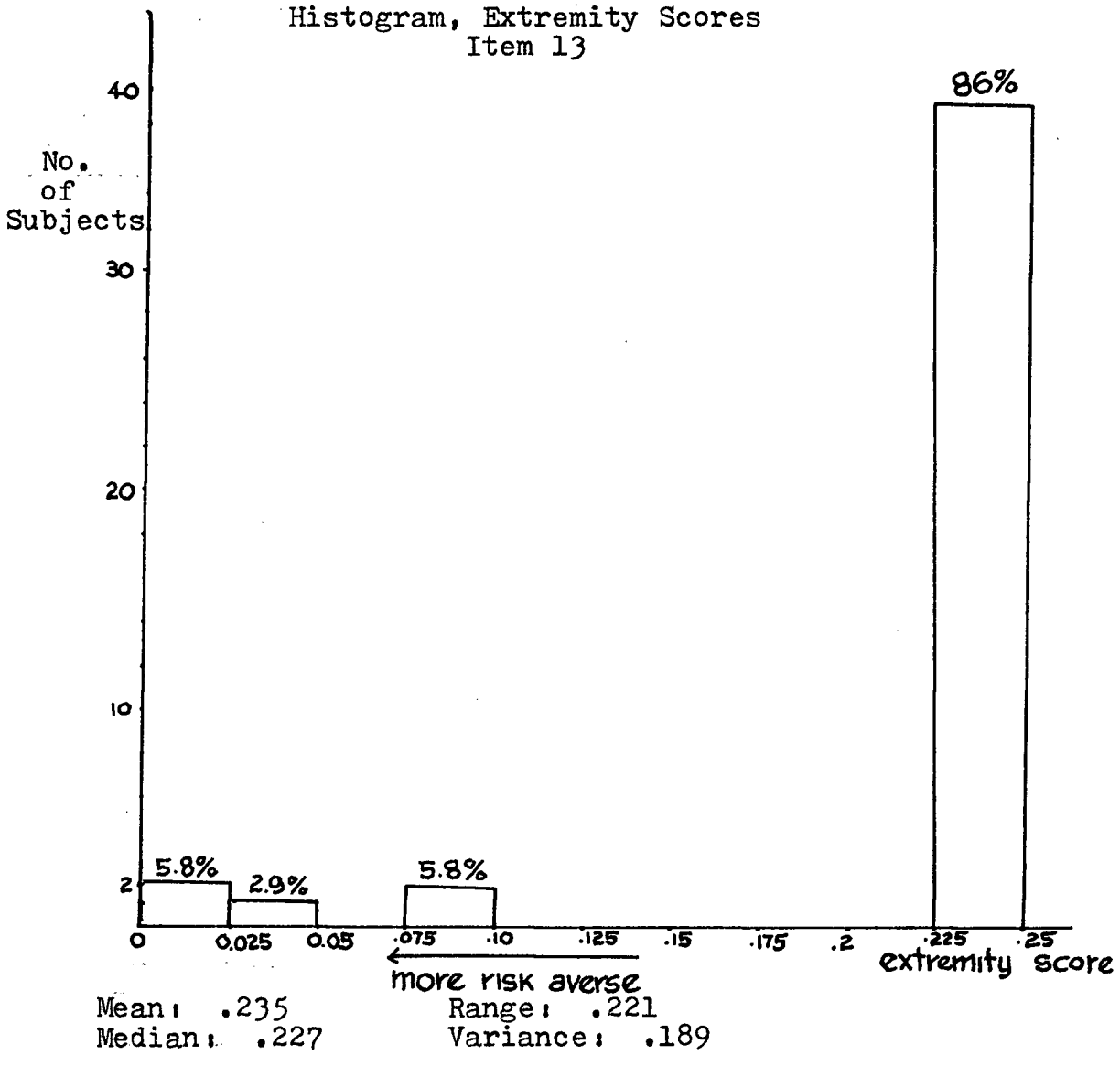


Table XVIII gives us the breakdown of the confidence score for this item. The confidence score for this item on the average is high. But, due to the subjects' possible misinterpretation, we cannot relate the confidence score to the extremity score. This item's average confidence score is the highest among the items.

TABLE XVIII

Confidence Score, Item 13

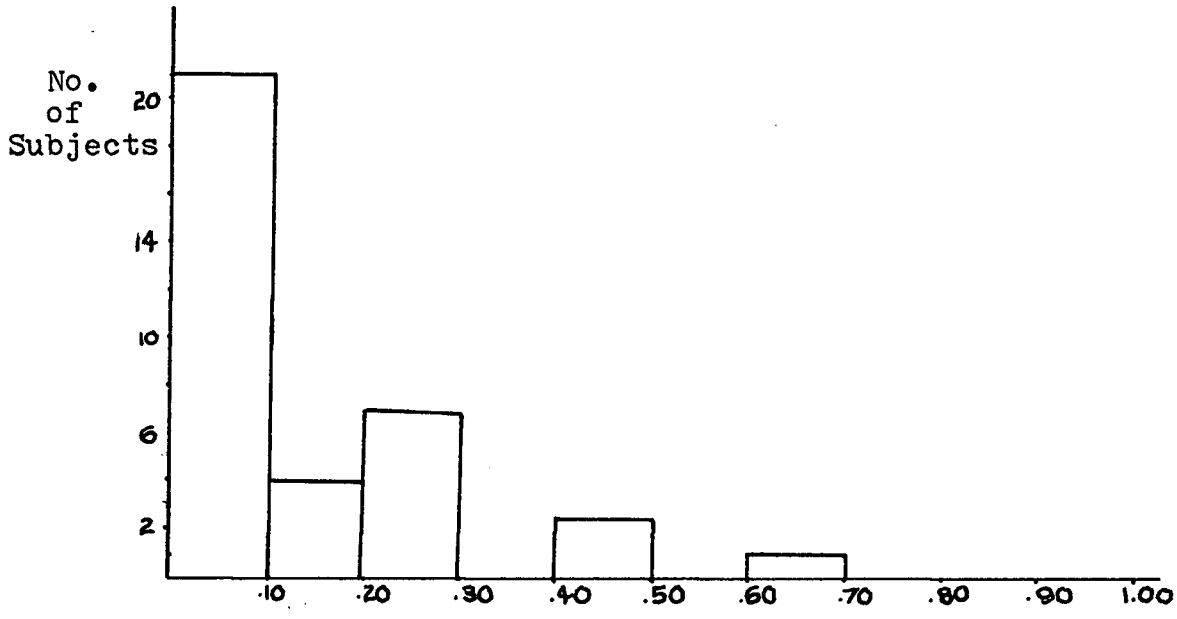
Value	Absolute Frequency	Relative Frequency
1	17	48.6
2	7	20.0
3	6	17.1
4	4	11.4
5	5	2.9

Mean: 2.000
Mode: 1.000
Variance: 1.412

Item 6, concerning the chances that a Canadian woman will abstain totally from alcoholic beverage is another interesting item in that the average assigned chance is .198. Figure 6-19 illustrates how these chances are distributed.

FIGURE 6-19

Histogram, Chance Assignments
Item 6



Median: 9.7%
Range: .68
Variance: .127

Thus, on average, subjects believed that there is a slim chance that a Canadian woman will abstain from alcoholic beverage. The mean confidence for this item is 2.6 which is a little better than 'Moderately Sure.'

TABLE XIX

Confidence Score
Item 6

Value	Absolute Frequency	Relative Frequency
1	3	8.6
2	13	37.1
3	11	31.4
4	6	17.1
5	2	5.7

D. Table XX gives us an indication of the strength of association between the aggregate extremity score and the item, and the intercorrelations of the items with one another. Inter-item extremity score correlations are not encouraging. However, except for items 4, 8, 9 and 14, the correlation of the item score with the aggregate score is significant at the 0.05 level.

Item 4's uniqueness is apparent from the Table XX. Thus, using the criterion of basing item validity on the resulting correlation with the aggregate score implies that items 4, 8, 9 and 14 are possible candidates for rejection. Item 6 (concerning a Canadian woman abstaining from alcohol) is another candidate for rejection even though its correlation with the aggregate score is significant (see C).

TABLE XX

Correlation Matrix
Extremity Scores

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Ave. Score
1		.1114	(.285)	.097	(.48)	(.29)	-0.03	-0.04	-0.11	-0.04	0.09	.231	-0.05	.105	.002	(0.376)
2			0.051	(.324)	.17	0.07	.24	-.09	(.29)	.10	.25	-0.02	.11	.28	.26	(.645)
3				.02	.20	.24	.09	.08	-.14	-.11	.18	.26	-.20	.07	-0.09	(.33)
4					.09	-.14	.18	-.21	.24	-.04	-0.13	-.17	-.15	-0.03	.26	.26
5						(.36)	.12	-0.02	(-.28)	.23	.30	.24	.08	-.002	-.07	(.493)
6							-.13	.19	-.18	(.34)	(.33)	.13	.001	.01	-.27	(0.328)
7								-.27	(.31)	-.12	-.19	-.12	-0.002	.018	(.469)	(.3004)
8									-0.16	.048	.017	.05	.21	-.27	-.16	-0.0114
9										-.24	-.19	(-.28)	.004	(.324)	.063	.052
10											.13	.03	.13	-.04	-0.012	(.311)
11												(.323)	(.351)	.27	-.19	(.47)
12													-.08	-.04	.21	(.36)
13														.13	.007	(.36)
14															-.010	.202
15																(.32)
Ave. Score																

—— Correlation coefficients (Pearson) are significant at the 0.05 level when enclosed in parenthesis.

TABLE XXI

Correlation Matrix
Confidence Scores

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Ag. Score
1		(.48)	.25	.20	(.39)	(.35)	.13	.18	.16	(.30)	(.39)	.26	.18	.13	.21	(.54)
2			(.59)	(.42)	.25	(.35)	(.45)	.05	(.43)	.22	(.38)	-.05	.14	.07	(.30)	(.62)
3				(.42)	(.35)	.23	(.40)	.26	(.52)	(.37)	.26	(.33)	.15	.04	.18	(.63)
4					(.63)	(.49)	(.39)	.16	(.57)	(.38)	(.52)	.20	(.43)	(.31)	(.43)	(.76)
5						(.56)	.18	.22	.27	(.45)	(.31)	(.30)	.17	.26	.25	(.67)
6							.26	.23	.18	.02	.22	.05	.28	.14	.16	(.55)
7								-.02	(.46)	.22	.21	.03	-.09	(.43)	(.45)	(.54)
8									.20	(.32)	.15	.16	.28	-.01	.22	(.38)
9										(.41)	(.33)	.09	.18	.22	.27	(.64)
10											(.51)	(.37)	.11	.31	(.43)	(.63)
11												.09	(.39)	(.39)	(.56)	(.65)
12													.13	.0	.21	(.37)
13														.23	.12	(.42)
14															(.42)	(.45)
15																
Ag. Score																

Correlation coefficients enclosed in parenthesis are significant at .05 level.

Table XXI reveals to us the intercorrelations of the confidence scores. All are significantly correlated with the aggregate confidence score. Inter-item confidence score correlations are significant for some but a few of the rest are not significant.

But one must remember that confidence and extremity scores are used jointly so that rejection of one item in the questionnaire means rejection of the confidence and extremity scores for that item.

E. Following Kogan and Wallach (1964), an analysis which divides extremity scores under high confidence (Very Sure-Quite Sure) and low confidence (Slightly Sure-Not Sure at All) is undertaken. The extremity scores of the subjects under high confidence range from .25 to 0.0 while the extremity score under low range from 0.17 to 0.0.

Kogan and Wallach asserted that 'one takes greater risks (or higher extremity score) when one is more confident.'

For each subject, the difference of the scores between the two conditions is taken. These differences are added up in order to utilize the t statistics. The resulting t is 0.769 with 34 degrees of freedom and implies that the difference is not significant, although 30 of the subjects have higher extremity scores (mean is about .097) under high confidence than under low (mean = .0092). This may be due to the size of the pooled standard deviation (.032). Thus, as far as our group is concerned, we must reject Kogan and Wallach's hypothesis concerning confidence and risk taking.

The correlation of the average confidence score with the squared extremity is not significant (r = -0.003). The same is true with the r between confidence score and the alternate extremity score (r = -0.006). This again is an indication that confidence score is not at all related to risk taking.

Event Occurrence and Activity Interest

A. Two scores are generated from this questionnaire. The internal control score is just the sum of the internal-control-oriented alternatives chosen by the subject while the optimal stimulation score (or sensation seeking score) is the sum of the 'sensation seeking' oriented alternatives chosen.

