

Risk Taking by Mutual Funds as a Response to Incentives

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An “agency problem” exists when one person (the agent) is hired to act as on the behalf of another person (the principal) and their interests diverge, so that the agent acts in ways that are not in the best interests of the principal.

One example is the relationship between the investors and managers of a mutual fund. Investors would like the fund to maximize risk-adjusted returns. Mutual fund companies, however, are motivated by their own profits. Further, the information they possess and how they use it are not directly observable by investors. As a result, if actions that maximize fund company profits differ from actions that maximize investor risk-adjusted returns, we would expect the fund to choose the actions that maximize profits.

Most fund companies receive a percentage of fund assets as compensation. Articles in the press often argue that fund companies have poor incentives to maximize returns for investors since fund compensation isn't explicitly tied to fund performance. But obviously funds do face a powerful *implicit* performance incentive, since the fund company's fees depend on the size of its assets—the fund company's income rises when new investment flows into the fund and falls when investment flows out. (This is true as long as the fund company's costs do not rise at a greater rate than its assets. Most accounts of the fund industry suggest that costs do rise more slowly than assets, except possibly for the very largest funds.)

This implicit incentive should work well. New investments flow into funds that perform well, while investment flows out of funds that perform poorly. Actions that lead to investment inflows will also tend to be actions that increase risk-adjusted returns for investors. When this is the case, there is no conflict. However, the fund's goal of asset inflow and the investor's goal of maximizing returns *may* sometimes be in conflict. These conflicts could occur when fund managers make decisions about the riskiness of the fund.

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In the first part of our paper, we estimate the shape of the flow-performance relationship. If managers maximize the expected inflow of investment into the fund, the shape of the flow-performance relationship could potentially affect the manager's incentives to alter the riskiness of the fund.

For example, suppose we were to show that the flow of assets increases slowly with performance, but that there is a very sharp increase in the flow of assets into a fund when a fund ends the year 15 points ahead of the market. (This could occur because funds with exceptional performance records appear in 'top funds' lists and receive considerable press coverage.)

Consider the incentives of a manager who, in September, finds his fund to be 14 points ahead of the market. What are this manager's incentives? If he were to continue to match the performance of the market, he would end up the year 14 points ahead. However, that is not good enough to generate the extraordinarily large increase in flow that stems, in our scenario, from beating the market by 15 points. Obviously, if the manager knew of some investment that would guarantee a 15-point return, he or she would invest. The manager's interests would not diverge from those of the shareholders.

Instead, suppose that the manager had an investment opportunity that had a 50 percent chance of leading the fund to lose 2 points by year's end and a 50 percent chance of leading the fund to gain 2 points. The manager would be eager to take this gamble. If the gamble pays off, the fund earns a sharp increase in asset flow. If the gamble fails, the fund loses assets, but the loss is not as great as the gain that comes from success. In other words, the gamble leads to an *expected* increase in assets under management and an increase in the fund company's fees. In this way,

the shape of the flow-performance relationship affects the manager's incentives to take risks.

We interpret the shape of the flow-performance relationship as an implicit incentive scheme. In the second part of the paper we use new data on mutual fund portfolio holdings to examine whether managers do in fact alter mutual fund portfolios in a manner consistent with fund company incentives toward the end of the year. Our paper is similar to two other papers on risk taking: Brown, Harlow and Starks (1996) and Roston (1996). The first paper looks at whether mutual funds whose performance is behind the market in the first part of the year have more variable returns during the rest of the year than do mutual funds that were ahead of the market. The authors discuss why "tournaments" among mutual fund managers might produce this pattern. Roston (1996) examines whether the shape of the flow-performance relationship and the unsystematic risk level of a mutual fund change systematically as the fund ages. We provide a more detailed view of risk taking, and most important, explore the connections between risk

taking and the incentives created by market demand.

Our analysis exploits new data that contain the complete equity portfolios of many mutual funds both at the end of September and at the end of December of a given year. We find that changes in the riskiness of funds' portfolios are related to the incentives we identified, and that the changes correspond to the estimated incentives in some detail.

The Data

We obtained virtually all of the data used in this paper from Morningstar Inc. The primary data source is Morningstar's January 1994 *Mutual Funds OnDisc*. From this CD-ROM, we got data on mutual fund returns, assets under management, minimum initial purchase requirements, and expense ratios as well as information on whether the fund had ever been involved in a merger.

Reporting to Morningstar is voluntary, and we have portfolio data for only a minority of the fund-years in this database. In addition, the frequencies with which portfolios are available varies with the fund: some portfolios are available quarterly or more frequently, some only at the end of the year, and some at sporadic intervals. Much of our analysis focuses on 839 cases (involving 398 different funds) where we have the portfolios at both the end of September and the end of December of the same year.

