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# PERCSPECTIVES ON RESEARCH



Liqun Liu is a Research Scientist at the Private Enterprise Research Center. He joined the Center after earning his Ph.D. in Economics from Texas A&M University in 1998.

He also received a B.S. and M.S. in Applied Mathematics from Huazhong University of Science and Technology in China. He served as an associate editor for the *Journal of Economic Behavior and Organization* and, along with his coauthors, received the SCOR - Geneva Risk and Insurance Review Best Paper Award for "Trade-offs for Downside Risk-Averse Decision-Makers and the Self-Protection Decision." Liu's primary research interests are public policy analysis, cost-benefit analysis, and decision analysis.

**Beginning at the Huazhong University of Science and Technology and then at Texas A&M, you've taught courses to many undergraduate, master's and doctoral students. What was your favorite teaching principle?**

I studied and then taught college-level mathematics at the Huazhong University of Science and Technology (HUST). I spent 12 years at HUST before coming to Texas A&M to pursue my Ph.D. degree in economics. Towards the end of my years at HUST, I took a few economics courses and I even taught a few sections of microeconomics. I found that economics was much more fun than mathematics, which eventually led me to TAMU, where I received rigorous training in economics from top-notch economics professors. I also taught a rather diverse set of economics courses at TAMU, first as a graduate TA and then as an adjunct professor.

Of the courses I have taught so far, my two favorite ones are Public Finance and Financial Decision Making under Uncertainty. The characteristics of public finance have a lot of policy implications, while financial decision making under risk explains individuals' or businesses' decisions in a real world environment.

**What advice or encouragement would you give students who are interested in studying economics?**

Economics is a lot of fun, offering unique insights into real-world phenomena. Although the skills learned in economics are probably less directly applicable to specific jobs than accounting or the actuarial science, economics training provides a solid foundation in logical and rational thinking that is critical for all kinds of jobs. I believe that it is very important for economics majors to study mathematics well, for math is a critical tool for economic analysis. In particular, economics majors should take, and do well in, such math courses as Calculus, Linear Algebra, and Probability & Statistics. If they take these courses and do well, they will be well prepared for a career in economics.

**You first joined Texas A&M in 1992, then PERC in 1998. Do you have any memorable experiences from your years at these institutions?**

It's amazing that I have lived in College Station for so long! I definitely have many memorable experiences during this period. I joined the Ph.D. program in economics at Texas A&M University in 1992 because of Guoqiang Tian, an economics professor here. Guoqiang received his Ph.D. in economics from the University of Minnesota, but he obtained math training at the undergraduate and master's level from HUST. Guoqiang recognized my credentials and recommended me to the Ph.D. program in economics. All of the wonderful experiences I have had here wouldn't have happened without his help.



After entering the Economics department, I took many courses under several professors. Tom Saving taught my first microeconomics theory course in the Ph. D. program, and Dennis Jansen taught my first macroeconomics course. After a while, I began to teach my own economics courses. I remember it vividly, during my 4th year in the graduate program, I got an opportunity to teach Public Finance. I was excited, but at the same time I was nervous because I wasn't very confident about speaking English. I had taught before in China, but had never taught in an English-speaking environment. For my lecture preparation, I basically had to write down every sentence I intended to say in the class. Sensing my nervousness, Butch Browning, my dissertation advisor, shared his teaching experience and teaching materials with me. He also lent me the audio tapes of an exemplary course taught by a top economics professor, and sat in one of my early lectures and provided very helpful comments. Butch's encouragement and help greatly boosted my confidence. As a result, the first course I taught in English was well-received by the students.

I have so many memorable experiences with my long-time PERC colleagues, Barbara Fisher, Andy Rettenmaier, Tom Saving and Zijun Wang, among others. As avid advocates of "private enterprise," we believed in the power of freedom to choose and trade, and tried to advance market oriented solutions to public policy problems. We also had a lot of fun together along the way. Interestingly, however, the belief in "private enterprise" cost me financially.

Shortly after I was hired by PERC, my wife, Jenny, enrolled in Sam Houston State University in Huntsville as a graduate student. According to tuition policies, Jenny would have been eligible for the lower, in-state tuition as the spouse of a faculty/staff member at a public higher education institution in Texas, even though she was considered an international student. However, the person handling Jenny's application for in-state tuition didn't like the word "private enterprise" as the name of my hiring department, and rejected Jenny's application! I called the tuition office at Sam Houston to reason with them, but to no avail. Knowing this, Barbara Fisher, PERC's administrative assistant at the time, came to our rescue and offered to help. Barbara called the tuition office multiple times and even reached higher

levels in the command chain to argue that PERC is indeed part of Texas A&M and I was a staff member at TAMU. Unfortunately, the tuition office upheld their initial decision to reject Jenny's application. Nonetheless, Jenny and I were deeply moved by Barbara's efforts, and felt a very warm welcome by the PERC family.

