

Project Principal	501(c)(3) Organization
<p>Jonathan Baron</p> <p>Professor</p> <p>University of Pennsylvania</p> <p>3720 Walnut St.</p> <p>Philadelphia, PA 19104-6241</p> <p>Phone: 215-898-6918 (no fax)</p> <p>Email: baron@psych.upenn.edu</p>	<p>University of Pennsylvania</p> <p>Office of Research Services</p> <p>3451 Walnut St., Room P-221</p> <p>Philadelphia, PA 19104-6205</p> <p>Phone: 215-898-5000</p> <p>Web: <a href="http://www.upenn.edu">http://www.upenn.edu</a></p> <p>Federal ID: 23-1352685</p>

Project title: New measures of financial risk tolerance

Type of grant: Research

Proposal due date: August 22 (revised October 21, 2008)

Project Summary:

The proposed research compares methods for eliciting individual attitude toward financial risk. Two general classes of methods are those based on hypothetical choices and those based on valuation of outcomes (income levels and or spending in various categories). Ideally, risk attitude should be determined by expected-utility theory, and the utility function for money — the subjective value of different possible wealth levels — should be critical. Choice-based methods may be distorted away from this ideal by biases and culturally-derived attitudes toward risk. One possible result is that risk tolerance inferred from judgments about outcomes will vary less than those inferred from choices. Such a result would argue for a “libertarian paternalistic” approach to financial advising.

# 1 PROPOSAL REQUIREMENTS

## 1. Qualifications

The University of Pennsylvania is a major research university. Several colleagues are available who are interested in this line of research, including Olivia Mitchell in Wharton (right next to my building).

I, Jonathan Baron, the Principal, am a major scholar in the field of judgment and decision making. I am author of a leading textbook in the field, past president of the Society for Judgment and Decision Making, and editor of its journal. The topic of this proposal is of some interest to people in this field, particularly given the recent work of Richard Thaler, Shlomo Benartzi and Cass Sunstein.

There are no collaborators at present, but others may be interested in this research as it develops, particularly students.

## 2. Detailed Project Description

### A. Project Overview

Many investment companies and individual advisors try to assess the risk preferences of clients with questionnaires. All the examples of this that I have seen ask directly about risk attitude, in various ways. For example, TIAA-CREF provides questions like the following in its web site:

Which of the following portfolios is most consistent with your investment philosophy?

- a. Portfolio A will most likely exceed long-term inflation by a significant margin

and has a high degree of risk.

- b. Portfolio B will most likely exceed long-term inflation by a moderate margin and has a high to moderate degree of risk.
- c. Portfolio C will most likely exceed long-term inflation by a small margin and has a moderate degree of risk.
- d. Portfolio D will most likely match long-term inflation and has a low degree of risk.

Yet, what ultimately matters is the income level of investors at different ages, and the wealth they pass to their heirs. Economic theory implies that the relevant issue is the utility (subjective value) of income and wealth, and investment decisions should be based on expected utility. That is, the best decisions are those that maximize the expected value of the money obtained. For example, if I have a choice between \$2,000,000 for sure and a 50% chance of getting either \$1,000,000 or \$4,000,000, I should take the gamble only if the difference between \$2,000,000 and \$4,000,000 matters more to me than the difference between \$1,000,000 and \$2,000,000. The former difference might be less, if all I care about is what I could get for \$2,000,000. I should not take the risk in that case.

Research in judgment and decision making has shown repeatedly that measures of risk attitude are influenced by many other factors aside from the utility of money. (My textbook, *Thinking and deciding* [4th edition 2008], reviews this research.) The purpose of this project is to evaluate measures of the utility of money as potential tools for helping people with financial planning, and possibly also to educate them about prudent investing.

## **B. Target Audience**

If the research is successful, I plan to publish articles in relevant academic journals and trade magazines. I may also develop decision aids in the form of web pages, but I do not plan to publicize them other than through the articles. The audience is thus others who are interested in the theory of preference measurement and its application to financial planning. Section E, below, discusses possible outcomes in more detail.

## **C. Project Scope**

The subjects for most of the proposed studies will be my standard panel of about 1400 people who have volunteered to do studies for pay. I usually pay about \$3 for a study that takes most of them 10–15 minutes. Most studies involve several pages, with several questions on each page. The panel is representative of the U.S. population in age (except that they are all over 18), average income, and education, but not gender: about 75% are women. Many are retired. Very likely the variance of income is smaller than the U.S. population: the poor don't have Internet access and the rich would not work for so little (although I do have a few medical doctors).

