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The Equity Risk-Premium Puzzle

Over a long span of U.S. history, a diversified portfolio of common equity has turned out to be an exceptionally good investment, especially when compared with government securities. From 1889 through 1988, the average real (compensated for inflation) rate of return on the Standard and Poor's 500 stock index was about seven percent, compared to 3/4 percent return for government securities. Of course, since equities involve credit risk and government bonds do not, equities ought to pay more on average. However, the advantage of stocks has been very large, larger than seems justifiable on the basis of risk considerations alone.

The magnitude of the equity risk premium has puzzled economists in recent years. This *Letter* considers the nature of the puzzle, a proposed solution, and some implications.

Risk aversion

To explain the equity risk premium, economists rely on a concept called "risk aversion." Since government securities offer a payoff, or return, that is known with certainty, while equities offer a payoff that is uncertain, or risky, investors who are averse to risk are willing to hold equity only if they expect to earn a premium over the return available on government securities. The more risk averse is the investor, the greater the risk premium must be to induce him or her to purchase equities.

To see how risk aversion affects the price of equities, consider the following example. A person is given a choice between two offers, a sure $50.50, or a lottery ticket that offers a fifty-fifty chance of $1 or $100. The expected return on the lottery is $50.50, the same as the first offer. An individual who is not risk averse would be indifferent between receiving a sure $50.50 and the lottery. But a risk averse individual would prefer the first offer of a sure $50.50 to the lottery, even though the lottery has the potential to yield $100.

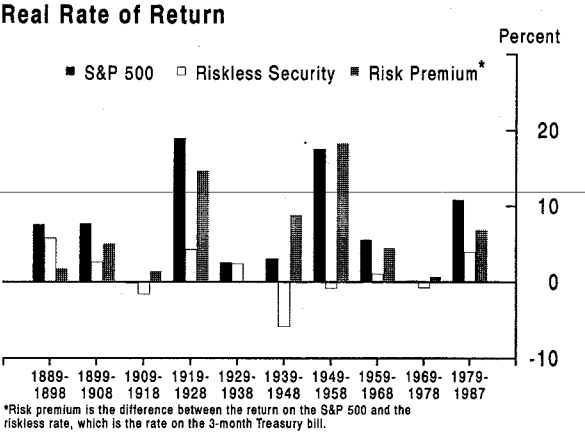
As risk aversion rises, the individual is willing to settle for a smaller and smaller payment with certainty instead of the lottery. Economists have estimated the degree of risk aversion of the average individual in the U.S. economy, and have concluded that most people act as if they are risk averse. These estimates of the average degree of risk aversion suggest that in the example above, most people would be indifferent between receiving a sure $2.30 and the lottery with its expected payoff of $50.50.

U.S. government bonds and stocks are analogous to the example described above. Because there is no default risk associated with U.S. government bonds, they offer a sure payoff. Common stock, on the other hand, entitles holders to the uncertain future flows of dividends and capital gains; they are like the lottery in the example above.

The equity risk premium

The chart shows the consecutive ten-year average realized rates of return on stocks (S&P 500 index) and ninety-day Treasury bills for the hundred-year period from 1889 through 1988. Each rate is adjusted for inflation. The ten-year average equity risk premiums for this hundred-year time span, then, are the differences between the rates of return on stocks and Treasury bills in each ten-year period.

Real Rate of Return



*Risk premium is the difference between the return on the S&P 500 and the riskless rate, which is the rate on the 3-month Treasury bill.

As shown in the chart, the observed risk premium has been quite volatile. This volatility

in the *realized* equity risk premium is not surprising, given that the return on equity itself is quite volatile. The realized return on equity has varied from period to period largely as a result of changes in the level of economic activity, inflation, interest rates, and other factors that have a bearing on the performance of the corporate sector of the economy. In the 1960s and '70s, for example, the unexpected increase in inflation, increased uncertainty regarding inflation, and excessive taxation of corporate income may have been important causes of the poor performance of equity and thus the low observed risk premium in those decades.

Where's the puzzle?

Thus, in any given period, a high or low observation for the equity risk premium should not be surprising. But what is surprising about the data presented in the chart is that on average over the hundred-year period, the observed risk premium has been relatively high, given current estimates of the degree of risk aversion among investors.

Economists have attempted to interpret this finding using so-called equilibrium business cycle models. These models analyze macroeconomic phenomena based upon key behavioral assumptions used in microeconomic theory, including utility maximization by individuals and profit maximization by businesses in markets characterized by perfect competition. These models eschew assumptions that institutional rigidities play an important role in macroeconomic developments. Instead, they assume that macroeconomic developments represent the equilibrium outcomes of fundamental economic forces. Of course, use of these models does not deny that institutional factors at times can have important effects.