B. Figure 6-20 and Figure 6-21 depict the distributions of these two scores.

FIGURE 6-20

Histogram, Internal Control Scores

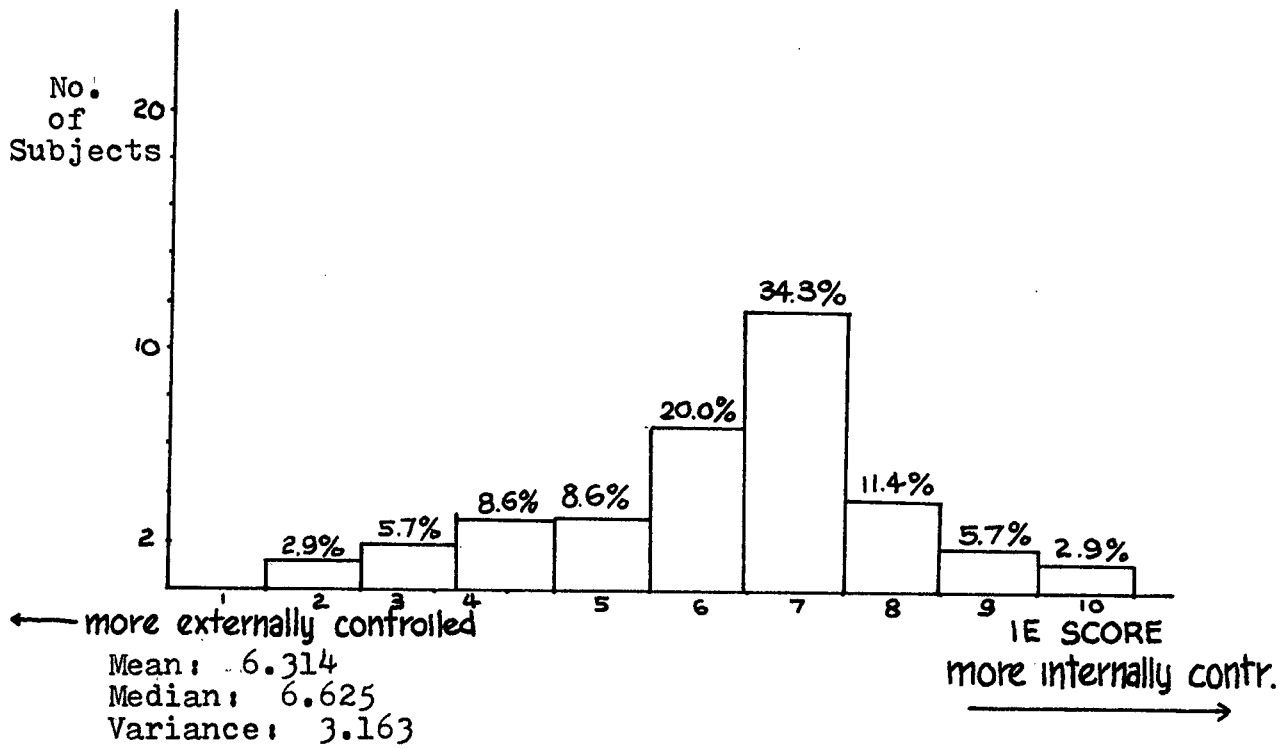
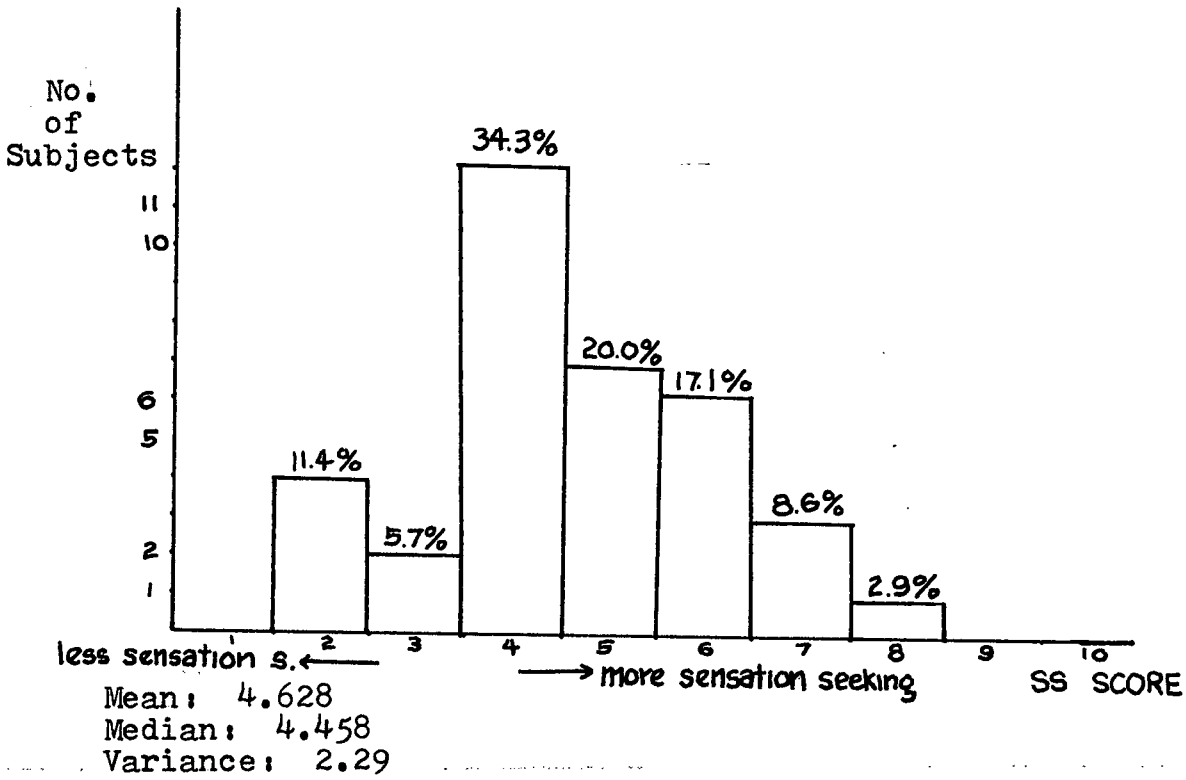


FIGURE 6-21

Histogram
Sensation Seeking Scores

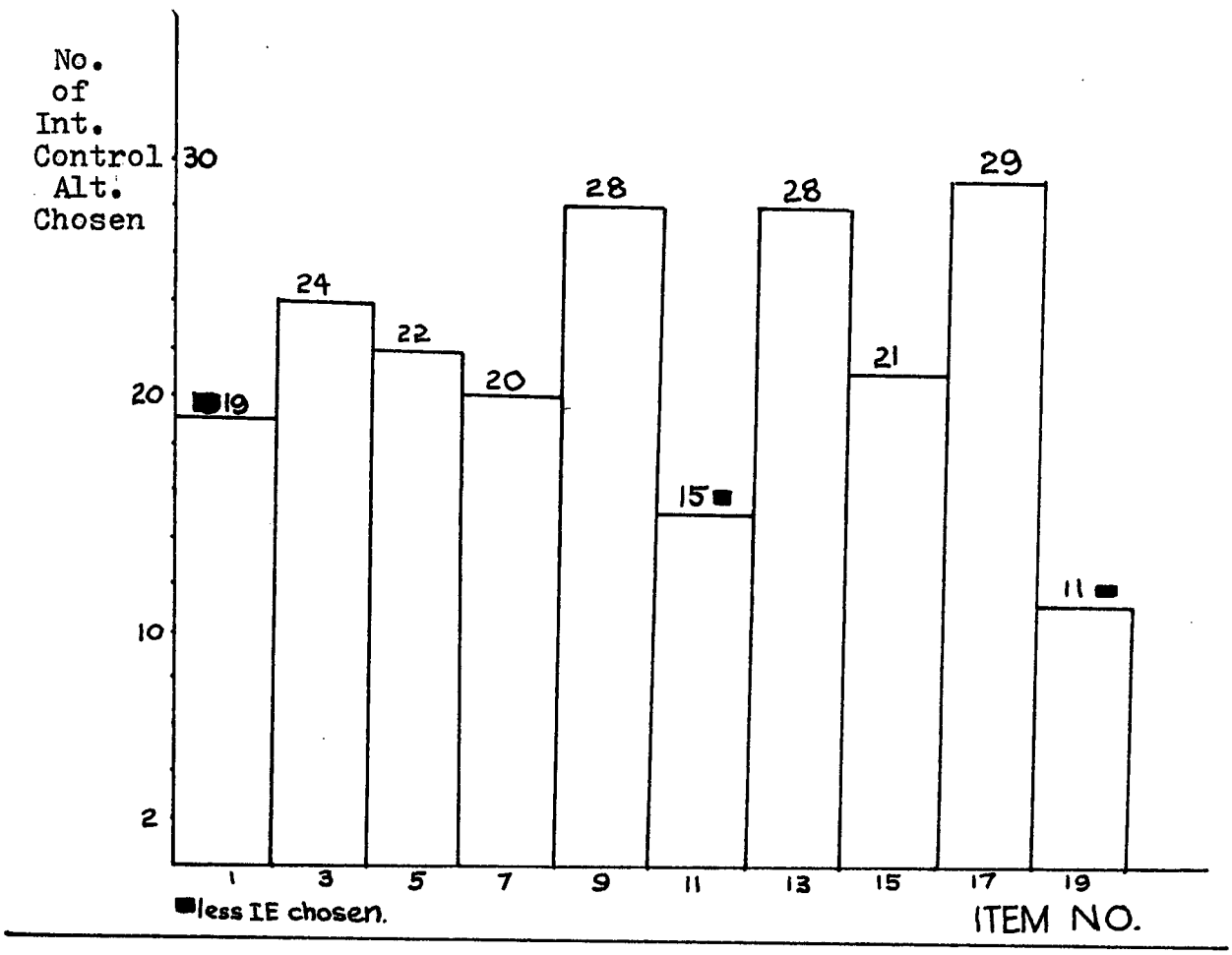


The implication of the above is that the students are more internally controlled than they are stimulation-seeking. On the whole, it may be argued that the Master's students do perceive greater locus of control in human affairs. But they do not seem to seek 'excitement' from stimulating events or social intercourse.

C. We break the items into two categories: IE Control and Sensation Seeking. Figure 6-22 gives us a picture of how the subjects respond to each item.

FIGURE 6-22

Histogram, Responses
for Each Item

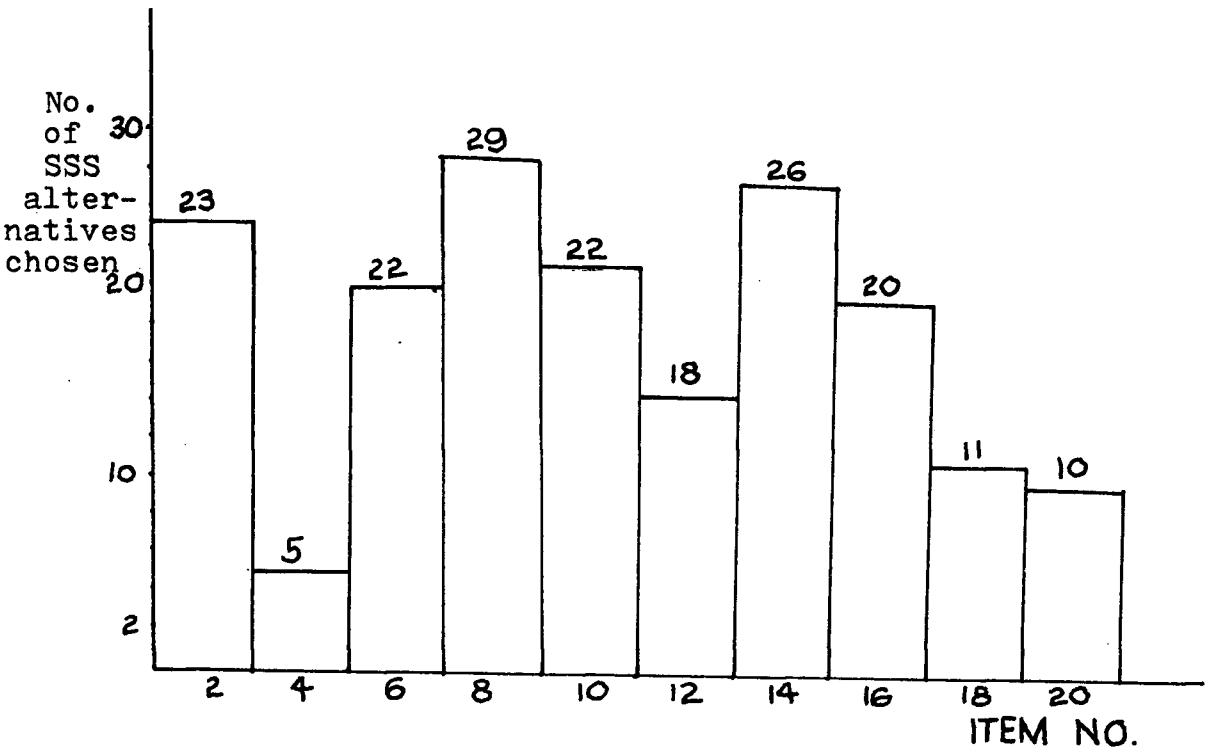


Items 9, 13, and 17 concern control in personal life (trusting to fate not turning out well in item 9; almost certain that plans made by self can be made to work in item 13; and 'what happens to me is my own doing' in item 17). The least perceived control is in item 19 concerning fortune and people in general. Thus, the subjects felt that they had greatest control over their personal lives and less control over world affairs, government decisions and other people's lives (items 11, 15, etc.).

Figure 6-23 shows us how the sensation-seeking items are answered.

FIGURE 6-23

Histogram, SSS Response for Each Item



Items 4, 12, 18 and 20 elicited the least number of SSS responses. Items 4, 18 and 20 are concerned with social activities (e.g., choosing friends who are reliable and predictable or not, enjoying or disliking routine works, and preferring people who are calm and even tempered or not). Item 12 may be considered as sensual stimulation (i.e., whether one dives into a cold pool or gradually sinks into it). The items where the subjects felt they should be more sensation-seeking concern travelling. We could say that because of these results,

the subjects are most stimulated by travelling (items 8, 14) and least by social activities.

D. Because of the way the IE-SSS scores are coded for computer analysis, only aggregate scores for each person are available. However, an indication of item validity may be secured from Rotter's (1966) results and from the biserial correlation table Zuckerman, et al. (1964) provided.

Table XXII and Table XXIII have been reproduced from the studies conducted by Rotter and Zuckerman. The item nos. referred to in the tables are the item numbers as they appeared in our questionnaire. The biserial correlations of the IE items are much better than those of the SS items.

Item 9, although it elicited high Internal Control responses, as shown from Rotter's, is one of the poorest among the IE items. Item 19, in the same vein, doesn't have high biserial correlation.

As for the SS items, item 4 and item 14 are, based on the table, the poorest.

If one desires to reduce the number of items in this questionnaire, the candidates are the items mentioned in this subsection.

E. Are externally controlled individuals less 'sensation-seeking'? This question is raised with the initial belief that individuals who find that most events are beyond their control do not seek stimulation from unpredictable social acquaintances, travelling without guides, etc. Instead, they prefer the notion of a 'quiet' life knowing that they are being externally

TABLE XXII

The IE Scale with Correlations of Each Item with Total Score, Excluding that Item[1]

Item No.	Biserial Item Correlations	
	200M	400M+F
1	.265	.460
3	.345	.319
5	.238	.289
7	.391	.301
9	.152	.164
11	.313	.357
13	.313	.265
15	.295	.307
17	.331	.238
19	.108	.152

[1] Reproduced from Rotter (1966) n = 400.

TABLE XXIII

SS Scale with Correlations of Each Item with Total Score, Excluding that Item[2]

Item No.	Biserial Item Correlations
2	.270
4	.155
6	.318
8	.391
10	.307
12	.192
14	.152
16	.185
18	.229
20	.271

[2] Zuckerman, et al. (1964) n = 180.

controlled anyway. On the other hand, people who perceive greater locus of control over their lives are perhaps those who also seek higher stimulation levels.

The correlation of IE Scores with SS Scores for our group is -0.032 ($p > 0.05$). Thus, the notion is not confirmed. It is possible that the underlying dimensions of the SS items are not the ones that the subjects perceive to contribute to stimulation-seeking. The items that subjects have low SS responses to are those which concern choice of social acquaintances. If they felt that they should have control over social acquaintances, they might not prefer unpredictable friends or emotionally expressive but unstable personalities (see Figure 6-23).

However, based on our results, the two constructs are not related at all.

Discussion

Analyses of the distributions of subjects' risk scores have been discussed together with some rough item analyses. The analyses indicated that some items should be revised or removed. The results also suggest that trimming is necessary. Some items which are less business relevant should not be included (e.g. item 3 of Choice Dilemma, item 2 of In-Basket, etc.). Items which do not seem to discriminate the risk takers from the risk averters are either subject to revision or to total elimination (items 4 and 5 of Scale of Wager, item 5 of In-Basket, etc.).

