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# MYOPIC LOSS AVERSION AND THE EQUITY PREMIUM PUZZLE*

SHLOMO BENARTZI AND RICHARD H. THALER

The equity premium puzzle refers to the empirical fact that stocks have outperformed bonds over the last century by a surprisingly large margin. We offer a new explanation based on two behavioral concepts. First, investors are assumed to be "loss averse," meaning that they are distinctly more sensitive to losses than to gains. Second, even long-term investors are assumed to evaluate their portfolios frequently. We dub this combination "myopic loss aversion." Using simulations, we find that the size of the equity premium is consistent with the previously estimated parameters of prospect theory if investors evaluate their portfolios annually.

## I. INTRODUCTION

There is an enormous discrepancy between the returns on stocks and fixed income securities. Since 1926 the annual real return on stocks has been about 7 percent, while the real return on treasury bills has been less than 1 percent. As demonstrated by Mehra and Prescott [1985], the combination of a high equity premium, a low risk-free rate, and smooth consumption is difficult to explain with plausible levels of investor risk aversion. Mehra and Prescott estimate that investors would have to have coefficients of relative risk aversion in excess of 30 to explain the historical equity premium, whereas previous estimates and theoretical arguments suggest that the actual figure is close to 1.0. We are left with a pair of questions: why is the equity premium so large, or why is anyone willing to hold bonds?

The answer we propose in this paper is based on two concepts from the psychology of decision-making. The first concept is *loss aversion*. Loss aversion refers to the tendency for individuals to be more sensitive to reductions in their levels of well-being than to increases. The concept plays a central role in Kahneman and Tversky's [1979] descriptive theory of decision-making under

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uncertainty, prospect theory.[1] In this model, utility is defined over gains and losses relative to some neutral reference point, such as the status quo, as opposed to wealth as in expected utility theory. This utility function has a kink at the origin, with the slope of the loss function steeper than the gain function. The ratio of these slopes at the origin is a measure of loss aversion. Empirical estimates of loss aversion are typically in the neighborhood of 2, meaning that the disutility of giving something up is twice as great as the utility of acquiring it [Tversky and Kahneman 1991; Kahneman, Knetsch, and Thaler 1990].

The second behavioral concept we employ is *mental accounting* [Kahneman and Tversky 1984; Thaler 1985]. Mental accounting refers to the implicit methods individuals use to code and evaluate financial outcomes: transactions, investments, gambles, etc. The aspect of mental accounting that plays a particularly important role in this research is the dynamic aggregation rules people follow. Because of the presence of loss aversion, these aggregation rules are not neutral. This point can best be illustrated by example.

Consider the problem first posed by Samuelson [1963]. Samuelson asked a colleague whether he would be willing to accept the following bet: a 50 percent chance to win $200 and a 50 percent chance to lose $100. The colleague turned this bet down, but announced that he was happy to accept 100 such bets. This exchange provoked Samuelson into proving a theorem showing that his colleague was irrational.[2] Of more interest here is what the colleague offered as his rationale for turning down the bet: "I won't bet because I would feel the $100 loss more than the $200 gain." This sentiment is the intuition behind the concept of loss aversion. One simple utility function that would capture this notion is the following:

$$U(x) = \begin{matrix} x & x \geq 0 \\ 2.5x & x < 0, \end{matrix} \tag{1}$$

1. The notion that people treat gains and losses differently has a long tradition. For example, Swalm [1966] noted this phenomenon in a study of managerial decision making. See Libby and Fishburn [1977] for other early references.

2. Specifically, the theorem says that if someone is unwilling to accept a single play of a bet at any wealth level that could occur over the course of some number of repetitions of the bet (in this case, the relevant range is the colleague's current wealth plus $20,000 to current wealth minus $10,000) then accepting the multiple bet is inconsistent with expected utility theory.

where $x$ is a *change* in wealth relative to the status quo. The role of mental accounting is illustrated by noting that if Samuelson's colleague had this utility function he would turn down one bet but accept two or more *as long as he did not have to watch the bet being played out.* The distribution of outcomes created by the portfolio of two bets {\$400, .25; 100, .50; −\$200, .25} yields positive expected utility with the hypothesized utility function, though of course simple repetitions of the single bet are unattractive if evaluated one at a time. As this example illustrates, when decision-makers are loss averse, they will be more willing to take risks if they evaluate their performance (or have their performance evaluated) infrequently.