**What first led you to focus on decision making under risk?**

We at PERC have done extensive research on Social Security reform and healthcare market policies. Since investment in the stock market is an important aspect in the discussion of Social Security reform and insurance is an institution inherent in the healthcare market, my colleagues and I became interested in research on investment in the stock market and health insurance, which eventually led me to research decision making under risk. This new research interest of mine was further sustained by two additional factors. First, Probability Theory is the main tool for analyzing risk and it happened to be my favorite math subject at HUST. Second, and very luckily, I had convenient access to the advice of two leading experts in the field of risk analysis, Bill Neilson and Jack Meyer. Bill was a faculty member at the economics department of TAMU until he left for the University of Tennessee in 2006, and Jack has visited PERC every year in the spring semester since 2008.

**You've had several long-term research collaborations with several of your coauthors. What are the keys to cultivating long-term, prolific research collaborations?**

I have had the good fortune to have collaborated with many highly competent coauthors, including Bill Neilson and Jack Meyer. Regarding the benefits from collaborations, economists would be quick to point out that there is a certain complementarity between coauthors that creates a situation where  $1 + 1 > 2$ . For me, in particular, it seems that having a co-author provides additional motivation and adds some fun to otherwise tedious research. To truly benefit from a collaborating relationship, the coauthors must have a common interest in the project they intend to work on together. I have different co-authors for different projects.



For those who are new to economic research, collaborating with an established researcher has additional benefits. The junior researcher can learn a great deal from the senior researcher in how to identify important research topics and how to respond to the comments from editors and referees on their work. I, for one, learned a lot in these aspects from the coauthors of my first few publications – Butch Browning, Tim Gronberg and Guoqiang Tian.

**Your paper, “Portfolio Choice in the Model of Expected Utility with a Safety-First Component” with Dennis Jansen was recently published in the Journal, *Decisions in Economics and Finance*. Can you share the important findings from this paper and how it relates to the everyday decision-maker?**

Dennis has done extensive research on investment in the stock market. One measure he used to quantify risk in his investment studies is the probability of final wealth falling below a certain “safety” level. And a decision maker is “risk averse” if he prefers this probability of shortfall to be as low as possible, that is, if he displays a preference for “safety first.” In my studies of stock investment, on the other hand, I opted for a measure of risk that is based on the dispersion in the final wealth distribution, and “risk aversion” is equivalent to preferring the dispersion to be as small as possible (other things equal), according to the model of expected utility. Experimental and empirical evidence reveal that real-world decision makers simultaneously dislike both types of risks -- the probability of shortfall and the dispersion in the wealth distribution. To combine both types of risk aversion, Dennis and I constructed a general model of decision making under risk, the model of expected utility with a safety-first component, and used this model to predict investors’ portfolio choice between a risky asset and a riskless asset.

With this general model, we can make a richer set of predictions. Some of our predictions fit the real-world observations better than those based on the narrower expected utility model. For example, a well-known prediction from the expected-utility model is that every investor would want to invest at least some of his wealth in the stock market where the average return is higher than the riskless

alternatives such as Treasury bonds or certificates of deposit. This prediction is, however, inconsistent with the fact that many savers do not have any stock investment account. In contrast, one prediction derived from our more general model says that the optimal investment in the stock market would be zero when the safety wealth level coincides with a benchmark value.

In our paper, we only applied the model of expected utility with a safety-first component to the investment decision. The model can also be applied to analyzing other decisions in risky environments such as insurance demand, prevention, precautionary saving, and so on.

**As your retirement approaches, can you share what you believe is the greatest accomplishment of your career?**

To begin, I have contributed to many policy reports produced at PERC, and it is my hope that some of the policy reports I helped write have informed policy makers and the public and have led to better policies. I hope our work here has influenced people’s way of thinking. The highlight of my career came one day about 20 years ago when Andy Rettenmaier and I received a hand-written letter from Professor Milton Friedman commenting on a policy report we had just published about Social Security reform. In his letter, Professor Friedman commended us for our work on Social Security reform, and discussed several issues stated in the paper. Even though one of his comments could be interpreted as questioning some of the assumptions in our analysis, we were very excited to have produced a policy piece that got the attention of one of the greatest economists.

Also, I would like to emphasize two specific contributions of mine to the economics profession -- one on the social discount rate issue and the other on the measure of higher-degree risk aversion. The social discount rate was an unresolved issue when I was writing my dissertation on the marginal cost of public funds. The social discount rate (SDR) was meant to be a shadow price that quantifies the trade-off between resources of different points in time. The SDR is not simply the prevailing market rate of return because the taxes falling on capital income create a wedge between the before-tax gross return and the



after-tax net return. The then-existing approaches to the SDR suffer from an insurmountable implementation problem. The marginal cost of funds (MCF) is also a shadow price that measures the real cost to taxpayers of one additional dollar in revenues collected by the government through taxation. The MCF is generally larger than one, and its exact value depends on the tax. Since both the SDR and the MCF come from distortionary taxation, I proposed a new approach to discounting that is based on the MCF rather than the SDR. Specifically, my approach to discounting in cost-benefit analysis involves the following well-implementable steps: (i) Discount project benefits (expressed in terms of willingness to pay) at the net return; (ii) discount project costs—including any indirect revenues from the project as negative costs—at the gross return; then (iii) multiply the present value of costs by an MCF associated with the marginal financing instrument before the cost side is compared with the present value of benefits. The resulting paper, which is based on a chapter of my dissertation, was published in the *Journal of Public Economics*. Later on, I, together with Andy Rettenmaier and Tom Saving, further extended this MCF-based approach to discounting to project

evaluation that involves multiple generations, which has important implications for government policies on climate change and debt.