In order to measure risk, we matched the portfolio holdings to the Center for Research in Security Prices database. For each fund-date for which portfolio data were available, the Morningstar database contained the name of the security, number of shares of the security, and value of the holding. Unfortunately, the database did not contain security identifiers and frequently did not contain ticker symbols—the tickers are missing for 80,435 of the 121,895 security records in the 1,678 portfolios (2 times 839). For each holding in the database, we attempted to match the security names to the CRSP data, using the price data to verify our match. At the end of this process, we were able to find matches for 92.5 percent of the security records. A variety of things appears in the lists of unmatched securities: foreign securities, holdings of shares in other mutual funds, securities where the prices in the Morningstar data may be incorrect, and securities that may be in CRSP but for which we could not find the match.

Estimating the Flow-Performance Relationship

Previous research on investment flows and past performance has demonstrated that consumers react strongly

to historical returns. We want to understand what incentives this creates for funds to manipulate the risk of their portfolios, and how these incentives vary both over time as returns are realized and cross-sectionally with fund attributes. Incentives are affected both by the sensitivity of investment flow to fund performance and by the shape of the flow-performance relationship. Hence, we begin with an analysis of the flow-performance relationship.

A model of the flow-performance relationship

What are the effects of past performance and other characteristics on the flow of investments into a fund? Our model maps the effect of year t excess returns on investment flows in year $t + 1$. We use an econometric technique, semiparametric analysis, to examine the shape of the relationship between year t excess returns and investment flows in year $t + 1$. A semiparametric specification is like a linear regression in which we fit a relationship between flow and performance. The distinction, however, is that we do not force the relationship between flow and performance to be a straight line. What we produce is essentially a smoothed version of the scatterplot, which shows the relationship between flow and performance, controlling for some other variables that might affect the flow of funds into a mutual fund.

Our dependent variable—the variable we are trying to explain—is the proportional growth in total assets under management for the fund between the start and end of year $t + 1$ *net* of internal growth in year t (assuming reinvestment of dividends and distributions). The measure of performance in our model, $r^{it} - r^{mt}$, is the simple linear difference between a fund's return and the return on a value-weighted market index. We focus on the relationship between year t excess returns and year $t + 1$ flows.

If it is true that consumers infer the quality of a fund from historical data, we would expect to find investment flows for younger funds to be more sensitive to recent performance, so we divided the data into “young” (two- to five-years-old) and “old” (six-years-old or older) funds. We separately estimated the shape of the flow-performance relationship for each subsample. However, even within these subsamples, flow might be more sensitive to performance for younger funds than for older funds. To address this, we divided the data into finer age categories. We forced the flow-performance relationship to have the same basic shape within each of the two subsamples, but we allowed the relationship to be displaced up or down and stretched or shrunken for the fund age categories within the subsamples.

The diagram we produce shows the relationship between the flow of new assets into a mutual fund in year

$t + 1$ and the fund's performance in year t . However, many variables other than past performance might help to explain the flow of funds. In the analysis used to create the diagram, we also allow the flow of funds to depend on the following variables:

- 1) the fund's return relative to the market for years $t - 1$ and $t - 2$
- 2) the market adjusted return in year $t + 1$ is included to reflect both flows in response to intrayear returns and the fact that funds with high returns in year $t + 1$ exhibit additional growth due to the internal growth of investments made before the end of year $t + 1$.
- 3) the growth in total assets under management by the equity mutual fund industry (taken from the 1994 *Mutual Fund Factbook*)
- 4) a measure of fund size (the natural logarithm of the ratio of total assets under management by the fund at the end of year t to the (geometric) mean of assets under management across all funds in the sample.)

Thus, we have taken out the variation in flow attributable to the control variables above in order to focus on the relationship between immediate past performance and investment flow. The reader should interpret the relationship between flow and fund performance as a relationship for a hypothetical fund that has the mean values of the variables enumerated above.