The relevance of this argument to the equity premium puzzle can be seen by considering the problem facing an investor with the utility function defined above. Suppose that the investor must choose between a risky asset that pays an expected 7 percent per year with a standard deviation of 20 percent (like stocks) and a safe asset that pays a sure 1 percent. By the same logic that applied to Samuelson's colleague, the attractiveness of the risky asset will depend on the time horizon of the investor. The longer the investor intends to hold the asset, the more attractive the risky asset will appear, so long the investment is not evaluated frequently. Put another way, two factors contribute to an investor being unwilling to bear the risks associated with holding equities, loss aversion and a short evaluation period. We refer to this combination as *myopic loss aversion.*

Can myopic loss aversion explain the equity premium puzzle? Of course, there is no way of demonstrating that one particular explanation is correct, so in this paper we perform various tests to determine whether our hypothesis is plausible. We begin by asking what combination of loss aversion and evaluation period would be necessary to explain the historical pattern of returns. For our model of individual decision making, we use the recent updated version of prospect theory [Tversky and Kahneman 1992] for which the authors have provided parameters that can be considered as describing the representative decision-maker. We then ask, how often would an investor with this set of preferences have to evaluate his portfolio in order to be indifferent between the historical distribution of returns on stocks and bonds? Although we do this several ways (with both real and nominal returns, and comparing stocks with both bonds and treasury bills), the answers

we obtain are all in the neighborhood of one year, clearly a plausible result. We then take the one-year evaluation period as given and ask what asset allocation (that is, what combination of stocks and bonds) would be optimal for such an investor. Again we obtain a plausible result: close to a 50-50 split between stocks and bonds.

## II. Is the Equity Premium Puzzle Real?

Before we set out to provide an answer to an alleged puzzle, we should probably review the evidence about whether there is indeed a puzzle to explain. We address the question in two ways. First, we ask whether the post-1926 time period studied by Mehra and Prescott is special. Then we review the other explanations that have been offered. As any insightful reader might guess from the fact that we have written this paper, we conclude that the puzzle is real and that the existing explanations come up short.

The robustness of the equity premium has been addressed by Siegel [1991, 1992] who examines the returns since 1802. He finds that real equity returns have been remarkably stable. For example, over the three time periods 1802–1870, 1871–1925, and 1926–1990, real compound equity returns were 5.7, 6.6, and 6.4 percent. However, returns on short-term government bonds have fallen dramatically, the figures for the same three time periods being 5.1, 3.1, and 0.5 percent. Thus, there was no equity premium in the first two-thirds of the nineteenth century (because bond returns were high), but over the last 120 years, stocks have had a significant edge. The equity premium does not appear to be a recent phenomenon.

The advantage of investing in stocks over the period 1876 to 1990 is documented in a rather different way by MaCurdy and Shoven [1992]. They look at the historical evidence from the point of view of a faculty member saving for retirement. They assume that 10 percent of the hypothetical faculty member's salary is invested each year, and ask how the faculty members would have done investing in portfolios of all stocks or all bonds over their working lifetimes. They find that faculty who had allocated all of their funds to stocks would have done better in virtually every time period, usually by a large margin. For working lifetimes of only 25 years, all-bond portfolios occasionally do better (e.g., for those retiring in a few years during the first half of the decades of the 1930s and 1940s) though never by more than 20 percent. In

contrast, those in all-stock portfolios often do better by very large amounts. Also, all 25-year careers since 1942 would have been better off in all stocks. For working lifetimes of 40 years, there is not a single case in which the all-bond portfolio wins (though there is a virtual tie for those retiring in 1942), and for those retiring in the late 1950s and early 1960s, stock accumulators would have more than seven times more than bond accumulators. MaCurdy and Shoven conclude from their analysis that people must be "confused about the relative safety of different investments over long horizons" [p. 12].

Could the large equity premium be consistent with rational expected utility maximization models of economic behavior? Mehra and Prescott's contribution was to show that risk aversion alone is unlikely to yield a satisfactory answer. They found that people would have to have a coefficient of relative risk aversion over 30 to explain the historical pattern of returns. In interpreting this number, it is useful to remember that a logarithmic function has a coefficient of relative risk aversion of 1.0. Also, Mankiw and Zeldes [1991] provide the following useful calculation. Suppose that an individual is offered a gamble with a 50 percent chance of consumption of $100,000 and a 50 percent chance of consumption of $50,000. A person with a coefficient of relative risk aversion of 30 would be indifferent between this gamble and a certain consumption of $51,209. Few people can be this afraid of risk.

Previous efforts to provide alternative explanations for the puzzle have been, at most, only partly successful. For example, Reitz [1988] argued that the equity premium might be the rational response to a time-varying risk of economic catastrophe. While this explanation has the advantage of being untestable, it does not seem plausible. (See Mehra and Prescott's [1988] reply.) First of all, the data since 1926 do contain the crash of 1929, so the catastrophe in question must be of much greater magnitude than that. Second, the hypothetical catastrophe must affect stocks and not bonds. For example, a bout of hyperinflation would presumably hurt bonds more than stocks.