Decision makers generally dislike dispersions (risks) in the wealth distribution, and this is referred to as (2nd degree) risk aversion. The strength of a decision maker's 2nd degree risk aversion is measured by the well-known Arrow-Pratt risk aversion measure. Many recent experimental studies also uncovered a category of risk attitudes that are labeled as "higher-degree risk aversion." For example, it has been found that decision makers dislike a certain dispersion occurring at a lower level of wealth relative to the same amount of dispersion occurring at a higher level of wealth. This is called "downside risk aversion" or "3rd degree risk aversion". My two coauthors, Jack Meyer and Bill Neilson, and I generalized the Arrow-Pratt measure to measure the strength of "nth degree risk aversion" where  $n = 3, 4, \dots$ . This work is included in two papers. The first paper was with Jack Meyer and was published in *Journal of Economic Theory*; the second paper was co-authored with Bill Neilson and was published in *Management Science*.



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## PORTFOLIO CHOICE IN THE MODEL OF EXPECTED UTILITY WITH A SAFETY-FIRST COMPONENT

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In the field of investment risk, the majority of economists interpret risk as dispersion or variation in an outcome variable. This safety-first principle, first introduced seventy years ago, proposes that a decision maker minimizes or maximizes the probability of wealth falling below or exceeding a given safety level. However, everyday decision makers tend to associate risk with the outcome failing to meet a certain safety level.

In PERC working paper 2010, authors Dennis Jansen, PERC's director, and Research Scientist Liqun Liu study the portfolio investment decision in a more general model of the expected utility with a safety-first component. This model accommodates the empirical and experimental evidence that shows real-world decision makers care about the probability of final wealth exceeding a safety wealth level in addition to the distribution of final wealth.

Since the first introduction of the safety-first principle, additional research has expanded its interpretation and use. For example, other economists have interpreted the goal of the safety-first model as being able to minimize the probability of shortfall subject to the constraint that the mean wealth does not fall below a given amount, or as being to maximize the mean wealth subject to the constraint that the probability of shortfall does not exceed a specified number. These various interpretations to the safety-first principle either do not allow any trade-offs between safety and the final wealth distribution or allow only limited trade-offs between the two.

To address this problem, a more general model of decision making under risk that includes both an expected utility component and a safety-first component was created and is known as the EU-SF model. In this model, a decision maker's concern about the final wealth distribution per se, absent of any benchmark, reference point or safety level, is captured by the expected utility of the final wealth, and his or her concern about meeting a safety wealth level is captured by the probability of final wealth exceeding the safety level. This allows the full

range of trade-offs between safety and final wealth distribution.

This paper studies the standard problem of portfolio choice between one risky and one riskless asset in the EU-SF model. The authors focus on the portfolio choice decision to explore the implications of the EU-SF model for risk-taking behavior for two reasons: The portfolio choice between a risky and a riskless asset provides a classic trade-off between risk and return, such as the production decision of a competitive firm under price uncertainty or the insurance coverage decision under coinsurance.

Findings show that a positive expected excess return remains sufficient for investing a positive amount in the risky asset except in the special situation where the safety wealth level coincides with the wealth obtained when the entire initial wealth is invested in the riskless asset. In this situation, the optimal amount invested in the risky asset is zero if the weight on the safety-first component is sufficiently large. Comparative statics analysis reveals that whether the optimal amount invested in the risky asset becomes smaller as the weight on the safety-first component increases depends on whether the safety wealth level is below the wealth obtained when the entire initial wealth is invested in the riskless asset. Further comparative statics analyses with respect to the safety wealth level and the degree of risk aversion in the expected utility component are also conducted.

Portfolio choice is important for both economists studying risk, but also for everyday decision makers. Here, the authors focus on the portfolio choice decision to explore the implications of the EU-SF model. The model better accommodates real-world decision makers, who care about the probability of final wealth exceeding a safety wealth level in addition to the distribution of the final wealth. This work also adds to literature on portfolio choices in alternative, behavioral decision models and sheds light on the effect of relative wealth placement in a reference group in taking risk.



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Founded in 1977 through the generosity of former students, corporations and foundations, the Private Enterprise Research Center pursues a dual mission of supporting academic research at Texas A&M University and developing market-oriented solutions to public policy problems.

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