Also, for each measure, some of the past hypotheses are examined. The severity of consequences issue is not confirmed (i.e., people who perceive the risky alternative as more serious in terms of consequences do not necessarily tend to be less risk-takers). This issue is examined for the In-Basket and the Choice Dilemma measures. In addition, Kogan and Wallach's conclusions on the extremity-confidence-in judgment questionnaire are examined; the results of this study reveal that the extremity scores under high confidence are not significantly different from those under low confidence. Strategies in risk taking are also examined in In-Basket and Stock Price Wagers and found to be highly individualistic.

In Chapter 7, an overall analysis of these measures is undertaken by presenting the correlation matrix of the risk measures and the factor analyses results.

CHAPTER 7

OVERALL ANALYSIS OF RISK MEASURES

Overview

In order to look at how the risk measures relate to one another, a correlation matrix is constructed and the implications are discussed.

This chapter also presents us with the factor analyses of the measures and discusses the results in the light of our expectations.

An attempt at model-building is shown in the latter section in that risk-taking, as measured by some of these instruments, is examined in relation to demographic variables.

Correlation Matrix of Risk Measures

Table XXIV summarizes the significant correlations among the risk measures. Spearman rho's are used because we are primarily interested in the placement of individuals as risk takers by these measures rather than the various magnitudes.

The personality type measures like IE and SSS do not seem to be related to the risk measures. IE is negatively correlated with the Memo Score, suggesting that the strategy one takes is related to one's perceived locus of control. This implies that a person who perceives more control in his situations will recommend a riskier strategy. This is contrary to the notion that more internally controlled individuals are moderate

risk takers. As far as SSS is concerned, it seems that people become more extreme in their judgments when they are more 'sensation-seeking.' But the direction of causation cannot be ascertained.

Extremity in judgment is correlated in the right direction only with the rate of return utility scores since higher risk-taking is reflected by higher extremity scores while higher risk taking is reflected by lower scores in the risk measures like In-Basket and utility scores. This suggests that individuals, encountering alternatives where rate of return is used as an attribute measurement, will be greater risk takers when they are more extreme in judging event occurrences.

The confidence score, reflecting the confidence level of individuals, is deleted from the matrix as it is not significantly correlated with any of the risk measures.

The significant correlation of the Stock Price Wager score and the Scale of Wager score suggests that real and imaginary wager results are related--i.e., individuals who recommend taking greater risk in hypothetical gambling situations will also gamble with higher risks when confronted with real wagers. Though significant, the correlation coefficient is only .29 (suggesting that the relationship is fairly weak).

The Choice Dilemma Score, which may be regarded as "advisory risk taking," correlates significantly with Scale of Wager and odds in In-Basket. The latter correlation may be partly explained by the contention that similarity in "format" (i.e. both ask the subjects to assign minimum odds) will

TABLE XXIV

Spearman Rho's of Risk Measures[1]
(One tailed test, $p < 0.05$)

Variables	IE	SSS	Stock	Eqext	Choice	Compenst.	Scale	Rate	Profit	Odd	Memo	Semdiff.
IE	1.00	--	--	--	--	--	--	--	--	--	-.42	--
SSS		1.00	--	.36	--	--	--	--	0.31	--	--	--
Stock			1.00	--	--	--	0.29	--	0.30	--	--	--
Eqext				1.00	0.36	--	--	-0.41	--	--	--	--
Choice					1.00	--	.35	--	--	.31	--	--
Compenst.						1.00	.48	--	--	.38	--	--
Scale							1.00	.32	.55	.61	--	--
Rate								1.00	.30	--	--	--
Profit									1.00	0.37	--	--
Odd										1.00	--	0.28
Memo											1.00	--
Semdiff.												1.00

[1] Legend:

IE - Internal External Control Scores
SSS - Sensation Seeking Score
Choice - Choice Dilemma Scores
Eqext - Squared Extremity Scores
Stock - Stock Price Wager Scores
Compenst. - Compensation Utility
Scale - Scale of Wager
Rate - Rate of Return
Profit - Net Profit Utility
Odd - Minimum Odd, In-Basket
Memo - Memo Scores, In-Basket
Semdiff. - Semantic Differential Scores

result in similar placement of individuals. As to the correlation with Scale of Wager, there seems to be no other explanation except the general notion that they are measuring the same construct. (This general notion is in fact applied to the analysis of the entire matrix.)

Scale of Wager seems to have the largest number of correlations with other measures. On the other end, the Semantic Differential score has the least number of significant correlations. Because it reflects subjects' evaluation of risk takers this may not be considered as a direct rt propensity measure and the correlations may be explained with this distinction.

If Compensation Utility is considered as "personal" monetary risk taking, it should correlate highly also with Stock Price Wager. But the matrix shows it correlates only with Scale of Wager and odds in In-Basket.

The results revealed by the matrix suggest that the underlying risk taking propensity is not as unidimensional as we initially thought. They also suggest that our initially defined "business risk" dimension is quite broad. Thus, the correlations may indicate that these measures are not measuring the same thing.

A statistical method called Factor Analysis is used by researchers to isolate either clusters of relationships, or underlying dimensions. The more important phase of this type of analysis is to define the factors based on the results and on the initial assumption of what these factors are. This

method of analysis is employed when the simple correlation matrix does not exhibit the factors or clusters of relationships clearly.

Factor Analysis

On the assumption that the underlying dimensions may be interrelated, the Pearson correlation matrix of the risk measures is used as input to oblique factor analysis.

The number of factors is set at four because of the initial belief that the possible factors inherent in the data are: (1) advisory risk taking--i.e., Choice Dilemma; (2) business role risk taking--i.e., Rate of Return and Net Profit Utility items, In-Basket, etc.; (3) personal risk taking--e.g., compensation, extremity score (which can be interpreted as "risk taking in the knowledge dimension"); (4) gambling personal--e.g. Stock Price Wager and Scale of Wager.

The oblique factor analysis shows that the factors are not significantly correlated (ranging from .067 to -0.015). Also, it indicates that there are five factors (using eigen value >1.0 as cut-off point).

Table XXV gives us the rotated factor loading matrix and the factor structure. Factor 1 is loaded on by Scale of Wager, Net Profit Utility, odds in In-Basket and the weighted grade-odds score (from In-Basket)--using a cut-off criterion of loading greater than .50. Only the two extremity scores load heavily on Factor 2 while the Semantic Differential, Stock Price Wager and Compensation Utility scores load heavily on

TABLE XXV OBLIQUE FACTOR MATRICES USING PEARSON'S AS INPUT [1]

ROTATED FACTOR-LOADINGS MATRIX
* INDICATES A VALUE GREATER THAN OR EQUAL TO 0.60000

VARIABLE	FACTOR 1	2	3	4
1 SPWAGERS	-0.2787	-0.1986	* 0.6731	-0.2616
2 SQEXTREM	0.0034	* -0.9031	-0.1193	-0.1144
3 EXTSCORE	-0.0201	* -0.8894	-0.1550	-0.1134
4 CONFIDEN	0.4583	-0.1482	0.3436	-0.3622
5 CHOICEDL	0.0955	-0.1091	-0.1062	* -0.7711
6 COMPENST	-0.1474	-0.2634	* -0.7507	-0.1057
7 SCWAGERS	* -0.5740	-0.1194	-0.1057	* -0.5269
8 RATERETN	-0.1592	0.3982	-0.0225	-0.4753
9 PROFITNT	* -0.7574	-0.3859	0.1030	0.1893
10 WIRESCOR	0.0109	0.0532	-0.0485	0.4421
11 ODINBASK	* -0.8249	0.2623	-0.0482	-0.2302
12 GRADEODD	* -0.9590	0.1185	0.1575	-0.0465
13 SEMDIFSC	-0.0539	0.2064	* 0.8101	0.1956

SUM OF SQUARED FACTOR-LOADINGS DIVIDED BY SUM OF COMMUNALITIES
0.3233 0.2495 0.2146 0.1882

MATRIX OF CORRELATIONS OF FACTORS WITH VARIABLES.
VARIABLES ARE REORDERED ACCORDING TO HIGHEST CORRELATION WITH A FACTOR.
* INDICATES A MAGNITUDE GREATER THAN OR EQUAL TO 0.500.

VARIABLE	FACTOR 1	2	3	4
4 CONFIDEN	0.4233	-0.1554	0.3592	-0.3351
7 SCWAGERS	* -0.6459	-0.1787	-0.1102	* -0.6119
9 PROFITNT	* -0.7207	-0.3368	0.0218	0.0390
11 ODINBASK	* -0.8629	0.2480	-0.0296	-0.3101
12 GRADEODD	* -0.9628	0.1524	0.1445	-0.1713
	********	********	--------	--------
3 EXTSCORE	-0.0220	* -0.9205	-0.2587	-0.2059
2 SQEXTREM	0.0028	* -0.9304	-0.2239	-0.2071
	--------	********	********	--------
13 SEMDIFSC	-0.0064	0.3285	* 0.8233	0.1679
1 SPWAGERS	-0.2889	-0.1391	* 0.6540	-0.3570
6 COMPENST	-0.1798	-0.3642	* -0.7320	-0.1146
	--------	--------	********	********
10 WIRESCOR	0.0679	0.0958	-0.0653	0.4520
8 RATERETN	-0.2322	0.3463	0.0468	-0.4517
5 CHOICEDL	-0.0096	-0.2091	-0.0754	* -0.7646
	--------	--------	--------	********

[1] Refer to table XXVI for meanings of the abbreviated variable names.

Factor 3. The Choice Dilemma items are primarily of Factor 4. The factor structure is shown by the second matrix of Table XXV while the first matrix (usually not discussed in statistical analysis) is the factor pattern. Factor 2 may be considered as the business knowledge dimension because of the loadings by Extremity scores and Factor 4 may be called advisory dimension due to the Choice Dilemma; as to Factor 3, the dimension cannot be named reasonably. If we disregard Semantic Differential's loading, we can call this the 'personal' risk taking dimension due to Stock Price Wager and Compensation Utility scores. Overall, the factors extracted are neither expected nor identifiable.

Because the factors are reasonably unrelated, an orthogonal factor analysis with varimax rotation is done using the Pearson correlation matrix of risk scores as input. The results of rotated factor matrix revealed in Table XXVI shows more or less the same kind of relationships. The Extremity Scores may be explained mostly by Factor 1 (called the knowledge dimension); the odds in In-Basket and the weighted Grade Odds are loaded heavily on Factor 2; Compensation Utility scores, on Factor 3; Scale of Wager, on Factor 4; and Choice Dilemma, on Factor 5. This time five factors are extracted as the computer program overrides one's initial setting of the number of factors by using the eigen value rule. Identifying the factors becomes harder. Factor 1 is still the knowledge dimension;

TABLE XXVI ORTHOGONAL FACTORMATRIX AND
TRANSFORMATION MATRIX
Using Pearson's.

VARIMAX ROTATED FACTOR MATRIX

(Without spedifying the number of variable factors)

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
Stock Price Wagers	0.07911	0.09506	-0.27687	0.39357	0.02933
Extremity Scores[1]	*0.96052	-0.03727	0.09413	0.02892	0.12329
Plain Extremity	*0.93344	-0.03711	0.13986	0.07266	0.06641
Confidence	0.00947	-0.41080	-0.03549	0.12130	0.07216
Choice Dilemma	0.17539	-0.04704	0.08329	0.22002	*1.24179
Compensation Util.	0.22852	0.08433	*1.24115	-0.00419	0.02997
Scale of Wagers	0.13405	0.12693	0.20558	*0.94467	0.03205
Rate,of Return	-0.17785	0.03695	-0.05833	0.33130	0.05219
Profit Net Util.	0.22637	0.39584	0.15444	0.37697	-0.18330
In-Basket Memo	-0.06966	0.00314	0.00316	-0.19125	-0.11361
In-Basket Odd	-0.19417	* 0.66501	0.04371	0.49454	0.11944
Grade-odd In-Bask.	-0.03094	*1.09641	-0.04626	*0.45531	0.06963
Semantic Differen.	0.21891	0.26949	0.29219	0.03051	0.10318

[1]Squared Extremity Score

TRANSFORMATION MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
FACTOR 1	-0.29430	-0.60500	-0.31377	-0.61830	-0.25809
FACTOR 2	0.70825	-0.43922	0.44350	-0.23076	0.23562
FACTOR 3	-0.00667	0.24250	0.55758	-0.19593	-0.76933
FACTOR 4	-0.61825	-0.04654	0.60543	-0.16415	0.47129
FACTOR 5	0.17172	0.61651	-0.16556	-0.70648	0.25277

Factor 2 is the business-role risk taking; Factor 3 is the personal utility dimension; Factor 4 may be called hypothetical monetary risk taking and Factor 5, 'advisory' risk taking. The business utility items are not loaded heavily on any of the factors; the same can be said of the Semantic Differential score. The Stock Price Wager scores have the heaviest loading on Factor 4 but the loading is not great. The results of the loadings may be explained by the low correlations of the risk measures. Because the loadings are generally weak (or small in value), factor analyses results should not be relied on solely.

Using the Spearman correlation matrix rather than the Pearson, an oblique factor analysis is undertaken. The factor correlation matrix of Table XXVIII reveals that Factors 1 and 5 are significantly correlated (at .05 level, $r > .29$). The correlation of Factors 4 and 5 is also significant at .05 level.

Five factors are extracted this time. Using a cut-off point at loading greater than or equal to .50, the Scale of Wager is discovered to load heavily on three factors (1, 4 and 5). This, together with the loadings of the weighted grade odd, may explain the resultant factor correlation mentioned above.

By comparing Table XXV with Table XXVII, we find that the Choice Dilemma score in the latter table does not load heavily on any of the factors. Also Factor 3 seems to be loaded heavily by the Memo score in Table XXVII. The dissimilarity of the two tables may be traced to the different correlation matrices used. However this difference is not overwhelming when we consider that only net profit and Choice Dilemma scores are

not as heavily loaded as in Table XXV.

Though the factors extracted in Table XXVII are correlated, an orthogonal factor analysis (varimax rotated) is also undertaken using the Spearman correlation matrix as input. A comparison of Table XXVI and XXVIII which shows the resultant factor loadings is done. Factor 1 of Table XXVIII is similar to Factor 2 of Table XXVI while Factor 2 (of XXVIII) is similar to Factor 1 of XXVI. Factor 3 of both is similar. This can also be said of Factor 4. Factor 5 is entirely different in XXVIII because the confidence score and the memo score load on this while in XXVI, only the Choice Dilemma does.