Another line of research has aimed at relaxing the link between the coefficient of relative risk aversion and the elasticity of intertemporal substitution, which are inverses of each other in the standard discounted expected utility framework. For example, Weil [1989] introduces Kreps-Porteus nonexpected utility preferences, but finds that the equity premium puzzle simply becomes transformed into a "risk free rate puzzle." That is, the puzzle is no

longer why are stock returns so high, but rather why are T-bill rates so low. Epstein and Zin [1990] also adopt a nonexpected utility framework using Yaari's [1987] "dual" theory of choice. Yaari's theory shares some features with the version of prospect theory that we employ below (namely a rank-dependent approach to probability weights) but does not have loss aversion or short horizons, the two key components of our explanation. Epstein and Zin find that their model can only explain about one-third of the observed equity premium. Similarly, Mankiw and Zeldes [1991] investigate whether the homogeneity assumptions necessary to aggregate across consumers could be the source of the puzzle. They point out that a minority of Americans hold stock, and their consumption patterns differ from nonstockholders. However, they conclude that while these differences can explain a part of the equity premium, a significant puzzle remains.

An alternative type of explanation is suggested by Constantinides [1990]. He proposes a habit-formation model in which the utility of consumption is assumed to depend on past levels of consumption. Specifically, consumers are assumed to be averse to reductions in their level of consumption. Constantinides shows that this type of model can explain the equity premium puzzle. However, Ferson and Constantinides [1991] find that while the habit formation specification improves the ability of the model to explain the intertemporal dynamics of returns, it does not help the model explain the differences in average returns across assets.

While Constantinides is on the right track in stressing an asymmetry between gains and losses, we feel that his model does not quite capture the right behavioral intuitions. The problem is that the link between stock returns and consumption is quite tenuous. The vast majority of Americans hold no stocks outside their pension wealth. Furthermore, most pensions are of the defined benefit variety, meaning that a fall in stock prices is inconsequential to the pension beneficiaries. Indeed, most of the stock market is owned by three groups of investors: pension funds, endowments, and very wealthy individuals. It is hard to see why the habit-formation model should apply to these investors.[3]

3. We stress the word "should" in the previous sentence. Firms may adopt accounting rules with regard to their pension wealth which create a sensitivity to short-run fluctuations in pension fund assets, and foundations may have spending rules that produce a similar effect. An investigation of this issue is presented below.

## III. Prospect Theory and Loss Aversion

The problem with the habit-formation explanation is the stress it places on consumption. The way we incorporate Constantinides' intuition about behavior into preferences is to assume that investors have preferences over returns, per se, rather than over the consumption profile that the returns help provide. Specifically, we use Kahneman and Tversky's [1979, 1992] prospect theory in which utility is defined over gains and losses (i.e., returns) rather than levels of wealth. Specifically, they propose a value function of the following form:

$$v(x) = \begin{cases} x^{\alpha} & \text{if } x \geq 0 \\ -\lambda(-x)^{\beta} & \text{if } x < 0, \end{cases} \tag{2}$$

where $\lambda$ is the coefficient of loss aversion.[4] They have estimated $\alpha$ and $\beta$ to be 0.88 and $\lambda$ to be 2.25. Notice that the notion of loss aversion captures the same intuition that Constantinides used, namely that reductions are painful.[5]

The "prospective utility" of a gamble, $G$, which pays off $x_i$ with probability $p_i$ is given by

$$V(G) = \sum \pi_i v(x_i), \tag{3}$$

where $\pi_i$ is the decision weight associated assigned to outcome $i$. In the original version of prospect theory [Kahneman and Tversky 1979), $\pi_i$ is a simple nonlinear transform of $p_i$. In the cumulative version of the theory [Tversky and Kahneman 1992], as in other rank-dependent models, one transforms cumulative rather than individual probabilities. Consequently, the decision weight $\pi_i$ depends on the cumulative distribution of the gamble, not only on $p_i$. More specifically, let $w$ denote the nonlinear transform of the cumulative distribution of $G$, let $P_i$ be the probability of obtaining an outcome that is at least as good as $x_i$, and let $P_i^*$ be the probability of obtaining an outcome that is strictly better than $x_i$.

4. Note that since $x$ is a change it is measured as the difference in wealth with respect to the last time wealth was measured, so the status quo is moving over time.

5. This value of $\lambda$ is consistent with other measures of loss aversion estimated in very different contexts. For example, Kahneman, Knetsch, and Thaler [1990] (KKT) investigate the importance of loss aversion in a purely deterministic context. In one experiment half of a group of Cornell students are given a Cornell insignia coffee mug, while the other half of the subjects are not given a mug. Then, markets are conducted for the mugs in which mug owners can sell their mug while the nonowners can buy one. KKT found that the reservation prices for two groups were significantly different. Specifically, the median reservation price of the sellers was roughly 2.5 times the median reservation price of the buyers.

Then the decision weight attached to $x_i$ is $\pi_i = w(P_i) - w(P_i^*)$. (This procedure is applied separately for gains and losses.)

Tversky and Kahneman have suggested the following one-parameter approximation:

$$w(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{1/\gamma}} \tag{4}$$

and estimated $\gamma$ to be 0.61 in the domain of gains and 0.69 in the domain of losses.