Data

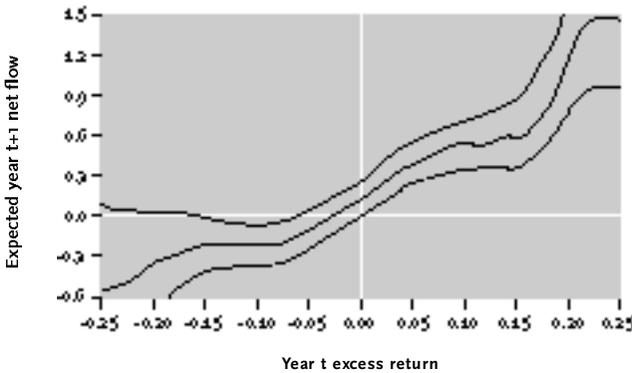
The data on which we estimate our flow regressions contain information on flows into 449 growth and growth-and-income mutual funds during all years between 1983 and 1993 for which the funds were active. We estimated our specifications on a sample of 3,036 fund-years that consists of all observations meeting our criteria. First, we removed funds that were closed to new investors, funds that are primarily institutional (which we defined as having a minimum initial purchase of at least \$25,000), and funds that have very high expense ratios (in excess of 4 percent). We also eliminated funds that merged with other funds in year $t + 1$ (and hence have misleading growth rates) and two groups of funds for which the flow data were exceptionally noisy: funds less than two-years-old at the end of year t and funds with less than \$10 million dollars in assets at the end of year t .

Results

We begin with the estimated shapes for the flow-performance relationship. Figure 1 presents a graph of the flow-performance relationship obtained from the subset of young funds, along with pointwise 90 percent confidence bands. The graph may be interpreted as presenting the expected growth rate in year $t + 1$ of a two-year-old fund as a function of its year t excess return (assuming also that the fund's excess return is zero in years $t - 2$, $t - 1$, and $t + 1$, that the fund's total assets match the geometric mean of our sample, and that the industry as a whole experiences zero growth). For example, such a fund would be expected to grow by approximately 15 percent in year $t + 1$ if its year t return matches the return on the market, and to grow by approximately 55 percent if its return is 10 points greater than the market return.

FIGURE 1: Flow-Performance Relationship

Funds of Age 2



The relationship in Figure 1 is roughly consistent with a situation in which investors try to assess the quality of various funds. When the firm's return is 15 or more points below the market, funds flow out quickly, as if even investors who pay little attention take notice of the fund's poor performance. For somewhat less disastrous results (between 15 and 8 points below the market) the curve appears to be largely flat, as if the fund attracts few or no new investors but does retain many of its old investors. At more typical performance levels, flow is increasing in year t excess returns. The marginal value of each unit of return appears to diminish once the excess return reaches 10 points and then increases sharply at excess return levels above 15 points.

This pattern is consistent with a model where very large returns bring sharply higher flows as a fund starts to make annual “Best Fund” lists and comes to the attention of uninformed investors.

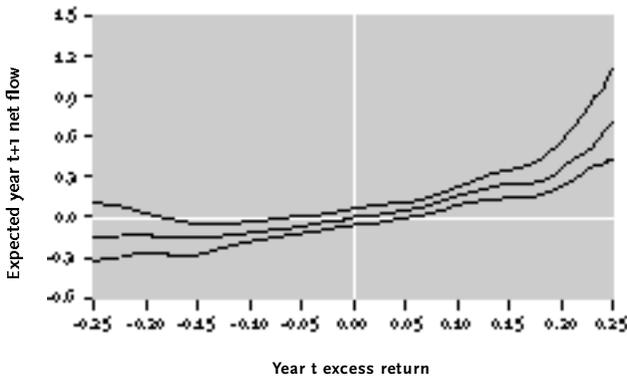
For our purposes, though, why the flow-performance relationship has the shape it has does not really matter. We think of the shape as an empirical fact and will be concerned in the next two sections with the incentives to manipulate riskiness that derive from it.

The flow-performance function estimated for older funds—age 11 years and above (and 90 percent confidence bands)—is presented in Figure 2. The flows for these funds are clearly less sensitive to year t excess returns than are those for two-year-old funds, never falling below -15 percent or rising above 75 percent for a fund whose return is within 25 points of the market. The most striking feature of this graph, its convex shape, suggests that incentives to carry unsystematic risk may be universal.

In contrast to the pattern for younger funds we do not see outflows increase dramatically at the worst performance levels. Flows do, however, again increase sharply for the best performing funds.

FIGURE 2: **Flow-Performance Relationship**

Funds of Age > 10



Estimating risk incentives

The flow-performance relationship, viewed as an incentive scheme, may induce mutual funds to manipulate the riskiness of their portfolios toward the end of the year. Given that a mutual fund wishes to maximize its value as a concern, how might it have an incentive to distort its portfolio?

Consider the case of a two-year-old fund that, by the end of September of year t , has fallen 8 percentage points behind the market and is confronted by the flow-performance relationship described in Figure 1.