Each study typically involves about 80 respondents. Given the nature of the experimental designs, which use comparisons of responses of each subject to other responses from the same subject, this has proven more than adequate. If anything, it is oversensitive to small differences, but I shall of course pay attention to the true sizes of effects.

Although this is a “convenience sample,” the population of interest is all people in developed countries, most of whom do not speak English, and most of whom are (if we are optimistic) not born yet. It is thus impossible to come close to a representative sample. The sample I will use is

quite varied. When analyzing data, I always look for individual differences.

In addition, I plan to try various studies on my undergraduate class in judgments and decisions. Some of this will be assigned for the class, and for that no pay is needed.

#### **D. Situation Analysis**

Two major decision variables affect individual differences in saving: risk attitude and time preference (for present vs. future). With respect to time preference, the literature suggests that most people save too little. That is, the gain in utility in their later years from additional saving would exceed the loss in their earlier years. (See, for example, Benartzi and Thaler, forthcoming in *Journal of Economic Perspectives*.)

With respect to risk attitude, some literature suggests that young people are too risk-averse. For example, they invest too little in stocks relative to fixed-income investments. (On the other hand, people are too risk-seeking to the extent to which they fail to diversify, as reviewed by Benartzi and Thaler. Diversification is not an issue in this proposal.)

Financial advisors often try to determine the risk attitude of their clients. Sometimes they do this informally, and sometimes they do it with questionnaires. All the questionnaires I have seen emphasize choices rather than outcomes. (I have not as yet searched thoroughly. Such a search would be part of the grant activity.)

Theoretically, decisions about risk should conform to expected-utility theory. What matters are the probabilities of the outcomes and their utilities. For investing, the relevant utilities are those for money, or for the things that money can buy.

Yet, we have reason to think that people's choices about risk are influenced by many factors other

than those that affect the utility of money for them. Expected-utility theory implies that the utility function for money should determine decisions. The other factors that affect risk attitude are not yet fully known. They include such things as distortion of stated probabilities (the  $\pi$  function of Kahneman and Tversky's Prospect Theory, but other theories, such as Michael Birnbaum's TAX theory, predict and explain many of the same observations) and cultural attitudes about risk itself. (See, for example, the article by Harris et al. in *Judgment and Decision Making*, 1 (1).)

If decisions are distorted in these ways, people could choose options that are consistent with their immediate preferences yet not best for them in the long run, once the consequences happen.

I propose to compare several measures of risk attitude and of the utility of money at various ages. These methods range from a focus on choices for investing (risky vs. safe, a lot vs. a little) to a decision analysis of the uses of money and the value of these uses to the individual. The former methods (choice based) should be more subject to biases. In theory, the latter methods, which I shall call "outcome based," should be more consistent with the total utility of the individual over time. However, the outcome-based methods may be more difficult to use as practical tools.

The project will involve testing of these various methods on students and on a broader sample of people. (The funds requested are for the broader sample, as they must be paid.) I shall examine individual differences in the risk attitude implied by each measure, and the consistency of the measures with each other, as well as their internal consistency.

The use of measures at different ages will also allow a parallel analysis of decisions about the appropriate amount of saving. This is a secondary interest, because advisors are generally less interested in expressed time preference than in expressed risk attitude. But all studies will be designed to assess time preference, and the total utility of distributions of income over time, as well as risk.

## **E. Project Goals and Objectives**

The ultimate applications of this research will depend on the findings.

One possible finding is that the outcome-based methods are internally consistent, easy to use, and show wide individual differences in the utility function for money. In this case, the next step would be to develop practical Web-based tools based on these methods. I would do this, but I would not market or publicize these tools other than through the articles I write about them. I would plan to make them available under the Gnu Public License (or some similar open-source license), so that others may use them freely.

Another possible finding is that these outcome-based tools are valid measures of individual differences but not easy to use. In this case, the next step would be to develop alternative methods of measuring individual differences that are short-cuts. For example, it may be possible to predict a person's utility of money fairly well from a relatively short questionnaire about hypothetical outcomes. This would be another research project beyond the scope of the current proposal. I would be interested in collaborating on such a project, but it is not my main interest.

A more interesting possible result is that the variability across people in assessed risk attitude is substantially greater with the choice-based methods than with the outcome-based methods. People may differ widely in their preference for risky investment, but they may differ relatively little in their relative preference for entertainment and food. In this case, optimal investment policies would tend to be similar for different people, despite their own risk attitudes.

Such a finding would have implications for an approach based on "libertarian paternalism" (the term used by Richard Thaler and Cass Sunstein), in which the "decision architect," is someone other than the investor, designs choices for the investor with the idea of "nudging" the investor toward wise choices while, at the same time, giving the investor freedom to depart from what

would be wise for most others. The result would argue for a default based on the policy that was generally optimal according to expected utility. It may even be the case that choice-based methods yield results that are not correlated at all with the outcome-based methods, in which case individuals should even be warned that they might make things worse by choosing something other than the default.