As discussed in the Introduction, the use of prospect theory must be accompanied by a specification of frequency that returns are evaluated. We refer to the length of time over which an investor aggregates returns as the *evaluation period.* This is not, in any way, to be confused with the planning horizon of the investor. A young investor, for example, might be saving for retirement 30 years off in the future, but nevertheless experience the utility associated with the gains and losses of his investment every quarter when he opens a letter from his mutual fund. In this case his horizon is 30 years but his evaluation period is 3 months.

That said, in terms of the model an investor with an evaluation period of one year behaves very much *as if* he had a planning horizon of one year. To see this, compare two investors. Mr. X receives a bonus every year on January first and invests the money to spend on a Christmas vacation the following year. Both his planning horizon and evaluation period are one year. Ms. Y has received a bonus and wishes to invest it toward her retirement 30 years away. She evaluates her portfolio annually. Thus, she has a planning horizon of 30 years but a one-year evaluation period. Though X and Y have rather different problems, in terms of the model they will behave approximately the same way. The reason for this is that in prospect theory, the carriers of utility are assumed to be changes in wealth, or returns, and the effect of the level of wealth is assumed to be second order. Therefore, every year Y will solve her asset allocation problem by choosing the portfolio that maximizes her prospective utility one year away, just as X does.[6] In this sense, when we estimate the evaluation period of investors below, we are also estimating their implicit time horizons.

Of course, in a model with loss aversion, the more often an

6. An important potential qualification is if recent gains or losses influence subsequent decisions. For example, Thaler and Johnson [1990] find evidence for a "house money effect." Namely, people who have just won some money exhibit less loss aversion toward gambles that do not risk their entire recent winnings.

investor evaluates his portfolio, or the shorter his horizon, the less attractive he will find a high mean, high risk investment such as stocks. This is in contrast to the well-known results of Merton [1969] and Samuelson [1969]. They investigate the following question. Suppose that an investor has to choose between stocks and bonds over some fixed horizon of length $T$. How should the allocation change as the horizon increases? There is a strong intuition that a rational risk-averse investor would decrease the proportion of his assets in stocks as he nears retirement and $T$ approaches zero. The intuition comes from the notion that when $T$ is large, the probability that the return on stocks will exceed the return on bonds approaches 1.0, while over short horizons there can be substantial shortfalls from stock investments. However, Merton and Samuelson show that this intuition is wrong. Specifically, they prove that as long as the returns on stocks and bonds are a random walk,[7] a risk-averse investor with utility function that displays constant relative risk in aversion (e.g., a logarithmic or power function) should choose the same allocation for any time horizon. An investor who wants mostly stocks in his portfolio at age 35 should still want the same allocation at age 64. Without questioning the normative validity of Merton and Samuelson's conclusions, we offer a model that can reveal why most investors find this result extremely counterintuitive.

## IV. How Often Are Portfolios Evaluated?

Mehra and Prescott asked the question, how risk averse would the representative investor have to be to explain the historical equity premium? We ask a different question. If investors have prospect theory preferences, how often would they have to evaluate their portfolios to explain the equity premium? We pose the question two ways. First, what evaluation period would make investors indifferent between holding all their assets in stocks or bonds. We then take this evaluation period and ask a question with more theoretical justification. For an investor with this evaluation period, what combination of stocks and bonds would maximize prospective utility?

We use simulations to answer both questions. The method is to draw samples from the historical (1926–1990) monthly returns

7. If stock returns are instead mean reverting, then the intuitive result that stocks are more attractive to investors with long horizons holds.

on stocks, bonds, and treasury bills provided by CRSP. For the first exercise we then compute the prospective utility of holding stocks, bonds, and T-bills for evaluation periods starting at one month and then increasing one month at a time.

The simulations are conducted as follows. First, distributions of returns are generated for various time horizons by drawing 100,000 $n$-month returns (with replacement) from the CRSP time series.[8] The returns are then ranked, from best to worst, and the return is computed at twenty intervals along the cumulative distribution.[9] (This is done to accommodate the cumulative or rank-dependent formulation of prospect theory.) Using these data, it is possible to compute the prospective utility of the given asset for the specified holding period.