If the fund holds its position relative to the market for the remainder of the year it will finish the year 8 points down and see an expected outflow of 14 percent of its value in year $t + 1$. If in the final quarter the fund loses 5 more points and finishes the year 13 points behind the market the outflow will be about the same. But if the fund outperforms the market by 5 points in the final quarter it will finish the year 3 points behind—a position sufficient to provide a small inflow in year $t + 1$. Clearly, the fund's expected size at the end of year $t + 1$ is far greater if it holds a portfolio that is equally likely to gain or lose 5 points than if it indexes the market. In other words, the fund manager has little to lose by gambling to catch up with the market.

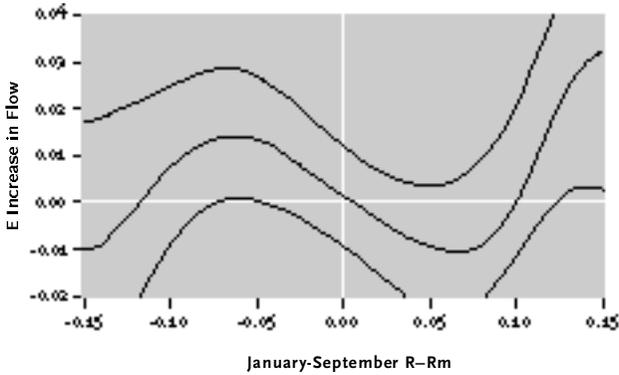
In contrast, suppose the fund were instead 8 points ahead of the market by the end of September. Inflows would now be only slightly higher with a small improvement in performance, but would be sharply lower with an inferior performance. Hence, the fund benefits from playing safe and locking in its gains throughout the fourth quarter.

The incentives to alter the riskiness of a portfolio derive from the fact that flows are a non-linear function of calendar year returns. Why should we believe that there is something magic about calendar year returns? The return in the most recent calendar year is important because calendar year data are the most heavily publicized data. Many news, business, and financial publications publish calendar year returns. Comprehensive fund listings (like Morningstar's) also publish annual returns. While a number of sources report return data more frequently, it is only necessary for our argument that a nonnegligible fraction of consumers rely on annual data.

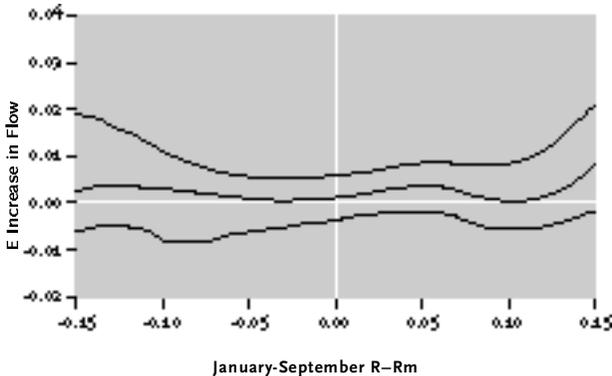
The upper panel of Figure 3 converts the flow-performance relationship for young funds into the incentives to take risks created by the flow-performance relationship. The figure presents the expected increase in the year $t + 1$ growth rate of a two-year-old fund that increases its risk in the fourth quarter of year t from the sample average to 50 percent above this average. The estimates in the figure indicate that funds that are behind the market have an incentive to gamble to catch up, while funds ahead of the market have an incentive to lock in their gains. The figure also suggests that these incentives reverse at extreme positions: funds that are well behind the market may want to reduce their risk, while funds that are well ahead of the market may have a strong incentive to gamble. The figure also quantifies the incentives. Such an increase in risk increases the expected growth rate of a fund that is somewhat behind the market by 1 percentage point, and may increase the expected growth rate of a fund that is well above the market by over 3 percentage points.

FIGURE 3: Risk Incentive

Funds of Age 2 w/90% Confidence Bands



Funds of Age > 10 w/90% Confidence Bands



The lower panel of Figure 3 presents the corresponding graph for 11-year-old and older funds. Note first that, as might be expected, the estimated incentives are much weaker than for the two-year-old funds. The potential increase in the year $t + 1$ growth rate is estimated to exceed one-half of 1 percentage point only for funds that are very far above the market. In addition, the pattern of the estimated incentives is much less striking. The older funds have an incentive to increase their risk toward the end of the year, but we do not observe clearly defined regions where the incentives are much stronger or weaker. While the confidence bands are tighter for older funds, we are unable in a pointwise test to reject the notion that the incentive at any intermediate return level is zero.

Do Funds Alter their Risk in Response to these Incentives?

We now come to the question that most interests us: Do mutual funds adjust the riskiness of their portfolios in response to the incentives created by the flow-performance relationship? We have already seen that the incentive of a mutual fund to hold unsystematic risk in its portfolio is affected by the fund's position relative to the market at the end of September. How do mutual funds actually alter their portfolios between the end of September and the end of December?