These factor analytical methods are utilized in order to aid us in identifying the factors. However, the results of these methods do not seem to be of much help to us. The reliability of the factors extracted by these methods are moreover open to doubt because of its instability. The stability check is done by first dividing the data ramdomly into two sets. An oblique factor analysis is done for each set. Four canonical correlations between the two sets of factor scores (because four factors are requested) are derived. These are 0.98, 0.83, 0.74, 0.42 respectively (16, 9, 4, 1 degrees of freedom for the respective correlations, and p = -0.0, -0.0, 0.00053, 0.013 based on chi-square). Factor coefficients derived under the four canonical correlations assumption reveal that these run in different directions (i.e., factor coefficients of one set are positive while the factor coefficients in the second set are negative). This means that factors extracted in the first

TABLE XXVII OBLIQUE FACTOR MATRICES USING SPEARMAN'S AS INPUT

AFTER ROTATION WITH KAISER NORMALIZATION

FACTOR PATTERN

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
STOCKS	0.01576	0.07936	-0.01058	0.04050	0.36100
SQEXT	0.03071	0.92292	-0.01850	-0.18561	0.10500
EXTSC	0.03823	0.98109	-0.12099	0.03955	-0.04495
AVECO	0.22596	-0.06307	0.52884	0.00988	-0.00703
CHOICE	-0.14582	0.30361	0.22178	0.08201	0.16598
COMPUT	-0.34224	-0.14157	0.32523	0.50507	-0.13135
SCALES	-0.19419	0.22821	0.22660	0.47180	0.46759
RATERT	0.19292	-0.17648	-0.44885	0.73933	0.23489
PROFIT	-0.04281	-0.06720	0.06432	-0.03608	0.82483
WIRESC	0.13597	-0.01842	-0.50240	0.03978	-0.06115
ODINBS	-0.66847	-0.11836	-0.04193	0.21867	0.22388
GRADDD	-1.06701	-0.20411	-0.29318	-0.17853	0.52616
SEMDIF	-0.43239	0.16386	0.05080	0.01780	-0.10656

FACTOR STRUCTURE

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
STOCKS	-0.11216	0.11466	-0.01962	0.12716	0.37864
SQEXT	-0.11766	*0.95713	0.08563	-0.30742	0.16109
EXTSC	-0.10846	*0.94526	0.02063	-0.14546	0.08698
AVECO	0.15895	-0.02862	0.48787	0.01933	-0.11138
CHOICE	-0.29764	0.36895	0.28447	0.13415	0.25785
COMPUT	-0.43510	-0.13088	0.41090	*0.59305	0.07742
SCALES	*-0.50612	0.28026	0.30392	*0.63275	*0.67554
RATERT	0.06256	-0.35942	-0.44737	*0.75083	0.39411
PROFIT	-0.27735	0.05930	0.00753	0.22566	*0.81477
WIRESC	0.22283	-0.12795	*-0.51762	-0.05099	-0.06198
ODINBS	*-0.75471	-0.01511	0.04641	0.43949	0.47236
GRADDD	*-1.10680	0.03270	-0.21404	0.20321	*0.78366
SEMDIF	-0.44032	0.22952	0.14614	0.05853	0.04462

FACTOR CORRELATIONS

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
FACTOR 1	1.00000	-0.17271	-0.14728	-0.21266	-0.29685
FACTOR 2	-0.17271	1.00000	0.14352	-0.15559	0.12701
FACTOR 3	-0.14728	0.14352	1.00000	0.09397	-0.06068
FACTOR 4	-0.21266	-0.15559	0.09397	1.00000	0.28629
FACTOR 5	-0.29685	0.12701	-0.06068	0.28629	1.00000

- refer to table XXVI for the meaning of abbreviated variable names.

TABLE XXVIII ORTHOGONAL FACTOR MATRIX
USING SPEARMAN'S AS INPUT

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
STOCKS	0.04977	0.09120	0.06692	0.36582	-0.01833
SQEXT	0.01694	*0.94104	-0.22299	0.13036	0.01010
EXTSC	0.02664	*0.95249	-0.02299	0.03041	-0.04705
AVECO	-0.17100	-0.04748	-0.01383	-0.05801	*0.51159
CHOICE	0.23096	0.32566	0.05218	0.21878	0.24984
COMPUT	0.46453	-0.16571	0.43658	0.00310	0.40790
SCALES	0.40353	0.21942	0.44741	0.59043	0.29334
RATERT	-0.04982	-0.30761	*0.76090	0.33568	-0.36808
PROFIT	0.15259	-0.00739	0.04053	*0.80466	0.01344
WIRESC	-0.13642	-0.07185	0.07042	-0.06446	*-0.49551
ODINBS	*0.72400	-0.08250	0.21228	0.36103	-0.00052
GRADDD	*1.03690	-0.08014	-0.12355	*0.64759	-0.31192
SEMDIF	0.43110	0.19302	-0.02244	-0.02115	0.08782

TRANSFORMATION MATRIX

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
FACTOR 1	-0.72746	-0.06998	-0.23272	-0.64152	-0.01377
FACTOR 2	0.00696	0.93503	-0.32299	0.00414	0.14605
FACTOR 3	0.15123	-0.09553	0.15023	-0.23581	0.94330
FACTOR 4	-0.55150	0.23370	0.72050	0.33621	0.08189
FACTOR 5	-0.37911	-0.23390	-0.54756	0.64791	0.28627

* REFER TO TABLE XXVI for meaning of the abbreviated variable names.

set are not identical to the factors in the second set. Thus, the factors are said to be unstable.

It is advisable not to read too much from the results of the factor analysis as these may not be stable. It is recommended that future research utilizes the analyses undertaken here in order to resolve the multidimensional issue and name the factors finally. This is done when the sample size (definitely greater than the ones we have secured) is sufficiently large.

Risk Taking as a Function of Other Variables

If one were to construct a model of risk taking behavior, one would like to look at how other variables--e.g., demographic--relate to risk taking. This is useful in predicting risk taking propensity once we know what the exact relationships are. Although seemingly elementary, the analysis to follow can be considered as a first step in model building. Before discussing the model, we would like to present here the results of the demographic information secured from the subjects.

The Personal Record questionnaire intends to secure information concerning the subjects' demography--e.g., age, amount of assets, number of years at work, dependents, academic background, amount of liability, etc. A review of some of these responses will also shed light on the nature of the subjects used.

Only three of the subjects are female, rendering the investigation of sex-risk taking relationship highly unlikely.

Cultural differences in risk taking propensity cannot be examined because 73% of the subjects are Canadian.

Twenty-eight of the subjects are M.B.A.'s while five are M.Sc. with one M.B.A.-Ph.D. combined and two missing. An interesting possibility, given a large sample size, is to look at risk taking propensity differences and the degrees sought by subjects, or their option areas.

This questionnaire also asks questions on hobbies and sports from which we try to deduce a person's risk taking attitudes (i.e., are the sports the subjects engaged in risky or not; do they gamble in real life, etc.). Skiing, considered as a risky sport, is engaged in by 42% of the subjects. But all of the subjects have such multiplicity of hobbies (ranging from violin to knitting) that the risk taking attitudes based on hobbies could not be deduced. As to gambling, 40% do not engage in any form of gambling--not even in investments. Because of this lack of variability or, to be specific, the failure to ascertain the subjects' rt propensity from their hobbies and leisure, these variables are deleted.

Only a few important variables are retained for practical purposes. The degrees of freedom are not likely to be big because of our sample size and because of the partial correlations that will be undertaken. The following variables are used: <u>average age of the dependents</u>, <u>working years</u>, <u>salary</u>, <u>face value of insurance</u>, <u>amount of assets</u> and <u>amount of liabilities</u>. Age is deleted because the partial correlations of this variable with risk measures are not significant.

There is also the question of what risk measures should be retained. For some questionnaires, two or more scores are extracted and they are close substitutes of one another. For example, the plain extremity score is deleted because it can be substituted by the squared extremity score. Also, if a measure showed poor relationship with the rest of the scores, it is deleted for this analysis. The candidates are Semantic Differential (discussed in the Correlation Matrix section and in the Factor Analysis section) and Net Profit Utility.

Table XXIX reveals to us all the significant partial correlations of the risk measures with the selected demographic variables. The results of the matrix imply that most of the risk measures are not directly related to these variables. Compensation and scale of wager do not have any relationship at all with these demographic variables. These results may be interpreted to indicate that more work should be undertaken for the risk measures in terms of revisions and trimming. And if the Personal Record responses were unreliable, this suggests that the design carried out failed to elicit true responses on personal records--e.g., most of the subjects felt that their anonymity was being threatened by giving responses on their personal lives.

Stock Price Wager score (Stock) is negatively related to number of years at work (Wyear). This suggests that there is the tendency for people with more years at work to take more risk when offered stock price wagers. It can be implied that the more 'experienced' a subject is, the greater risk-taker he is.

Salary and number of years at work are highly related to extremity in judgment. But the relationships are negative. The subjects with higher previous salary and number of years at work become less extreme in their judgment. It is possible to guess that the more experienced one is the less one dares to take risk in the knowledge dimension.

The Choice Dilemma score, which reflects advisory risk-taking, is negatively related to number of years at work, amount of previous salary and amount of liabilities, but it is positively related to face value of insurance. This implies that higher salaried, 'more years at work' individuals recommend other people to take greater risks. But if their insurance face value is high, they advise other people to take less risks. One must however exercise caution in interpreting these results. Choice Dilemma, by far, has the most relationships with these demographic variables.

The relationship of the memo score and the age (average) of the dependents is strange in that it implies that a person with heavy responsibility (support of the dependents) recommends taking greater risk in business ventures. This relationship is thus highly doubtful. The positive relationship of the number of years of work and salary with the memo score suggests that the more experienced subjects are more conservative.

The In-Basket Odd score is positively related to amount of liabilities--i.e., individuals who have large amounts of liability tend to be more risk averse.

Internal-External control, based on the table, can be viewed as a function of salary and average age of dependent. Following this line of causation, we can say that as an individual gets more and more salary, reflecting more promotion or reward for abilities, he becomes more internally controlled.

The relationship of IE control and age of dependent is doubtful because it could imply that the age of the dependent determines a person's IE control. This means the individual becomes more internally controlled when the average age of his dependents increases.

Sensation-seeking is related significantly only to the amount of previous salary. This implies that subjects with higher previous salaries tend to seek more stimulation from travelling, social activities, etc.

Asset, expressed in terms of gross value, does not have any relationship with any of the variables. Taken at its face value, this would mean the rejection of the various hypotheses concerning size of asset and risk taking.

The poor results of the table can be traced to either of three sources: (1) either the personal records did not elicit true responses in that subjects disguised their answers to protect anonymity, (2) the majority of risk measures are faulty so that the hypothesized relationships between measures and demographic variables did not occur; or (3) both the measures and the personal record questionnaire are faulty. Source (1) seems to be predominant in that the verbal feedbacks from the subjects after they responded indicated that they had to put down unreal

TABLE XXIX

Partial Correlations of Risk Measures with Selected Variables[1]

	Age Dependent	Working Years	Salary	Insurance Face Value	Assets	Liabilities
Stock	--	-0.44	--	--	--	--
Extremity Sc.	--	-0.98	-.98	--	--	--
Choice Dilemma	.689	-0.69	-.55	0.40	--	-0.43
Compensation	--	--	--	--	--	--
Scale Wager	--	--	--	--	--	--
Rate Return	--	--	--	--	--	--
Memo Score	-0.597	0.497	0.51	--	--	--
In Basket Odd	--	--	--	--	--	0.43
Int.-Ext. Control	.40	--	.45	--	--	--
SSS	--	--	.39	--	--	--

[1] Only those significant ($p < 0.05$) presented, DF = 16.

Legend:
Stock - Stock Price Wager
Extremity - Squared Extremity Score
Choice - Choice Dilemma Odd
SSS - Sensation Seeking

amounts sometimes because the questionnaire was too personal. As to source (2), some of the measures must be revised. This has been suggested in the previous parts.

Discussion

The correlation matrix of the various risk measures implies that the underlying construct is not unidimensional. Although one should not rely too heavily on the factor analyses carried out, extremity-confidence in judgment is definitely of a different dimension. This entire measure, when viewed in the light of our previously cited criteria, may be removed. The Semantic Differential score is another risk score that should be eliminated because of its weak association with the other scores and because it is not a direct rt propensity measure.

The Utility measures can be dichotomized into two kinds: a personal and a business utility measure. Net Profit Utility appears to be weakly loaded on all the factors.

The results of the factor analyses reveal that the factors are neither expected nor identifiable.

The Memo score, as revealed by the overall analysis, is implied to be questionable in validity. This may be corrected by a better judging procedure than the one employed here.

An attempt at model-building reveals that the demographic variables like age of dependents, insurance, liabilities, etc., have very little relationship with our risk measures. Asset, considered by many to be highly related to risk taking, has no significant relationship with any of the risk measures. Compensation and Scale of Water utility scores cannot be considered

as functions of the demographic variables we look at.

The empirical study undertaken should be considered as a pre-pilot in that the objective is not to undertake a major empirical research venture but to get a feel of how the questionnaires are being responded to. It is suggested that one could use this group as a pivot for studying other groups--e.g., comparison of this group with other professional groups like actual businessmen, economists, etc.

CHAPTER 8

CONCLUSIONS

Men do not live by
expected value alone.

Alfred Kwong, 1973

The purpose of this study has been to develop a series of risk taking measures which are relevant to business. Thirty-five graduate students were administered a package of risk taking measures in business, personal record and personality questionnaires. Several research questions were examined.

The results of the intercorrelations among the various risk measures suggest that the underlying characteristic is not unidimensional. Several factor analytical methods were tried but the resultant factors were neither expected nor identifiable.

The risk measures were developed by adopting revised versions of past measures and constructing measures relevant for our purposes.

Chapters 2 and 3 deal with the background, economical and psychological, of risk measures and the research conducted in the past concerning these measures.

Chapter 4 describes the package of measures and discusses the importance of studying risk taking propensity, especially in relation to decision theory.

Chapter 5 outlines the method employed in the empirical study, emphasizing the way the package has been administered; and the instructions to the subjects have been presented in toto.

Chapter 6 examines the measures and the responses in the light of past hypotheses concerning risk-taking. Item analysis, although fairly general, has been done.

Chapter 7 presents an overall analysis of the measures by examining the resulting correlation matrix of the risk measures, the factor analytical results of four different methods and the relationship of risk taking with demographic variables.

Risk taking propensity, due to the state of the art, is an 'unknown primitive' according to Slovic. However, attempts at the final empirical definition of the construct have not been numerous. The multidimensionality issue, raised for quite some time, is still extremely difficult to resolve. The right direction is taken only when more construct validation of past measures and of newer measures is undertaken. The interest in the area is beginning to move in the right direction.