We have done this simulation four different ways. The CRSP stock index is compared both with treasury bill returns and with five-year bond returns, and these comparisons are done both in real and nominal terms. While we have done all four simulations for the sake of completeness, and to give the reader the opportunity to examine the robustness of the method, we feel that the most weight should be assigned to the comparison between stocks and bonds in nominal terms. We prefer bonds to T-bills because we think that for long-term investors these are the closest substitutes. We prefer nominal to real for two reasons. First, returns are usually reported in nominal dollars. Even when inflation adjusted returns are calculated, it is the nominal returns that are given prominence in most annual reports. Therefore, in a descriptive model, nominal returns should be the assumed units of account. Second, the simulations reveal that if investors were thinking in real dollars they would not be willing to hold treasury bills over any evaluation period as they always yield negative prospective utility.[10]

8. Our method, by construction, removes any serial correlation in asset price returns. Since some research does find mean reversion in stock prices over long horizons, some readers have worried about whether our results are affected by this. This should not be a concern. The time horizons we investigate in the simulations are relatively short (in the neighborhood of one year) and at short horizons there is only trivial mean reversion. For example, Fama and French [1988] regress returns on the value weighted index in year $t$ on returns in year $t - 1$ and estimate the slope coefficient to be $-0.03$. The fact that there is substantial mean reversion at longer horizons (the same coefficient at three years is $-0.25$) only underscores the puzzle of the equity premium since mean reversion reduces the risk to a long-term investor.

9. We have also tried dividing the outcomes into 100 intervals instead of 20, and the results are substantially the same.

10. This suggests a solution to the "risk-free rate puzzle" employing a combination of framing and money illusion. In nominal terms, treasury bills offer the illusion of a sure gain which is very attractive to prospect theory investors, while

The results for the stock and bond comparisons are presented in Figure I, panels A and B. The lines show the prospective value of the portfolio at different evaluation periods. The point where the curves cross is the evaluation period at which stocks and bonds are equally attractive. For nominal returns, the equilibrium evaluation period is about thirteen months, while for real returns it is between ten and eleven months.[11]

How should these results be interpreted? Obviously, there is no single evaluation period that applies to every investor. Indeed, even a single investor may employ a combination of evaluation periods, with casual evaluations every quarter, a more serious evaluation annually, and evaluations associated with long-term planning every few years. Nevertheless, if one had to pick a single most plausible length for the evaluation period, one year might well be it. Individual investors file taxes annually, receive their most comprehensive reports from their brokers, mutual funds, and retirement accounts once a year, and institutional investors also take the annual reports most seriously. As a possible evaluation period, one year is at least highly plausible.

There are two reasonable questions to ask about these results. Which aspects of prospect theory drive the results, and how sensitive are the results to alternative specifications? The answer to the first question is that loss aversion is the main determinant of the outcomes. The specific functional forms of the value function and weighting functions are not critical. For example, if the weighting function is replaced by actual probabilities, the evaluation period for which bonds have the same prospective utility as stocks falls from eleven–twelve months to ten months. Similarly, if actual probabilities are used and the value function is replaced by a piecewise linear form with a loss aversion factor of 2.25 (that is, $v(x) = x, x \geq 0$, $v(x) = 2.25\ x, x < 0$), then the equilibrium evaluation period is eight months. With this model (piecewise linear value function and linear probabilities) a twelve-month evaluation period is consistent with a loss aversion factor of 2.77.

The previous results can be criticized on the grounds that investors form portfolios rather than choose between all bonds or all stocks. Therefore, we perform a second simulation exercise that is grounded in an underlying optimization problem. We use this as

in real terms treasury bills offer a combination of barely positive mean returns and a substantial risk of a loss—not an attractive combination.

11. The equilibrium evaluation period between stocks and T-bills is about one month less in both real and nominal dollars.