In a paper published in 1985, economists Rajnish Mehra of the University of California and Edward Prescott of the University of Minnesota and the Federal Reserve Bank of Minneapolis attempt such an interpretation of the equity risk premium. They construct a model in which the degree of risk aversion of the average individual is one of the key determinants of asset yield.

In their model consumption is assumed to follow a path that is very similar to the consumption series of the U.S. economy over time, but in each period there is uncertainty regarding future consumption. Future consumption is financed with income on equity holdings and income from holdings of a riskless asset. The riskless asset provides a stream of income that is certain, while the equity holdings provide an uncertain stream of income.

The premium that is required for people to be indifferent between the two assets depends on their attitudes toward uncertain future consumption. The more people are averse to risk, the larger is the premium they demand for holding risky equity. Thus, the Mehra-Prescott model gives rise to a systematic relationship between an assumed degree of risk aversion and the average equity premiums.

However, at levels of risk aversion estimated by most economists, the Mehra-Prescott model fails to generate the magnitude of the risk premium that is observed historically. In other words, their model suggests that the public would need to be more risk averse than is now believed to be the case to generate the average magnitude of the equity premium we observe from the chart. It is this finding that has been termed the equity risk premium puzzle. A similar puzzle has been recognized by financial market participants regarding the difference between the returns on high-grade (low-risk) bonds and low-grade (high-risk) bonds.

A solution?

In 1988, T. A. Rietz of Northwestern University published a paper "The Equity Risk Premium: A Solution," which reports results that provide a solution to the puzzle using a model specification very similar to the model of Mehra and Prescott. His solution can be summarized as follows. While retaining other features of the Mehra-Prescott model, Rietz introduces the possibility that the output of the economy and the rate of return on equity can fall dramatically. Although this possibility is assumed to be quite remote, equity holders nonetheless face the risk of very low income from equity sometime in the future. This risk has to be compensated for by an increased average rate of return on equity. By introducing the risk of a remotely-possible, catastrophic decline in equity income, Rietz's

model gives rise to a large equity risk premium that is comparable to the historically observed value.

End of puzzle?

Rietz's approach has merit, given that the U.S. economy has experienced stock market crashes in which equity prices have fallen drastically, including the one in October 1987. The 1929 stock market crash, in particular, is similar to the one posited by Rietz in that it caused a drastic reduction in the rate of return on equity and thus in consumption opportunities available to individuals. However, the similarity is far from perfect.

First, the magnitude of the crash posited by Rietz is far greater than that of the 1929 crash. The *best* of many bad states (which has probability of one percent, or roughly once in 100 years) assumed by Rietz involves a drastic 25 percent reduction in consumption in a single year! To put this in perspective, we can examine the experience during the Great Depression. The shortfall from trend GNP (that is, the difference between the GNP that would have resulted at three percent annual growth and actual GNP) was 38% over the four year period from 1929 through 1933, and only half of that shortfall is attributed to the fall in consumption. Thus, it took four years for real consumption to decrease by 19 percent (about five percent a year). It is hard to imagine that equity holders perceive themselves facing even a small risk of a decline in equity income as devastating as Rietz assumes.

Moreover, even with this dire scenario, Rietz still needs a very high degree of risk aversion to generate a risk premium that is close to the observed average. To use the earlier example of the lottery, Rietz's assumption concerning the magnitude of risk aversion implies that an average person prefers a certain *$1.08* over the prospect of one dollar or 100 dollars with a fifty-fifty chance. This is much too large compared to many empirical estimates of the relative risk aversion parameter. Thus, Rietz does not appear to have fully resolved the puzzle.

Different opinion

In attempting to explain the average magnitude of the equity risk premium over the past 100 years, economists generally have used some key assumptions that are very strong. For example, in the Mehra and Prescott work, preferences are assumed stable over time. However, Nobel laureate economist James Tobin criticizes the widespread use of utility functions that posit stable preferences.

Specifically, the utility function used by both Mehra and Prescott, and Rietz makes a strong prediction about how an individual makes choices involving risk. They assume that a person who prefers a sure $10 to a lottery that pays either $1 or $100 with a fifty-fifty chance also will prefer a sure $100,000 to another lottery that has a fifty-fifty chance of winning $10,000 or $1,000,000. However, precisely because the awards of the second lottery are 10,000 times larger than the awards in the first example, many individuals might not behave as predicted above. In fact, it is reasonable to expect that their choices might also depend on what they already own.

In addition to changing the way in which risk aversion is modelled, resolution of the equity risk premium puzzle might be feasible only when important institutional factors are considered. For example, some economists have suggested that monetary policy may be an important factor because it influences interest rates, inflation, and thus, the desirability of equity as a portfolio choice. Including institutional factors of this nature also may enhance our ability to examine and understand other economic phenomena, as well as helping to explain the equity risk premium puzzle. In any event, thus far, the puzzle is not completely resolved.

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