The study of risk taking propensity is not confined to one discipline. Each disciplinary approach to the study, however, has its advantages and disadvantages. Utility theory has progressed to such a stage that risk aversion is examined for normative reasons. Currently, economists are more concerned with the forms of utility curves, the equations and the indices, than with the problem of validating the measures. However, there is a contention that by examining the forms of the

utility curve and deriving utility functions the economists are validating their measures. The psychologists, on the other hand, have generally been more preoccupied with using past measures and examining the relationship of risk taking and personality variables than in more creative endeavours like newer construction and 'updating validation.'

For the layman like myself, the central question is how to make use of the facts concerning risk taking propensity. And this is important in the field of decision-making.

The present study undertaken has its limitations. One is the sample size and two, the nature of the sample. Also, the suggestions contained in Chapters 6 and 7 would mean more design work (by design, I mean the design of the measures themselves).

The thesis, however, has been able to indicate areas of weakness in the measures themselves. The definition of business related risk taking has also been examined and found to be a broader construct than we originally thought. Our major accomplishment is in suggesting what a final package of business related risk measures should contain.

Recommendations for Future Research

Data from different segments of the profession (e.g., graduate students in other areas) might yield different results--e.g., different factors might emerge, different correlations might result, etc. Also, the purpose of the study is to construct 'business-related risk measures' and what other group can aid us in validating these measures than the businessman.

Based on a statistical analysis of data from other samples, one could ascertain once and for all which measures should be

retained, revised or completely removed.

The psychology of economic development has been an enigma ever since someone thought up the topic. We hear comments about risk taking and the like, but they are not confirmed. Thus, a further extension would be the development of a comprehensive business risk taking measure on an international basis. A further dynamism would be a study of risk taking propensity in the international setting using time as a variable, i.e., tracing the nature of changes in risk taking propensity.

The so-called theory of independence implies that society would benefit economically if its components took greater risks in business. Various government incentives have been implemented to encourage business risk takings. However, the empirical findings concerning the risk taking propensity of the business community are not in existence. Assumptions of the general risk aversion of the public are useful but knowing the exact degree of risk aversion would be a better guide to government economic incentive planning.

Also, what determines one's business risk taking may be answered after a package of business rt measures has been finally validated and developed. Perhaps the result of an intensive study suggests a newer form of orientation--specifically, newer methods in teaching business students.

For the business organization, possession of a satisfactory risk taking measure would help in setting up a corporate risk profile and in human resource allocation. This is one of

the major implications of the final development of a sound business risk taking measure.

Bargaining and risk taking is another interesting topic to research into in that risk sharing or the division of spoils may become more systematic and deterministic as a result of the study. Also, the various coalition models may be examined in a risk-taking-propensity context--i.e., whether risk taking propensity influences the type of coalition that results or not.

A Model of risk taking, as a further development, should be attempted in which one could look at risk taking propensity and the various variables that are related to it.

There are, to be sure, many possibilities once one gets beyond the development stage.

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APPENDIX A
LIST OF RAW DATA

APPENDIX A-1
CHOICE DILEMMA IE CONTROL - SSS

1 row per subject, starting with subject's I.D., IE Control Score, SSS Score, 10 Choice Dilemma Ranks and 10 minimum odds for 10 items.

APPENDIX A-2
EXTREMITY CONFIDENCE IN JUDGMENT

1 row per subject, starting with subject's I.D., 15 extremity scores, 15 confidence scores for 15 items.

APPENDIX A-3
IN BASKET RESPONSES

2 rows per subject, File Numbered.
1st row: 7 Memo Strategy Scores, Memo Score w/ 5 & 6 included Memo Score 5 & 6 treated as 2.5 and Memo Score 5 & 6 excluded;

2nd row: 7 minimum odds, minimum odd average, 7 Grade assignments, average Grade assigned, Weighted Minimum odd score with Grade as weight, 4 Semantic Differential Scores, a consolidated SD Score.

APPENDIX A-3
IN BASKET (CONTINUED)

APPENDIX A-4
UTILITY RESPONSES

2 rows per subject
1st row: Subject's I.D., 4 compensation response, No. of NO Answers to Scale of Wager, 5 Scale of Wager responses.

2nd row: 5 Rate of Return responses, 6 Net Profit responses.

APPENDIX A-4
UTILITY RESPONSES (CONTINUED)

APPENDIX A-5
PERSONAL RECORDS

2 rows per subject

1st row:
SUBJ'S. I.D.
SEX: 1 for Male, 2 for Female, 99 missing

AGE: 95 missing

STATUS (MARITAL): 1-married, 2-single, 3-separated, 4-divorced, 99,0-missing.

NUMBER OF DEPENDENTS: 99 for missing.

AGE OF DEPENDENTS: Average, 999 for missing.

CITIZENSHIP: 1 for Canada: 2 for H.K., 3 for Singapore, 4 - Brazil, 5 - U.S., 6 - India, 7 - Others, 0,99 - missing.

PRESENT YEAR: 1-MBA I; 2-MBA II; 3-MsCI; 4-Msc II, 5-Phd; 6-Others, 7-MsC no year; 8-MBA no year; 95-missing.

OPTION: - 1-Acctg; 2-Mktg; 3-Transportation, 4-Urb. Land Economics; 5-Finance, 6-Int. Business; 7-Management Sc.; 8-O. Behavior, 9-Others, 99 missing.

AVERAGE GRADE LAST YEAR - number represent the ordered item checked. Please see questionnaire.

PREVIOUS DEGREE - two digit number used. First digit represent degree, 2nd digit represent option.
1st digit: 1-B Comm; 2-Eng'g., 3-Education, 4-Law, 5-B.Science, 6-Computer Sc.; 7-Others; 8-BA; 9-Masters;
2nd digit: Eng'g-1: Civil; 2-Mech; 3-Electrical; 4-Chem., 5-Agricultural, 6-Others; Others- 0 (for other degrees). 99-missing.

NUMBER OF DEGREES
COUNTRY OBTAINED - same code as citizenship.
Working Years - no. of years at work.
Salary: latest salary in thousands.
Position (latest): 1-higher level management; 2-middle management; 3-employee; 95-missing.

2nd row:

NUMBER OF SOURCES - count the number of sources of educational financing. See Questionnaire. 99-missing.

TOTAL AMOUNT OF EDUCATIONAL FINANCING

SOURCE WITH GREATEST FINANCING COMING FROM: Number referred to number in the item.

AMOUNT OF LARGEST FINANCING - in thousands.

FACE VALUE OF INSURANCE - in thousands

TYPEINSURANCE - type of insurance 1-with savings feature 2-without saving feature.

AMOUNT OF ASSET - Total in ten thousands

AMOUNT OF LIABILITIES

AVERAGE INTEREST RATE

APPENDIX A-6
STOCK PRICE WAGER RESPONSES

1 row per subject, with subjects I.D.,
5 ranks per set, five sets in all and 5 overall set rankings.

LISTING OF CHOICE DILEMMA AND CONTROL-SSS
WITH ID OF SUBJ, INTERNAL CONTROL, SENSATION SEEKING, 10 CHOICE DILEMMA RANKS AND 10 MINIMUM ODDS

4.	2.	4.	11.	11.	11.	11.	11.	11.	11.	11.	11.	11.	7.	7.	7.	7.	3.	9.	7.	7.	5.	5.
6671.	7.	4.	7.	6.	1.	3.	8.	2.	4.	5.	9.	10.	7.	9.	9.	7.	5.	7.	9.	5.	5.	5.
457.	8.	4.	3.	4.	1.	2.	8.	7.	6.	5.	9.	10.	5.	3.	5.	5.	10.	10.	5.	3.	3.	3.
502.	7.	2.	2.	3.	1.	4.	10.	5.	9.	6.	7.	8.	7.	7.	5.	7.	5.	10.	9.	9.	7.	7.
563.	7.	3.	3.	4.	6.	8.	2.	7.	5.	1.	9.	10.	5.	3.	9.	7.	5.	9.	7.	7.	7.	3.
2401.	9.	6.	4.	3.	1.	2.	5.	6.	7.	8.	9.	10.	3.	7.	9.	7.	3.	5.	5.	5.	3.	3.
3720.	10.	4.	8.	2.	1.	4.	10.	5.	6.	7.	3.	9.	5.	5.	7.	7.	7.	7.	9.	5.	5.	3.
90349.	6.	6.	2.	4.	1.	3.	9.	8.	6.	10.	5.	7.	7.	5.	9.	9.	7.	10.	7.	9.	10.	3.
101112.	3.	4.	2.	4.	1.	6.	5.	7.	9.	10.	8.	3.	3.	5.	9.	5.	5.	3.	10.	3.	7.	7.
121314.	7.	5.	5.	6.	1.	3.	7.	2.	8.	4.	9.	10.	5.	7.	9.	7.	5.	5.	7.	5.	7.	5.
121943.	7.	5.	11.	11.	11.	11.	11.	11.	11.	11.	11.	11.	9.	5.	5.	9.	7.	7.	9.	5.	9.	7.
124167.	4.	3.	8.	4.	1.	3.	10.	5.	7.	6.	9.	2.	7.	9.	9.	5.	7.	5.	9.	5.	5.	5.
131313.	8.	2.	3.	4.	1.	2.	10.	9.	8.	5.	7.	6.	9.	5.	5.	9.	5.	10.	7.	5.	10.	5.
191235.	7.	5.	10.	3.	1.	6.	9.	2.	5.	4.	7.	8.	3.	3.	9.	7.	9.	10.	9.	10.	10.	1.
214714.	8.	6.	4.	3.	1.	2.	5.	7.	8.	9.	6.	10.	7.	7.	5.	7.	5.	9.	7.	7.	3.	5.
224903.	4.	4.	4.	6.	1.	3.	10.	5.	8.	9.	7.	2.	5.	5.	7.	5.	3.	3.	9.	9.	5.	3.
235502.	9.	6.	4.	3.	1.	7.	9.	2.	5.	6.	10.	8.	3.	3.	5.	7.	9.	9.	9.	5.	5.	3.
241805.	6.	5.	3.	1.	2.	4.	8.	10.	5.	6.	7.	9.	7.	7.	7.	7.	5.	7.	9.	3.	5.	5.
261039.	7.	8.	3.	8.	1.	2.	9.	4.	6.	7.	5.	10.	3.	1.	7.	5.	5.	9.	7.	3.	7.	5.
330043.	7.	7.	3.	2.	1.	4.	6.	5.	10.	9.	8.	7.	5.	7.	10.	7.	10.	10.	10.	7.	5.	3.
356126.	7.	4.	4.	3.	1.	2.	5.	7.	8.	10.	6.	9.	3.	9.	10.	9.	7.	7.	5.	5.	3.	3.
404044.	6.	4.	4.	1.	9.	2.	10.	3.	7.	6.	4.	8.	9.	7.	9.	10.	5.	9.	9.	7.	7.	3.
449771.	5.	4.	9.	8.	1.	6.	10.	2.	3.	4.	7.	5.	5.	3.	7.	9.	9.	7.	7.	3.	9.	3.
443971.	3.	6.	3.	2.	1.	6.	9.	5.	8.	4.	7.	10.	5.	7.	9.	5.	7.	5.	9.	7.	5.	3.
474747.	6.	4.	2.	3.	1.	11.	4.	6.	5.	7.	9.	8.	7.	7.	9.	11.	10.	10.	7.	5.	1.	3.
519725.	6.	7.	9.	8.	2.	4.	10.	1.	7.	5.	3.	6.	3.	1.	5.	3.	9.	10.	9.	10.	7.	5.
614715.	6.	4.	8.	4.	1.	3.	9.	2.	5.	6.	11.	7.	10.	7.	5.	7.	5.	7.	9.	5.	11.	7.
654321.	5.	5.	9.	4.	3.	5.	10.	1.	8.	2.	7.	6.	7.	7.	9.	9.	7.	7.	9.	1.	5.	9.
654537.	7.	2.	4.	8.	1.	3.	7.	2.	5.	6.	10.	9.	5.	3.	10.	9.	3.	9.	9.	7.	3.	3.
755316.	7.	5.	7.	6.	1.	2.	10.	5.	8.	4.	3.	9.	3.	5.	9.	5.	5.	7.	9.	9.	5.	3.
806662.	6.	7.	4.	5.	1.	2.	10.	3.	7.	6.	8.	9.	7.	5.	10.	9.	5.	9.	10.	5.	9.	7.
960321.	8.	2.	4.	2.	1.	5.	8.	9.	3.	10.	7.	6.	5.	7.	9.	9.	3.	5.	5.	9.	3.	7.
977713.	4.	6.	8.	4.	9.	7.	5.	1.	3.	2.	10.	6.	1.	3.	7.	5.	3.	9.	3.	1.	7.	1.
998877.	5.	5.	7.	6.	1.	5.	10.	2.	4.	3.	8.	9.	7.	5.	5.	7.	3.	9.	9.	5.	3.	5.
999000.	7.	4.	6.	4.	1.	5.	9.	7.	3.	2.	10.	8.	9.	9.	7.	7.	9.	10.	10.	9.	7.	9.

APPENDIX A-1 CHOICE DILEMMA IE CONTROL SSS

1 row per subject, starting with subject's I.D., IE Control Score, SSS Score, 10 Choice Dilemma Ranks and 10 minimum odds for 10 items.