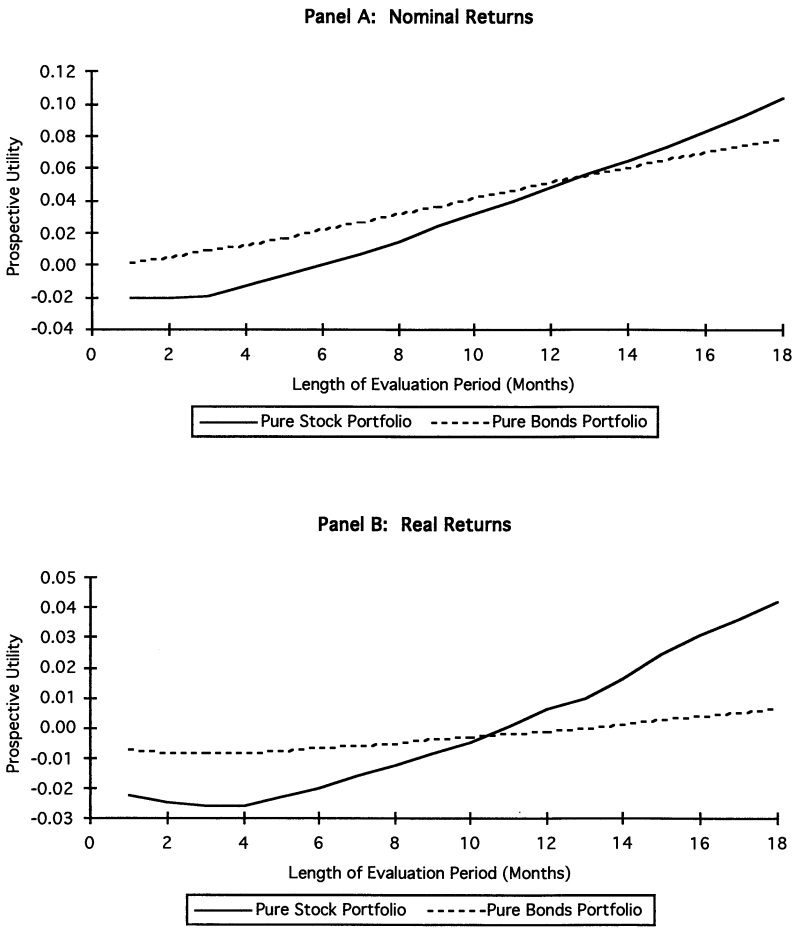


FIGURE I
Prospective Utility as Function of the Evaluation Period

a reliability check on the previous results. Suppose that an investor is maximizing prospective utility with a one-year horizon. What mix of stocks and bonds would be optimal? We investigate this question as follows. We compute the prospective utility of each portfolio mix between 100 percent bonds and 100 percent stocks, in 10 percent increments. The results are shown in Figure II, using nominal returns. (Again, the results for real returns are similar.) As the figure shows, portfolios between about 30 percent and 55 percent stocks all yield approximately the same prospective value.

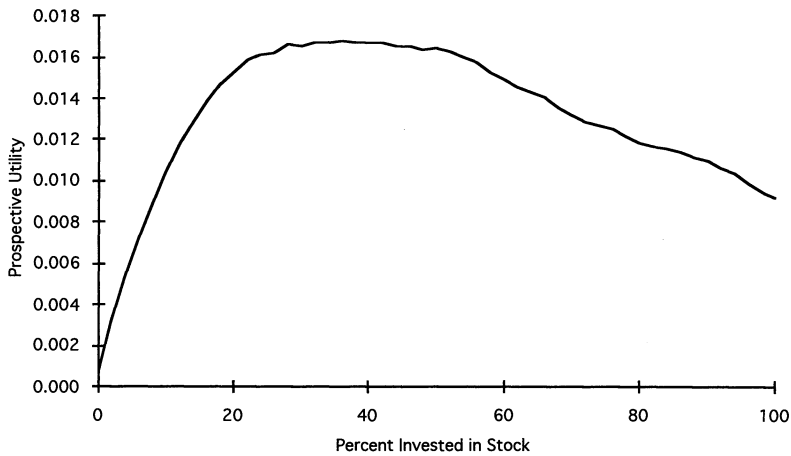


FIGURE II
Prospective Utility as Function of Asset Allocation (One-Year Evaluation Period)

Once again, this result is roughly consistent with observed behavior. For example, Greenwich Associates reports that institutions (primarily pensions funds and endowments) invest, on average, 47 percent of the assets on bonds and 53 percent in stocks. For individuals, consider the participants in TIAA-CREF, the defined contribution retirement plan at many universities, and the largest of its kind in the United States. The most frequent allocation between CREF (stocks) and TIAA (mostly bonds) is 50-50, with the average allocation to stocks below 50 percent.[12]

## V. MYOPIA AND THE MAGNITUDE OF THE EQUITY PREMIUM

According to our theory, the equity premium is produced by a combination of loss aversion and frequent evaluations. Loss aver-

12. See MaCurdy and Shoven [1992] for illustrative data. It is interesting to note that average allocation of new contributions is now and has always been more than half in TIAA, but the size of the two funds is now about equal because of the higher growth rate of CREF. As Samuelson and Zeckhauser [1988] report, the typical TIAA—CREF participant makes one asset allocation decision and never changes it. This does not seem consistent with any coherent optimization. Consider a contributor who has been dividing his funds equally between TIAA and CREF, and now has two-thirds of his assets in CREF because of higher growth. If he likes the 2-1 ratio of stocks to bonds consistent with his asset holdings, why not change the flow of new funds? But if a 50-50 allocation is optimal, then why not switch some of the existing CREF holdings into TIAA (which can be done costlessly)?

sion plays the role of risk aversion in standard models, and can be considered a fact of life (or, perhaps, a fact of preferences). In contrast, the frequency of evaluations is a policy choice that presumably could be altered, at least in principle. Furthermore, as the charts in Figure I show, stocks become more attractive as the evaluation period increases. This observation leads to the natural question: by how much would the equilibrium equity premium fall if the evaluation period increased?