Of course, the opposite result could happen too, with greater individual differences in outcome measures (although I would have no hypothesis about why). In this case, further work on measurement of outcome utilities would be in order.

## **F. Procedures and Methodology**

I will attempt to measure risk attitude with the following methods, presented to each subject in counterbalanced order. About 100 subjects will do each study, to allow assessment of individual differences, and there will be several studies, each designed to follow up the last. Each study will involve several cases, so that a reliable measure of individual differences is obtained.

1. Direct measurement of risk preferences for investments, using hypothetical investments that trade off risk (outcome variance) and expected return. For example, “Which would you prefer, an investment that earns 6% per year for 10 years on \$10,000 (returning about \$17,900 over that period), or an investment that has an equal chance of paying 4% (\$14,800 over the period) or 11% (\$28,400)?” (I will use both 10-year and 20-year investments.) The variance, expectation differences of the two options, duration and overall amount will be systematically varied.
2. Measurement of utility differences for the same outcomes, e.g., “Which matters more to you for a 10-year investment of \$10,000, the difference between \$14,800 and \$17,900, or the

difference between \$17,900 and \$28,000?” According to expected-utility theory, the answer to this question should agree with the direct measurement of risk preference, but I expect less risk aversion (a less concave utility function, that is, less sharply declining in slope as money increases) here.

3. Measurement of risk preferences for total income, rather than individual investments, at different ages (30, 50, 70 years).
4. Measurement of utility differences for total income, at the same ages. The utility function for total income should be consistent with that for the outcomes of individual investments (assuming some reasonable form, such as a power function). I expect that it will be more concave for investments than it should be, because people think narrowly about the utility of money.
5. Analysis of total income into major budget categories: saving, food, housing, health, entertainment and travel, car ownership and maintenance. Subjects will estimate a utility function within each category (under the assumption of a simple form, so that only one intermediate point is required for each category) and then compare the categories, e.g., “Would the difference between spending \$200/week and \$300 on food matter more or less to you than the difference between spending \$0 and \$200 on entertainment?” This would be done for different ages. Subjects would also indicate how they would allocate a given total income among the categories.

The last method, which would almost certainly require separate studies, would permit an inference about the utility of total income. Concavity of the utility function (less value per dollar as money increases) would result from greater elasticity of some categories than others, that is, less effect of that category on subjective value. For example, with increased income, the allocation to entertain-

ment would increase disproportionately, and entertainment would have a lower utility per dollar than the other categories. (Similarly for saving, perhaps.) I have no particular prediction about whether this method would yield more or less concavity of the overall utility function than direct measurement.

Statistical analysis is done with  $R$ . With Yuelin Li, I am second author of a book on the use of  $R$  for data analysis in psychology, under contract with Springer. Most analysis will compute parameters for each subject and then analyze these as individual difference measures.

## **G. Project Outcomes and Deliverables**

I have described these in section E.

## **3. Distribution plan**

I have described this in sections B and E. In addition to papers and possible web sites, I shall present results at meetings, such as the meeting of the Society for Judgment and Decision Making.

## C. REQUIRED ATTACHMENTS

### A. Milestones and deadlines

Milestone	Start date	End date	Primary activities	Deliverables
1	now	3/2008	pilot studies on undergrad class	none
2	12/2008	12/2008	gain IRB approval	none
3	3/2009	12/2010	carry out research	none
4	3/2010	as needed	write papers and give presentations	papers

### B. Budget (2 years)

Subject payments	\$10,000
Overhead	\$1,000
TOTAL	\$11,000

Subjects are paid through PayPal. This is an estimate based on past experience. I expect the funded part of the project to take 2 years, approximately \$5,000 per year in subject payments.

During the first year, my other research may be (if we can extend it past its ending date) supported by a grant from the U.S.-Israel Bi-national Science Foundation, joint with Ilana Ritov of the Hebrew University of Jerusalem. I have no other grants, or pending proposals, as yet.

## **Other sections**

Attachment C, the 501(3)(c) letter, follows. Then attachment D, my CV. The remaining attachments (board members, funding sources, and audited financial report) do not exist (funding sources) or are not available at the level of the school or department. The financial report for the University, which lists the board members, is 50 pages long (in a larger paper size) and is available at [http://www.archives.upenn.edu/primdocs/uph/uph4\\_5/2007fin\\_report.pdf](http://www.archives.upenn.edu/primdocs/uph/uph4_5/2007fin_report.pdf).