4.	30.	30.	30.	30.	0.	30.	30.	30.	30.	0.	30.	30.	30.	30.	30.	5.	2.	2.	2.	4.	2.	2.	3.	4.	3.	5.	3.	2.	3.	3.
6671.	40.	10.	40.	10.	5.	30.	0.	30.	0.	20.	0.	10.	49.	20.	0.	3.	3.	5.	3.	3.	2.	4.	2.	4.	4.	4.	4.	1.	3.	4.
457.	10.	40.	0.	10.	10.	25.	30.	0.	25.	20.	40.	0.	49.	25.	0.	3.	3.	3.	4.	4.	3.	2.	4.	5.	4.	4.	3.	2.	3.	4.
502.	20.	20.	30.	10.	20.	20.	30.	20.	10.	40.	25.	0.	50.	0.	20.	3.	4.	5.	4.	4.	3.	3.	2.	4.	3.	3.	4.	1.	2.	2.
563.	10.	20.	10.	40.	10.	40.	20.	20.	30.	45.	20.	0.	49.	20.	10.	2.	3.	5.	5.	4.	3.	3.	3.	5.	1.	3.	5.	4.	2.	3.
2401.	20.	40.	10.	10.	30.	40.	10.	40.	10.	10.	30.	20.	45.	10.	30.	3.	3.	3.	3.	2.	3.	3.	2.	3.	2.	3.	2.	2.	3.	3.
3720.	35.	10.	10.	20.	40.	49.	10.	0.	20.	30.	30.	10.	40.	20.	20.	1.	2.	2.	3.	2.	1.	3.	4.	3.	4.	3.	3.	2.	3.	3.
90349.	10.	45.	15.	15.	40.	25.	20.	25.	20.	40.	45.	0.	49.	45.	10.	2.	1.	1.	2.	1.	1.	2.	2.	3.	1.	1.	5.	1.	1.	3.
101112.	0.	50.	0.	50.	0.	0.	50.	0.	50.	0.	0.	0.	50.	0.	50.	5.	2.	3.	2.	4.	2.	1.	2.	1.	3.	2.	5.	1.	2.	1.
121314.	10.	0.	0.	0.	0.	40.	0.	20.	0.	20.	40.	0.	49.	0.	0.	2.	2.	3.	3.	5.	2.	3.	3.	3.	3.	2.	3.	1.	3.	3.
121943.	0.	20.	30.	0.	30.	20.	40.	30.	0.	10.	20.	49.	45.	0.	30.	4.	3.	2.	4.	3.	2.	2.	1.	5.	3.	3.	2.	2.	3.	3.
124167.	30.	40.	0.	0.	20.	45.	10.	40.	0.	30.	25.	10.	49.	0.	20.	3.	4.	2.	5.	4.	2.	4.	1.	5.	3.	4.	2.	1.	5.	3.
131313.	40.	48.	30.	30.	40.	45.	40.	30.	20.	10.	31.	10.	45.	40.	20.	3.	2.	3.	0.	2.	2.	3.	3.	4.	3.	3.	3.	3.	1.	2.
191235.	0.	10.	30.	0.	10.	40.	40.	10.	10.	20.	40.	10.	49.	30.	30.	2.	2.	2.	4.	5.	4.	1.	1.	2.	2.	2.	3.	2.	1.	2.
214714.	40.	20.	0.	20.	20.	20.	20.	20.	20.	30.	40.	40.	49.	30.	30.	3.	3.	4.	4.	5.	4.	3.	5.	5.	4.	2.	3.	1.	3.	3.
224903.	20.	15.	40.	10.	15.	40.	25.	0.	30.	0.	20.	25.	15.	20.	10.	4.	4.	2.	5.	4.	5.	4.	2.	2.	2.	5.	2.	4.	5.	5.
235602.	30.	0.	40.	0.	30.	40.	25.	30.	0.	10.	40.	40.	49.	0.	20.	2.	4.	5.	3.	3.	2.	3.	2.	5.	3.	3.	1.	1.	2.	4.
241805.	0.	46.	30.	25.	10.	45.	10.	15.	30.	30.	40.	20.	50.	40.	20.	3.	2.	2.	2.	3.	3.	3.	3.	3.	3.	2.	3.	1.	2.	3.
261039.	40.	30.	25.	0.	10.	25.	20.	15.	40.	0.	30.	20.	49.	40.	25.	2.	3.	2.	3.	4.	2.	2.	3.	2.	2.	3.	1.	1.	1.	3.
330143.	50.	50.	40.	25.	50.	45.	40.	0.	0.	50.	40.	50.	40.	0.	40.	5.	5.	4.	4.	5.	3.	3.	3.	5.	5.	4.	5.	4.	4.	4.
356126.	40.	47.	40.	10.	20.	30.	30.	10.	30.	10.	45.	20.	50.	30.	25.	5.	5.	5.	5.	5.	4.	4.	5.	5.	4.	4.	3.	5.	3.	4.
404044.	0.	45.	0.	0.	0.	20.	20.	20.	40.	45.	20.	0.	50.	30.	30.	3.	1.	3.	5.	5.	2.	4.	3.	4.	5.	4.	5.	1.	4.	5.
449771.	20.	10.	10.	0.	10.	40.	20.	25.	30.	40.	0.	40.	10.	0.	20.	2.	2.	3.	4.	3.	4.	2.	4.	5.	3.	4.	2.	3.	3.	2.
443971.	10.	30.	10.	0.	20.	40.	0.	30.	0.	40.	48.	45.	50.	30.	0.	4.	5.	4.	3.	3.	3.	4.	3.	3.	3.	3.	3.	1.	3.	4.
474747.	40.	45.	0.	10.	10.	30.	20.	0.	10.	20.	45.	40.	49.	40.	40.	4.	4.	5.	5.	5.	4.	5.	3.	5.	3.	3.	4.	1.	2.	3.
519725.	30.	40.	40.	10.	10.	45.	35.	40.	30.	20.	30.	0.	40.	25.	10.	2.	2.	3.	5.	5.	3.	4.	2.	5.	5.	4.	5.	3.	5.	5.
614715.	35.	30.	30.	20.	40.	45.	20.	0.	0.	40.	48.	40.	50.	35.	10.	3.	4.	4.	3.	3.	3.	3.	4.	3.	3.	4.	1.	2.	3.	
654321.	40.	45.	20.	10.	30.	50.	45.	10.	10.	49.	10.	0.	45.	30.	40.	1.	1.	2.	2.	2.	1.	1.	2.	2.	2.	2.	2.	4.	3.	1.
654337.	15.	40.	0.	20.	10.	45.	30.	15.	10.	20.	15.	0.	35.	0.	25.	3.	2.	5.	0.	4.	2.	2.	4.	3.	4.	4.	5.	3.	5.	4.
755316.	35.	10.	0.	30.	30.	35.	25.	35.	20.	35.	10.	10.	50.	0.	20.	2.	3.	3.	2.	3.	3.	4.	1.	3.	3.	3.	4.	1.	3.	3.
806662.	20.	40.	40.	20.	10.	40.	0.	40.	0.	40.	45.	50.	50.	0.	40.	2.	3.	4.	3.	3.	2.	5.	1.	5.	2.	2.	1.	1.	5.	2.
960321.	30.	40.	40.	40.	20.	20.	10.	0.	0.	20.	20.	10.	0.	20.	20.	3.	1.	2.	3.	5.	5.	3.	3.	3.	2.	2.	3.	2.	4.	2.
977713.	40.	40.	20.	10.	30.	40.	20.	10.	40.	10.	20.	30.	50.	40.	10.	2.	2.	2.	3.	3.	2.	2.	2.	2.	3.	4.	2.	1.	2.	3.
998877.	20.	0.	0.	10.	10.	0.	15.	10.	0.	0.	0.	10.	40.	20.	30.	3.	4.	5.	5.	5.	3.	3.	2.	5.	5.	4.	4.	3.	2.	2.
999000.	43.	45.	25.	25.	40.	40.	10.	30.	20.	10.	48.	10.	49.	0.	0.	4.	4.	5.	5.	5.	4.	3.	3.	5.	4.	5.	5.	3.	3.	4.

APPENDIX A-2 EXTREMITY CONFIDENCE IN JUDGMENT

1 row per subject, starting with subject's I.D., 15 extremity scores, 15 confidence scores for 15 items.

$LIST NEWBAS

1				4.	1.	1.	4.	1.	4.	1.	4.	2.29	2.29	2.29											
2	5.	2.	9.	9.	9.	5.	5.	6.286	90.	50.	100.	70.	40.	60.	80.	70.000	6.408	-25.	0.	-9.	10.	-44.00			
3				6671.	4.	2.	1.	1.	4.	1.	9.	2.17	2.17	2.17											
4	8.	5.	6.	10.	8.	6.	3.	6.571	70.	50.	90.	60.	100.	65.	75.	72.857	6.598	0.	14.	19.	18.	-13.00			
5				457.	5.	1.	2.	5.	4.	5.	9.	3.67	2.33	2.42											
6	5.	6.	4.	1.	5.	6.	4.	4.429	100.	50.	65.	90.	50.	70.	60.	69.286	4.247	-6.	-7.	-7.	36.	-42.00			
7				502.	4.	1.	4.	2.	4.	1.	3.	2.71	2.71	2.71											
8	10.	2.	8.	10.	10.	5.	3.	6.857	100.	80.	85.	90.	95.	90.	90.714	6.984	35.	6.	4.	20.	13.00				
9				563.	1.	9.	1.	3.	2.	9.	3.	2.00	2.00	2.00											
10	4.	2.	10.	10.	4.	5.	5.	5.714	999.	999.	999.	999.	999.	999.	999.	999.000	999.000	16.	11.	22.	17.	10.00			
11				2401.	5.	1.	1.	5.	9.	5.	4.	3.50	2.00	2.25											
12	4.	2.	1.	4.	5.	4.	4.	3.429	70.	40.	75.	50.	90.	60.	55.	62.857	3.511	7.	7.	16.	31.	-15.00			
13				3720.	2.	99.	3.	9.	1.	9.	5.	2.75	2.00	2.13											
14	5.	5.	3.	0.	9.	6.	3.	4.429	55.	90.	70.	20.	85.	40.	75.	62.143	4.977	6.	9.	-2.	9.	-14.00			
15				90349.	4.	1.	1.	1.	4.	1.	4.	2.29	2.29	2.29											
16	7.	4.	6.	3.	10.	6.	7.	6.143	85.	50.	90.	50.	100.	75.	65.	73.571	6.583	37.	-44.	2.	16.	67.00			
17				101112.	1.	4.	3.	2.	5.	1.	1.	2.43	2.00	2.07											
18	5.	1.	4.	7.	8.	8.	0.	4.714	999.	999.	999.	999.	999.	999.	999.	999.000	999.000	-13.	5.	15.	-3.	0.00			
19				121314.	1.	9.	1.	4.	4.	1.	9.	2.20	2.20	2.20											
20	5.	4.	7.	10.	10.	7.	5.	6.857	80.	100.	90.	50.	70.	50.	40.	68.571	6.625	-5.	30.	-10.	40.	-85.00			
21				121943.	1.	4.	1.	2.	4.	4.	1.	2.43	2.43	2.43											
22	5.	8.	7.	5.	9.	8.	3.	6.429	999.	999.	999.	999.	999.	999.	999.	999.000	999.000	-3.	3.	6.	21.	-21.00			
23				124167.	1.	9.	1.	1.	4.	1.	4.	2.00	2.00	2.00											
24	4.	3.	5.	1.	10.	4.	8.	5.000	80.	95.	85.	70.	100.	65.	50.	77.857	5.064	23.	11.	-3.	24.	-15.00			
25				131313.	1.	9.	1.	2.	4.	5.	1.	2.33	1.80	1.92											
26	5.	5.	7.	0.	10.	6.	3.	5.143	90.	100.	80.	70.	40.	50.	60.	70.000	4.878	2.	4.	-10.	23.	-35.00			
27				191235.	1.	2.	4.	3.	5.	5.	1.	3.00	2.20	2.29											
28	7.	5.	9.	10.	9.	9.	8.	8.143	85.	30.	100.	90.	75.	90.	75.	77.857	8.495	24.	3.	6.	20.	7.00			
29				214714.	6.	1.	1.	2.	4.	1.	1.	2.29	1.67	1.79											
30	8.	5.	5.	5.	10.	5.	1.	5.571	100.	50.	90.	80.	30.	80.	80.	72.857	5.255	34.	-1.	-8.	26.	1.00			
31				224903.	1.	2.	4.	3.	4.	1.	2.	2.43	2.43	2.43											
32	5.	5.	5.	5.	8.	5.	1.	4.857	80.	70.	90.	75.	65.	60.	65.	72.143	4.871	11.	17.	4.	9.	-11.00			
33				235602.	1.	9.	2.	2.	4.	1.	4.	2.33	2.33	2.33											
34	4.	3.	6.	10.	10.	6.	10.	7.000	90.	10.	60.	100.	0.	20.	95.	53.571	7.520	-3.	11.	-15.	30.	-59.00			
35				241805.	4.	9.	1.	4.	4.	1.	1.	2.50	2.50	2.50											
36	7.	8.	4.	8.	9.	5.	2.	6.143	70.	80.	35.	40.	75.	60.	55.	59.286	6.446	27.	9.	6.	15.	9.00			
37				261039.	2.	1.	4.	2.	4.	5.	5.	3.29	2.60	2.57											
38	5.	1.	0.	3.	10.	99.	2.	3.500	999.	999.	999.	999.	999.	999.	999.	999.000	999.000	14.	17.	0.	0.	-3.00			
39				330043.	1.	9.	1.	2.	4.	2.	1.	1.83	1.83	1.83											
40	5.	0.	1.	2.	10.	1.	2.	3.000	85.	65.	70.	75.	69.	40.	100.	72.000	3.125	5.	23.	-18.	3.	-39.00			
41				356126.	4.	1.	1.	3.	4.	1.	1.	2.14	2.14	2.14											
42	4.	2.	5.	9.	9.	6.	3.	5.429	5.	0.	20.	10.	15.	20.	30.	14.286	5.550	15.	-9.	12.	21.	15.00			
43				404044.	2.	9.	6.	5.	4.	9.	1.	3.60	2.33	2.40											
44	3.99.	6.	8.	10.	6.	2.	5.833	95.	20.	80.	90.	80.	85.	80.	75.714	5.575	14.	0.	-2.	6.	6.00				

APPENDIX A-3 IN BASKET RESPONSES

2 rows per subject, File Numbered.
1st row: 7 memo strategy scores, memo score w/ 5&6 included
Memo Score 5 & 6 treated as 2.5 and Memo Score 5&6 Excluded;
2nd row: 7 minimum odds, minimum odd average, 7 Grade assignments, average Grade assigned, weighted Minimum odd score with Grade as weight, 4 Semantic Differential Scores, a consolidated SD Score.

```
 45      449771.  1.  4.  4.  3.  3.  1.  4.  2.86  2.86  2.86
 46   4. 3. 5. 5.10. 5. 2.  4.857  80.  40. 100.  55.  45.  60.  80. 65.714  4.620  22.  32. -15.  36.  -61.00
 47      443971.  5.  9.  5.  5.  4.  5.  5.  4.83  4.00  2.75
 48   5. 2. 5.10. 9. 5. 7.  6.143  98.  90.  95. 100.  50.  80.  80. 84.714  5.995  15.   0.  10.  24.    1.00
 49      474747.  2.  5.  9.  2.  4.  1.  4.  3.00  2.60  2.58
 50   4. 1. 5. 8.10. 4. 5.  5.286 100.  10.  50.  60.   5.  20.  70. 45.000  5.143  -5.  12.  -1.  -6.  -12.00
 51      519725.  1.  4.  6.  4.  1.  1.  4.  3.00  2.50  2.50
 52   6. 0. 1. 6.10. 5.10.  5.429  40.  30.  50.  75.  80.  95. 100. 67.143  6.415  14. -10. -26.  -6.    4.00
 53      614715.  2.  1.  5.  4.  5.  9.  4.  3.50  2.75  2.67
 54   3. 1. 1.10.10. 4. 7.  5.143  30.  50.  40. 100.  20.  95.  90. 60.714  5.624   8.   9. -12.  21.  -34.00
 55      654321.  1.  4.  1.  4.  4.  9.  4.  3.00  3.00  3.00
 56   5. 8. 7. 9.10. 8. 6.  7.571 100.  25.  90.  80.  65.  70.  75. 72.143  7.347 -16. -14. -19. -14.   -7.00
 57      654837.  1.  9.  2.  2.  4.  5.  1.  2.50  2.00  2.08
 58   4.99. 5.10.10. 7. 6.  7.000 999. 999. 999. 999. 999. 999. 999.999.000999.000   7.   0.   0.  36.  -29.00
 59      755316.  4.  2.  2.  3.  4.  2.  4.  3.00  3.00  3.00
 60   6. 4. 5. 6. 9. 6. 4.  5.571 100.  80.  80.  80.  60.  50.  40. 70.000  5.592  18.  26.  -6.  23.  -37.00
 61      806662.  5.  2.  1.  9.  3.  1.  9.  2.40  1.75  1.90
 62   6. 1. 7. 7. 9. 6. 3.  5.571  80.  10.  80.  70.  50.  30.  60. 54.286  6.184  12.  11.   9.  19.   -9.00
 63      963321.  4.  4.  1.  1.  4.  1.  1.  2.29  2.29  2.29
 64  10.10. 7. 3.10. 4. 4.  6.857 999. 999. 999. 999. 999. 999. 999.999.000999.000  -3.  -5.   9.   0.   11.00
 65      977713.  4.  9.  4.  1.  4.  1.  1.  2.50  2.50  2.50
 66  10. 5.10. 7.10. 7. 7.  8.000 100.  50.  98.  90.  51.  80.  95. 80.571  8.147  35. -10.  -4.  35.    6.00
 67      998877.  2.  9.  1.  4.  4.  2.  4.  2.83  2.83  2.83
 68   2. 0.99.99.10. 5.10.  5.400 999. 999. 999. 999. 999. 999. 999.999.000999.000 999. 999. 999. 999. 9999.00
 69      999000.  1.  9.  1.  9.  4.  4.  1.  2.20  2.20  2.20
 70   5. 5. 7.10.10. 9. 3.  7.000  95.  75. 100.  87.  50.  90.  70. 81.000  6.949  24.  16.  20.  16.   12.00
END OF FILE
```