Figure III shows the results of an analysis of this issue using real returns on stocks, and the real returns on five-year bonds as the comparison asset. With the parameters we have been using, the actual equity premium in our data (6.5 percent per year) is consistent with an evaluation period of one year. If the evaluation period were two years, the equity premium would fall to 4.65 percent. For five, ten, and twenty-year evaluation periods, the corresponding figures are 3.0 percent, 2.0 percent, and 1.4 percent. One way to think about these results is that for someone with a twenty-year investment horizon, the psychic costs of evaluating the portfolio annually are 5.1 percent per year! That is, someone with a twenty-year horizon would be indifferent between stocks and bonds if the equity premium were only 1.4 percent, and the remaining 5.1 percent is potential rents payable to those who are

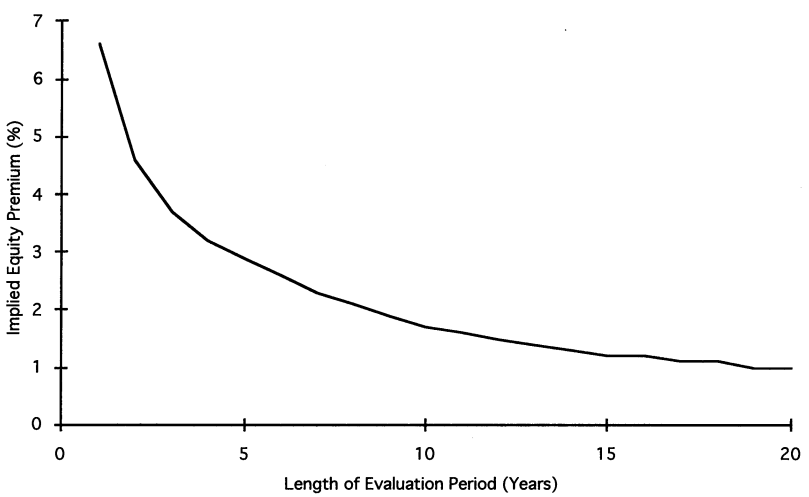


FIGURE III
Implied Equity Premium as Function of the Evaluation Period

able to resist the temptation to count their money often. In a sense, 5.1 percent is the price of excessive vigilance.[13]

## VI. Do Organizations Display Myopic Loss Aversion?

There is a possible objection to our explanation in that it has been based on a model of *individual* decision-making, while the bulk of the assets we are concerned with are held by organizations, in particular pension funds and endowments. This is a reasonable concern, and our response should help indicate the way we interpret our explanation.

As we stressed above, the key components of our explanation are loss aversion and frequent evaluations. While we have used a specific parameterization of cumulative prospect theory in our simulation tests, we did so because we felt that it provided a helpful discipline. We did not allow ourselves the luxury of selecting the parameters that would fit the data best. That said, it remains true that almost any model with loss aversion and frequent evaluations will go a long way toward explaining the equity premium puzzle, so the right question to ask about organizations is whether they display these traits.

### *A. Pension Funds*

Consider first the important case of defined benefit pension funds. In this, this most common type of pension plan, the firm promises each vested worker a pension benefit that is typically a function of final salary and years of service. For these plans, the firm, not the employees, is the residual claimant. If the assets in the plan earn a high return, the firm can make smaller contributions to the fund in future years, whereas if the assets do not earn a high enough return, the firm's contribution rate will have to increase to satisfy funding regulations.

Although asset allocations vary across firms, a common allocation is about 60 percent stocks and 40 percent bonds and treasury bills. Given the historical equity premium, and the fact that pension funds have essentially an infinite time horizon, it is a bit puzzling why pension funds do not invest a higher proportion in stocks.[14] We argue that myopic loss aversion offers an explanation.

13. Blanchard [1993] has recently argued that the equity premium has fallen. If so, then our interpretation of his result would be that the length of the average evaluation period has increased.

14. See Black [1980] for a different point of view. He argues that pension funds should be invested entirely in bonds because of a tax arbitrage opportunity. However, his position rests on the efficient market premise that there is no equity

In this context the myopic loss aversion is produced by an agency problem.

While the pension *fund* is indeed likely to exist as long as the company remains in business (barring a plan termination), the pension fund *manager* (often the corporate treasurer, chief financial officer (CFO), or staff member who reports to the CFO) does not expect to be in this job forever. He or she will have to make regular reports on the funding level of the pension plan and the returns on the funds assets. This short horizon creates a conflict of interest between the pension fund manager and the stockholders.[15] This view appears to be shared by two prominent Wall Street advisors. In Leibowitz and Langetieg [1989] the authors make numerous calculations regarding the long-term results of various asset allocation decisions. They conclude as follows:

> If we limit our choice to "stocks" and "bonds" as represented by the S&P 500 and the BIG Index, then under virtually any reasonable set of assumptions, stocks will almost surely outperform bonds as the investment horizon is extended to infinity. Unfortunately, most of us do not have an infinite period of time to work out near term losses. Most investors and investment managers set personal investment goals that must be achieved in time frames of 3 to 5 years . . ." [p. 14].

Also, when discussing simulation results for twenty-year horizons under so-called favorable assumptions (e.g., that the historic equity premium and mean reversion in equity returns will continue) they offer the following remarks. "[Our analysis] shows that, under 'favorable' assumptions, the stock/bond [return] ratio will exceed 100% most of the time. *However, for investors who must account for near term losses, these long-run results may have little significance*" [p. 15, emphasis added]. In other words, agency costs produce myopic loss aversion.[16]

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premium puzzle; that is, the return on stocks is just enough to compensate for the risk.

15. The importance of short horizons in financial contexts is stressed by Shleifer and Vishny [1990]. For a good description of the agency problems in defined-benefit pension plans see Lakonishok, Shleifer, and Vishny [1992]. Our agency explanation of myopic loss aversion is very much in the same spirit of the one they offer to explain a different puzzle: why the portion of the pension fund that *is* invested in equities is invested so poorly. The equity component of pension plans systematically underperforms market benchmarks such as the S&P 500. Although pension fund managers eschew index funds, they often inadvertently achieve an inferior version of an index fund by diversifying across money managers who employ different styles. The portfolio of money managers is worse on two counts: lower performance and higher fees.

16. Of course, many observers have accused American firms of myopia. The pension asset allocation decision may be a useful domain for measuring firms' horizons.

*B. Foundation and University Endowments*

Another important group of institutional investors is endowment funds held by universities and foundations. Once again, an even split between stocks and bonds is common, although the endowment funds are explicitly treated as perpetuities. In this case, however, there appear to be two causes for the myopic loss aversion. First, there are agency problems similar to those for pension plans. Consider a foundation with 50 percent of its assets invested in stocks. Suppose that the president of the foundation wanted to increase the allocation to 100 percent, arguing that with an infinite horizon, stocks are almost certain to outperform bonds. Again the president will face the problem that his horizon is distinctly finite *as are the horizons of his board members.* In fact, there is really no one who represents the interests of the foundation's potential beneficiaries in the twenty-second century. This is an agency problem without a principal!

An equally important source of myopic loss aversion comes from the spending rules used by most universities and foundations. A typical rule specifies that the organization can spend $x$ percent of an $n$-year moving average of the value of the endowment, where $n$ is typically five or less.[17] Although the purpose of such moving averages is to smooth out the impact of stock market fluctuations, a sudden drop or a long bear market can have a pronounced effect on spending. The institution is forced to choose between the competing goals of maximizing the present value of spending over an infinite horizon, and maintaining a steady operating budget. The fact that stocks have outperformed bonds over every twenty-year period in history is cold comfort after a decade of zero nominal returns, an experience most institutions still remember.

There is an important difference between universities (and operating foundations) and individuals saving for retirement. For an individual saving for retirement, it can be argued that the only thing she should care about is the size of the annuity that can be purchased at retirement, i.e., terminal wealth. Transitory fluctuations impose only psychic costs. For universities and operating foundations, however, there is both a psychic cost to seeing the value of the endowment fall and the very real cost of cutting back programs if there is a cash flow reduction for a period of years. This in no way diminishes the force of the myopic loss aversion

17. Foundations also have minimum spending rules that they have to obey to retain their tax-free status.

explanation for the equity premium. If anything, the argument is strengthened by the existence of economic factors contributing to loss aversion. Nevertheless, institutions could probably do better at structuring their spending rules to facilitate a higher exposure to risky assets.

## VII. CONCLUSIONS

The equity premium *is* a puzzle within the standard expected utility-maximizing paradigm. As Mehra and Prescott forcefully argue, it seems impossible to reconcile the high rates of return on stocks with the very low risk-free rate. How can investors be extremely unwilling to accept variations in returns, as the equity premium implies, and yet be willing to delay consumption to earn a measly 1 percent per year? Our solution to the puzzle is to combine a high sensitivity to losses with a prudent tendency to frequently monitor one's wealth. The former tendency shifts the domain of the utility function from consumption to returns, and the latter makes people demand a large premium to accept return variability. In our model investors are unwilling to accept return variability even if the short-run returns have no effect on consumption.

In their reply to Reitz, Mehra and Prescott [1988] offer the following guidelines for what they think would constitute a solution to the equity premium puzzle. "Perhaps the introduction of some other preference structure will do the job. . . . For such efforts to be successful, though, they must convince the profession that the proposed alternative preference structure is more useful than the now-standard one for organizing and interpreting not only these observations on average asset returns, but also other observations in growth theory, business cycle theory, labor market behavior, and so on" [p. 134]. While prospect theory has not yet been applied in all the contexts Mehra and Prescott cite, it has been extensively tested and supported in the study of decision-making under uncertainty, and loss aversion appears to offer promise as a component of an explanation for unemployment[18] and for understanding the outcomes in many legal contexts.[19] For this reason, we believe that myopic loss aversion deserves consideration as a possible solution to Mehra and Prescott's fascinating puzzle.

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18. For example, Kahneman, Knetsch, and Thaler [1986] find that perceptions of fairness in labor market contexts are strongly influenced by whether actions are framed as imposing losses or reducing gains.
19. See Hovenkamp [1991].

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