APPENDIX A-3

IN BASKET (CONTINUED)

UTILITY RESPONSES,COMEPNSATION IN THOUSANDS OF DOLLARS,SCALEOFWAGER IN AMOUNTS SPECIFIED, RATE OF RETURN IN PERCENTAGE,NET PROFIT IN PROBABILITY MISSING IS A 99. OR A 0.0

4.	8.	10.	20.	30.	4.		0.10	0.00	0.00	0.00	0.00
	40.	0.300	0.500	0.150	0.300	600.	200.	0.250	0.800	0.500	0.500
6671.	8.	13.	24.	35.	2.		0.25	1.00	5.00	0.00	0.00
	47.	0.350	0.600	0.150	0.250	600.	100.	0.800	0.700	0.400	0.600
457.	15.	25.	30.	40.	2.		1.00	1.00	50.00	0.00	0.00
	30.	0.200	0.300	0.150	0.250	100.	100.	0.500	0.300	0.500	0.500
502.	12.	25.	40.	100.	4.		0.50	0.00	0.00	0.00	0.00
	12.	0.200	0.300	0.200	0.250	100.	50.	0.700	0.700	0.900	0.850
563.	8.	15.	20.	30.	3.		1.30	10.00	0.00	0.00	0.00
	40.	0.400	0.500	0.300	0.100	600.	300.	0.330	0.600	0.600	0.700
2401.	12.	14.	15.	16.	1.		0.50	5.00	25.00	100.00	0.00
	600.	0.150	0.400	0.050	0.250	40.	20.	0.400	0.100	0.600	0.400
3720.	12.	14.	15.	18.	0.		0.30	3.00	30.00	300.00	3000.00
	200.	0.250	0.130	0.380	0.250	5.	1.	0.460	0.500	0.500	0.460
90349.	10.	15.	22.	30.	3.		0.30	2.50	0.00	0.00	0.00
	600.	0.100	0.150	0.070	0.120	40.	20.	0.750	0.900	0.750	0.750
101112.	6.	8.	8.	10.	0.		1.50	15.00	150.00	1500.00	15000.00
	40.	0.500	0.500	0.500	0.500	600.	300.	0.750	1.000	0.750	0.850
121314.	15.	22.	30.	35.	3.		0.25	2.50	0.00	0.00	0.00
	40.	0.300	0.200	0.500	0.300	600.	300.	0.750	0.600	0.750	0.750
121943.	12.	16.	20.	30.	5.		0.00	0.00	0.00	0.00	0.00
	600.	0.100	0.200	9.990	0.150	40.	20.	0.900	0.800	0.800	0.700
124167.	10.	13.	18.	30.	4.		0.25	0.00	0.00	0.00	0.00
	40.	0.250	0.400	0.100	0.250	600.	50.	0.800	0.900	0.700	0.900
131313.	10.	11.	13.	15.	1.		1.00	1.00	10.00	1000.00	0.00
	600.	0.500	0.750	0.250	0.500	40.	20.	0.330	0.500	0.500	0.330
191235.	12.	20.	56.	145.	5.		0.00	0.00	0.00	0.00	0.00
	800.	0.100	0.100	0.100	0.100	40.	5.	0.750	0.750	0.750	0.750
214714.	15.	30.	50.	75.	3.		0.50	5.00	0.00	0.00	0.00
	40.	0.300	0.500	0.150	0.100	600.	300.	0.700	0.400	0.500	0.600
224903.	10.	12.	14.	17.	0.		0.50	5.00	50.00	500.00	5000.00
	600.	0.500	0.750	0.250	0.500	40.	20.	0.330	0.500	0.500	0.670
235602.	20.	24.	0.	0.	3.		0.10	0.20	0.00	0.00	0.00
	600.	0.150	0.250	0.120	0.160	40.	20.	0.700	0.300	1.000	0.400
241805.	9.	12.	15.	21.	2.		0.35	4.00	30.00	0.00	0.00
	200.	0.250	0.400	0.120	0.250	50.	20.	0.700	0.750	0.400	0.600
261039.	12.	15.	20.	25.	0.		1.00	10.00	100.00	1000.00	10000.00
	40.	0.250	0.750	0.250	0.500	600.	300.	0.750	0.500	0.500	0.750

APPENDIX A-4 UTILITY RESPONSES

2 rows per subject.

1st row: subj's I.D., 4 Compensation Response, No. of NO answers to scale of wager, 5 scale of wager responses.

2nd row: 5 rate of return responses, 6 net profit responses

330043.	30.	36.	46.	61.	3.		0.50	5.00	0.00	0.00	0.00
	600.	0.500	0.500	0.130	0.250	40.	20.	0.750	0.670	0.670	0.670
356126.	10.	30.	60.	200.	4.		0.49	0.00	0.00	0.00	0.00
	600.	0.500	0.750	0.250	0.500	40.	8.	0.500	0.500	0.500	0.500
404044.	10.	11.	13.	14.	0.		1.50	15.00	110.00	1005.00	10010.00
	600.	0.250	0.380	0.130	0.500	40.	20.	0.250	0.600	0.750	0.250
449771.	10.	13.	0.	0.	1.		0.50	5.00	50.00	500.00	500.00
	600.	0.000	0.000	0.000	0.000	40.	20.	0.000	0.000	0.000	0.000
443971.	12.	18.	30.	45.	3.		0.49	3.00	0.00	0.00	0.00
	40.	0.200	0.400	0.150	0.250	600.	200.	0.500	0.500	0.500	0.500
474747.	12.	14.	19.	23.	1.		0.00	0.00	0.00	0.00	0.00
	40.	0.450	0.700	0.200	0.400	600.	300.	0.500	0.550	0.450	0.400
519725.	10.	13.	15.	16.	5.		0.00	0.00	0.00	0.00	0.00
	40.	0.250	0.500	0.250	0.200	600.	300.	0.980	0.950	0.900	0.500
614715.	16.	50.	70.	80.	3.		0.25	1.00	0.00	0.00	0.00
	20.	0.300	0.250	0.700	0.400	200.	50.	0.800	0.700	0.300	0.800
654321.	15.	17.	20.	30.	5.		0.00	0.00	0.00	0.00	0.00
	40.	0.180	0.200	0.150	0.120	600.	300.	0.850	0.750	0.700	0.700
654537.	10.	14.	17.	22.	3.		0.70	4.00	0.00	0.00	0.00
	40.	0.100	0.100	0.050	0.080	600.	300.	0.400	0.700	0.600	0.400
755316.	9.	13.	17.	23.	2.		0.35	3.50	20.00	0.00	0.00
	40.	0.350	0.550	0.180	0.300	600.	100.	0.550	0.750	0.800	0.600
806662.	6.	7.	8.	9.	0.		0.40	3.00	20.00	100.00	0.00
	48.	0.500	0.750	0.250	0.500	660.	110.	0.920	0.500	0.500	0.670
960321.	9.	18.	25.	50.	2.		0.50	2.00	10.00	0.00	0.00
	608.	0.400	0.600	0.250	0.450	47.	5.	0.300	0.200	0.300	0.300
977713.	16.	25.	28.	32.	4.		0.50	0.00	0.00	0.00	0.00
	40.	0.200	0.500	0.200	0.300	600.	50.	0.800	1.000	1.000	0.700
998877.	10.	12.	14.	0.	0.		0.50	5.00	50.00	500.00	5000.00
	40.	0.100	0.400	0.050	0.200	600.	300.	0.750	0.500	0.500	0.600
999000.	8.	12.	16.	18.	5.		0.00	0.00	0.00	0.00	0.00
	600.	0.500	0.750	0.250	0.500	40.	20.	0.800	0.700	0.650	0.900

APPENDIX A-4

UTILITY RESPONSES (CONTINUED)

APPENDIX A-5

PERSONAL RECORDS

2 rows per subject.

1st row

SUBJ's I.D.

SEX: 1 for Male, 2 for Female, 99 missing.

AGE: 99 - missing

STATUS (MARITAL): 1-married, 2-single, 3-separated
4-divorced, 99,0-missing

NUMBER OF DEPENDENTS: 99 for missing

AGE OF DEPENDENTS: AVERAGE. 999 for missing.

CITIZENSHIP: 1 for Canada; 2 for H.K., 3 for Singapore, 4 - Brazil, 4- U.S.; 6-India, 7-Others, 0,99-missing.

PRESENT YEAR: 1-MBA I; 2-MBA II; 3-MsC I; 4-MsC II, 5-PhD., 6-Others, 7-MsC No. year; 8-MBA no year. 99 missing

OPTION: 1-Acctg: 2-Mktg.; 3-Transportation, 4-Urb. Land Economics; 5-Finance, 6-Int. Business, 7-Management Sc; 8-O.Behavior, 9-Others, 99 missing.

AVERAGE GRADE LAST YEAR - number represent the ordered item checked. Please see questionnaire.

PREVIOUS DEGREE - two digit number used. First digit represent degree, 2nd digit represent option.
1st digit: 1-B.Comm; 2-Eng'g., 3-Education, 4-Law, 5-B.Science, 6-Computer Sc.; 7-Others; 8-B.A.; 9-Masters; 2nd Digit: Eng'g -1: Civil; 2-Mech; 3-Electrical; 4-Chem, 5-Agricultural, 6-others; others-0 (for other degrees). 99 missing.

NUMBER OF DEGREES:

COUNTRY OBTAINED - samecode as citizenship.
Working years - no of years at work.
Salary - latest salary in thousands
Position (latest): 1-higher level management; 2-middle management; 3-employee, 99-missing.

2nd row

NUMBER OF SOURCES - count the number of sources of educational financing. See questionnaire. 99-missing.

TOTAL AMOUNT OF EDUCATIONAL FINANCING - in thousands

SOURCE WITH GREATEST FINANCING COMING FROM: number referred to number in the item.

AMOUNT OF LARGEST FINANCING - in thousands

FACE VALUE OF INSURANCE - in thousands

TYPEINSURANCE - type of insurance 1-with savings feature
2-without saving feature

AMOUNT OF ASSET - total in ten thousands

AMOUNT OF LIABILITIES

AVERAGE INTEREST RATE

LISTING OF STOCK PRICE WAGER,RESPONSES IN RANKS FROM SET A TO E AND OVERALL SET RANKING, MISSING IS A 0 OR A 9. FIVE RANKS PER SET.

4.	3.	5.	4.	2.	1.	5.	4.	3.	1.	2.	2.	5.	4.	3.	1.	1.	2.	3.	5.	4.	5.	4.	3.	1.	2.	0.	0.	0.	0.	0.
6671.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	2.	1.	3.	4.	5.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	3.	5.	1.	4.	2.
457.	4.	3.	2.	1.	5.	3.	2.	4.	5.	1.	3.	4.	2.	5.	1.	2.	3.	1.	4.	5.	4.	3.	5.	2.	1.	3.	4.	1.	2.	5.
502.	3.	1.	2.	4.	5.	4.	5.	1.	2.	3.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	4.	5.	3.	2.	1.	5.	1.	2.	3.	4.
563.	5.	4.	3.	2.	1.	5.	4.	3.	1.	2.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	5.	4.	3.	1.	2.	2.	3.	1.	4.	5.
2401.	3.	2.	1.	4.	5.	5.	4.	3.	2.	1.	3.	2.	1.	4.	5.	5.	4.	1.	2.	3.	5.	4.	3.	1.	2.	3.	5.	1.	4.	2.
3720.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	2.	5.	1.	3.	4.
90349.	2.	3.	1.	4.	5.	5.	4.	3.	1.	2.	2.	5.	4.	3.	1.	5.	4.	3.	2.	1.	5.	4.	3.	1.	2.	4.	2.	1.	5.	3.
101112.	1.	2.	3.	4.	5.	2.	3.	1.	4.	5.	5.	3.	4.	1.	2.	1.	2.	3.	4.	5.	4.	3.	2.	1.	5.	3.	5.	4.	1.	2.
121314.	2.	3.	1.	4.	5.	3.	1.	4.	5.	2.	2.	1.	3.	4.	5.	5.	4.	1.	3.	2.	5.	4.	3.	1.	2.	1.	4.	5.	3.	2.
121943.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	2.	3.	1.	4.	5.
124167.	3.	2.	1.	4.	5.	5.	4.	1.	3.	2.	4.	3.	1.	2.	5.	5.	4.	3.	2.	1.	5.	4.	3.	1.	2.	2.	3.	1.	4.	5.
131313.	1.	2.	3.	4.	5.	5.	3.	4.	2.	1.	1.	5.	4.	3.	2.	5.	4.	3.	2.	1.	0.	0.	0.	0.	1.	2.	5.	1.	3.	4.
191235.	3.	4.	2.	1.	5.	5.	4.	3.	2.	1.	3.	2.	1.	4.	5.	3.	4.	5.	1.	2.	4.	5.	3.	2.	1.	4.	5.	1.	3.	2.
214714.	5.	2.	1.	3.	4.	5.	4.	1.	2.	3.	5.	4.	1.	2.	3.	4.	2.	1.	3.	9.	4.	3.	9.	1.	2.	4.	3.	2.	5.	1.
224903.	1.	4.	2.	3.	5.	5.	4.	3.	1.	2.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	3.	1.	2.	5.	4.
235602.	1.	5.	4.	2.	3.	5.	4.	2.	3.	1.	1.	5.	4.	3.	2.	2.	3.	4.	5.	1.	5.	4.	3.	2.	1.	3.	4.	1.	2.	5.
241805.	3.	2.	1.	4.	5.	5.	2.	1.	4.	3.	3.	1.	2.	4.	5.	5.	4.	3.	2.	1.	5.	4.	3.	1.	2.	3.	3.	2.	5.	4.
261039.	4.	3.	1.	2.	5.	5.	3.	2.	4.	1.	2.	3.	1.	4.	5.	5.	4.	3.	2.	1.	5.	4.	3.	1.	2.	1.	5.	3.	4.	2.
330043.	3.	2.	1.	4.	5.	2.	1.	4.	5.	3.	3.	2.	1.	4.	5.	5.	4.	2.	1.	3.	4.	3.	2.	1.	5.	5.	4.	2.	3.	1.
356126.	1.	5.	2.	4.	3.	5.	4.	3.	2.	1.	1.	5.	4.	3.	2.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	2.	1.	3.	5.	4.
404044.	4.	5.	3.	1.	2.	5.	4.	1.	3.	2.	4.	5.	3.	1.	2.	4.	1.	3.	5.	2.	5.	4.	3.	2.	1.	2.	5.	1.	4.	3.
449771.	3.	4.	1.	2.	5.	5.	1.	3.	4.	2.	1.	3.	2.	4.	5.	5.	4.	2.	3.	1.	5.	4.	3.	2.	1.	3.	4.	1.	5.	2.
439717.	5.	2.	1.	3.	4.	5.	4.	1.	2.	3.	5.	1.	2.	3.	4.	4.	3.	2.	1.	5.	4.	3.	2.	1.	5.	1.	5.	2.	3.	4.
474747.	1.	5.	4.	2.	3.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	5.	4.	1.	2.	3.	3.	5.	1.	4.	2.
519725.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	2.	4.	1.	3.	5.
614715.	2.	3.	1.	4.	5.	5.	4.	3.	1.	2.	3.	5.	4.	1.	2.	5.	4.	3.	2.	1.	5.	4.	3.	1.	2.	2.	1.	4.	5.	3.
654321.	1.	3.	2.	4.	5.	5.	2.	3.	4.	1.	1.	2.	3.	4.	5.	5.	4.	2.	3.	1.	4.	5.	3.	2.	1.	4.	5.	2.	3.	1.
654537.	2.	5.	2.	3.	4.	5	4.	3.	1.	2.	1.	5.	4.	3.	2.	4.	1.	3.	5.	2.	5.	4.	3.	2.	1.	4.	1.	3.	2.	5.
755316.	5.	4.	3.	1.	2.	4.	3.	1.	2.	5.	5.	4.	3.	1.	2.	2.	1.	3.	4.	5.	4.	3.	2.	1.	5.	2.	3.	1.	4.	5.
806662.	3.	2.	1.	5.	4.	4.	2.	1.	5.	3.	4.	3.	2.	1.	5.	5.	4.	3.	2.	1.	2.	3.	4.	1.	5.	4.	2.	1.	5.	3.
960321.	4.	5.	2.	1.	3.	5.	1.	2.	3.	4.	3.	5.	1.	2.	4.	5.	3.	2.	1.	4.	3.	5.	3.	2.	1.	4.	4.	2.	1.	3.
977713.	1.	2.	3.	4.	5.	2.	5.	4.	3.	1.	2.	4.	3.	1.	5.	5.	3.	4.	1.	2.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.
998877.	1.	2.	3.	4.	5.	5.	4.	3.	2.	1.	1.	5.	4.	3.	2.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	2.	5.	1.	3.	4.
999000.	2.	1.	3.	4.	5.	5.	4.	3.	2.	1.	2.	1.	3.	4.	5.	5.	4.	3.	2.	1.	5.	4.	3.	2.	1.	4.	1.	2.	3.	5.

APPENDIX A-6 STOCK PRICE WAGER RESPONSES

1 row per subject
5 ranks per set, five sets in all and 5 overall set ranking.

LISTING OF PERSONAL RECORDS

```
     4.  2. 25.  2.  0.   0.  7.  2.  1.  4. 11.  1.  2.  1.    1.
         3.  1.     2.    3. 2.       0.    0.       1.     0. 0.00
  6671.  1. 23.  2.  0.   0.  1.  4.  5.  3. 15.  1.  1.  1.    8.
         3.  3.     3.    1. 2.       0.    0.       6.     0. 0.00
   457.  1. 55.  1.  2.  40.  1.  2.  9.  4. 12.  1.  1. 35.   13.
         3.  2. 9999.     2. 1.      35.    2.      13.     1. 0.08
   502.  1. 25.  1.  2.   4.  1.  2.  9.  3. 70.  1.  1. 99.  999.
        99.  2.     4.    2. 2.       0.    0.       3.     7. 0.99
   563.  1. 25.  1.  0.   0.  1.  2.  9. 99. 99. 99. 99. 99.  999.
        99. 99. 9999.   99. 9.    9999.   99.   99999. 9999. 0.99
  2401.  1. 27.  1.  2.  26.  1.  4.  4.  5. 80.  1.  1.  2.    8.
         3.  1.     8.   10. 1.       1.    1.       9.     5. 0.05
  3720.  1. 31.  1.  3.  20.  6.  5.  8.  3. 91.  3.  5. 99.  999.
        99.  1.     4.    2. 1.       1.    1.       2.     0. 0.00
 90349.  1. 23.  2.  0.   0.  1.  2.  9.  5. 50.  1.  1.  1.   10.
         3.  2.     3.    1. 2.       0.    0.       1.     2. 0.08
101112.  1. 25.  2.  0.   0.  1.  8.  5.  3. 54.  1.  1.  0.    0.
         0.  1.     2.    1. 9.       0.    0.       0.     0. 0.00
121314.  1. 34.  1.  1.  27.  5.  2.  5.  3. 50.  1.  1.  9.   15.
         2.  2. 9999.   99. 1.       5.    2.       6.     0. 0.00
121943.  1. 29.  2.  0.   0. 99.  8.  6. 99. 94.  2.  1.  5.    4.
         3.  2. 9999.   99. 9.    9999.   99.   99999.     0. 0.00
124167.  1. 23.  2.  0.   0.  1.  1.  9.  4. 60.  1.  1.  1.    7.
         3.  1.     3.    1. 2.       0.    0.       1.     0. 0.00
131313. 99. 99. 99. 99. 999. 99. 99. 99. 99. 99. 99. 99. 99.  999.
        99. 99. 9999.   99. 9.    9999.   99.   99999. 9999. 0.99
191235. 99. 99. 99. 99. 999. 99. 99. 99. 99. 99. 99. 99. 99.  999.
        99. 99. 9999.   99. 9.    9999.   99.   99999. 9999. 0.99
214714.  1. 31.  1.  0.   0.  1.  2.  3.  4. 40.  2.  1.  5.   10.
         3.  2. 9999.   99. 1.      10.    2.       2.     1. 0.05
224903.  1. 24.  2.  0.   0.  2.  2.  1.  4. 11.  1.  1. 99.  999.
        99.  3. 9999.   99. 2.       0.    0.       1. 9999. 0.99
235602.  1. 38.  1.  3.  11.  1.  2.  6.  4. 70.  1.  1.  5.   20.
         1.  1. 9999.    3. 1.      60.    3.     123.    22. 0.09
241805.  1. 23.  2.  0.   0.  1.  2.  9.  4. 12.  1.  1.  1.    7.
         2.  3.     2.    4. 1.       2.    1.       6.     4. 0.08
261039.  1. 24.  1.  1.  24.  1.  2.  5.  4. 80.  1.  1.  3.   12.
         3.  3.     3.    1. 1.      10.    2.       7.     1. 0.00
330043.  1. 26.  1.  0.   0.  1.  4.  4.  5. 70.  1.  1.  3.    6.
         3.  3. 9999.   99. 1.      10.    1.       9.     1. 0.04
356126.  1. 24.  2.  0.   0. 11.  2.  6.  5. 80.  1.  1.  1.    6.
         3.  2.     2.    1. 2.       0.    0.       0.     0. 0.00
404044.  1. 27.  2.  0.   0.  1.  8.  5.  4. 50.  1.  1.  2.    6.
         3.  2.     2.    4. 2.       0.    0.       1.     2. 0.00
449771.  1. 25.  1.  0.   0.  1.  2.  3.  4. 12.  1.  1.  1.    6.
         3.  2. 9999.   99. 1.      15.    1.       8.     0. 0.00
443971.  1. 26.  1.  0.  24.  7.  2.  5.  1. 91.  2.  7.  3.    4.
         2.  3. 9999.   99. 1.      15.    2.      11.     0. 0.00
474747.  1. 37.  2.  0.   0.  1.  8.  9.  4. 40.  1.  2.  8.    8.
         3.  1. 9999.    3. 2.       0.    0.     220.     2. 0.06
519725.  2.  0.  3.  2.   7.  1.  8.  2.  6. 70.  1.  1. 99.  999.
        99.  3. 9999.   99. 2.       0.    0.   99999.     1. 0.99
614715.  1. 30.  1.  4.  10.  1.  7.  5.  3. 15.  1.  1.  7.   14.
         2.  4.     6.    4. 1.      98.    0.      57.    22. 0.07
654321.  1. 28.  1.  0.   0.  7.  8.  6.  3. 15.  1.  3.  4.   10.
         2.  4.     8.    4. 1.      30.    1.       4.     0. 0.00
654537.  1. 24.  2.  0.   0.  2.  2.  5.  3. 50.  1.  1.  0.    0.
         0.  2.     3.    1. 2.       0.    0.       1.     0. 0.00
755316.  1. 27.  1.  0.   0.  1.  1.  1.  3. 80.  1.  1.  6.    7.
         3.  2. 9999.   99. 2.       0.    0.       6.     2. 0.09
806662.  1. 25.  2.  0.   0.  1.  2.  9.  4. 80.  1.  1.  2.    3.
         1.  1.     1.    1. 2.       0.    0.       5.     5. 0.08
960321.  1.  0.  2.  0.   0.  2.  2.  1.  3. 11.  1.  5.  7.    4.
         3.  3.     2.    2. 2.       0.    0.       1.     0. 0.00
977713.  2. 25.  1.  1.   1.  1.  1.  9.  5. 40.  1.  1.  3.    8.
         3.  1.     1.    0. 1.       0.    0.      25. 7501. 0.50
998877.  1. 27.  2.  0.   0.  1.  7.  7.  4. 50.  1.  1. 99.  999.
        99.  1. 9999.   99. 9.    9999.   99.   99999. 9999. 0.99
999000.  1. 23.  2.  0.   0.  1.  1.  9.  5. 50.  1.  1.  0.    7.
         3.  3.     3.    1. 2.       0.    0.       1.     0. 0.00
```

PERSONAL RISK PROFILE FOR I.D. 614715.

NOTE: THIS LISTING PROVIDES YOU WITH THE SCORES
ON THE VARIOUS MEASURES AND YOUR PERCENTILE ON IT
THE HIGHER PERCENTILE WOULD MEAN HIGHER RISK TAKING .
PERCENTILE IS BASED ON GROUP DISTRIBUTION.ALSO ALL ID WERE TRUNCATED
TO SIX DIGITS.

IN BASKET RESPONSE:
RATING OF YOUR 7 MEMO RESPONSES BY JUDGE,WHERE 1 MEANS QUICK
DECISION TO TAKE RISKY ALTERNATIVE,2 MEANS TAKING RISKY ALTERNATIVE BUT QUALIFIED
3 MEANS QUICK BUT QUALIFIED CONSERVATIVE ALTERNATIVE ,4 MEANS TAKING
CONSERVATIVE ALTERNATIVE,5 MEANS MORE INFORMATION
NEEDED TO MAKE DECISION,AND 6 MEANS DELAY AS A STRATEGY.
YOUR SCORE 3.500 PERCENTILE 5.
MINIMUM CHANCE OUT OF 10 ON THE 7 MEMOS:
YOUR SCORE 5.1430 PERCENTILE 100.
RATING OF LETTER WRITERS:
YOUR SCORE -34.000 PERCENTILE 100.

CHOICE DILEMMA SCORE - AVERAGE CHANCE OUT OF 10 YOU WOULD RECOMMEND BEFORE TAKING UNCERTAIN ACTION.
YOUR SCORE 6.890 PERCENTILE 5.

UTILITY ITEMS
COMPENSATION LEVEL - COMPUTED ON BASIS OF RISK PREMIUM FROM EXPECTED VALUE IN PERCENTAGE:
YOUR SCORE 0.680 YOUR PERCENTILE 5.
RATE OF RETURN - COMPUTED IN THE SAME WAY AS COMPENSATION.
YOUR SCORE 0.081 PERCENTILE 100.
NET PROFIT -COMPUTED ON BASIS OF RISK PREMIUM.
YOUR SCORE 2.000 PERCENTILE 65.

SCALE OF WAGERS - COMPUTED WITH THE BUYING PRICE OF WAGER AND THE NUMBER
OF NO RESPONSES AS WEIGHTS:
YOUR SCORE 16.663 PERCENTILE 5.

STOCK PRICE WAGER - COMPUTED WITH VARIANCE AND RANKS AS WEIGHTS.
YOUR SCORE 2.483999 PERCENTILE 95.

EXTREMITY-CONFIDENCE SCORE - EXTREMITY SCORE COMPUTED AS AVERAGE SQUARED DEVIATION FROM
.50,WHILE CONFIDENCE IS WITH THE FOLLOWING CODE: 1 FOR VERY SURE,2 FOR QUITE SURE,
3 FOR MODERATELY SURE,4 FOR SLIGHTLY SURE,5 FOR NOT SURE
YOUR EXTREMITY SCORE 0.111860 PERCENTILE 95.
YOUR CONFIDENCE SCORE 3.0670 PERCENTILE 55.

PERSONALITY MEASURES
INTERNAL CONTROL - MEASURE OF HOW YOU PERCEIVE YOUR DECISION AS HAVING ANY INFLUENCE
ON THE OUTCOMES OF YOUR CHOICES.
YOUR SCORE 6.00 PERCENTILE 85.
NEW EXPERIENCES MEASURE - MEASURES THE DEGREE TO WHICH YOU SEEK VARIETY,
NEW SOCIAL ACQUAINTANCES AND EXPERIENCES.
YOUR SCORE 4. PERCENTILE 100.