To answer this question, we looked at data on fund equity, data that contain complete listings of the common stock holdings of 398 growth and growth-and-income mutual funds at both the end of September and at the end of December. We analyzed how funds change their portfolios toward the end of the year and show that these changes relate to the incentives to take risks. To allay fears that the changes we find in the equity portion of portfolios may not reflect the nature of overall portfolio changes, we also look at measures of risk constructed from time series data.

Our measure of the riskiness of a fund's portfolio at a point in time is the sample standard deviation of the difference between the return of the portfolio and the return on the market portfolio (calculated from historical data on the component securities).

Recall that the pattern of incentives to manipulate the riskiness of a mutual fund depends on the age of the fund. For young funds, the payoff for increasing risk (pictured in the upper panel of Figure 3) is negative for funds that are far behind the market, increases with a fund's January–September excess return until it reaches a local maximum at about six points behind the market, then decreases to a minimum for funds that are about seven points ahead of the market, and finally increases sharply to reach its highest level for funds that are far ahead of the market. For “old” funds, an incentive to increase risk (pictured in the lower panel of Figure 3) appears to exist, although the pattern of the incentive is not clear.

To assess whether actual risk changes follow such patterns in detail, we felt it would be most valuable simply to produce pictures of actual changes that could be compared visually with Figure 3. Because of the limited number of funds for which we have portfolio data, we chose not to attempt another semiparametric analysis but instead simply to fit a piecewise linear model to the relationship between risk changes and January–September excess returns.

Our piecewise linear model consists of three connected line segments. We estimate which pattern of three connected line segments best fit the data. The slopes of the three line segments and the location of the best kinks, or breakpoints, between the line segments are not imposed on the data but rather are estimated.*

*The methodology used is nonlinear least squares. The details of this and all estimation procedures in the paper can be found in the longer version of the paper.

We present coefficient estimates from the piecewise linear model for the subsample of young funds in column 1 of Table 1. The correspondence between actual changes and incentives is fairly strong. The first estimated kinkpoint, KINK 1, is located at -0.06, with the estimate being highly significant. The second turning point, KINK2, is estimated very imprecisely, with the estimate of 0.001 not being significantly different from 0.07. The estimated slope of the first segment, SLOPELEFT, is positive as predicted and significantly different from zero at the 5 percent level. The estimated slope of the second segment, SLOPEMID, is negative as predicted but not significantly different from zero. SLOPEMID is, however, significantly different from SLOPELEFT. The slope of the third segment, SLOPERIGHT, is positive, although very small and again not significant.

To facilitate comparisons with the incentives shown in Figure 3, we graphed predicted values from this regression in the top panel of Figure 4. From the graph, the most salient feature of the actual risk change data is that funds that are behind the market do tend to increase the riskiness of their portfolios toward the end of the year, as if trying to gamble and catch the market.

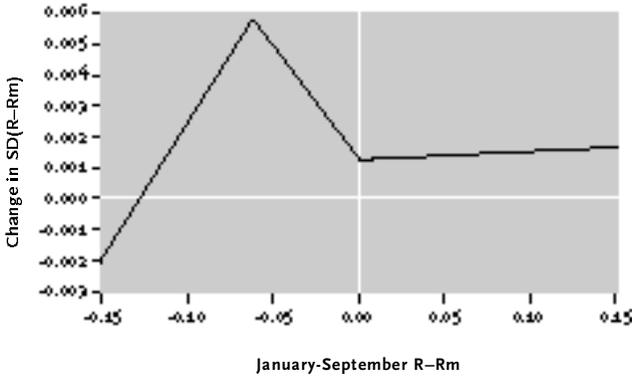
TABLE 1: **Actual Risk Changes as a Function of January-September Returns**

Independent Variables	Dependent Variable: $\Delta SD(r-rm)^*$	
	Young Funds	Old Funds
Constant	-0.02 (0.006)	-0.003 (0.002)
KINK 1	-0.06 (0.02)	0.03 (0.03)
KINK 2	0.001 (0.04)	0.08 (0.03)
SLOPELEFT	0.09 (0.04)	-0.02 (0.01)
SLOPEMID	-0.07 (0.07)	0.06 (0.08)
SLOPERIGHT	0.003 (0.02)	-0.05 (0.04)
$\log(\text{Assets})$	-0.0007 (0.0006)	0.00002 (0.0003)
Sept. $SD(r-rm)$	-0.02 (0.04)	0.09 (0.02)
N	94	375
R^2	0.11	0.08

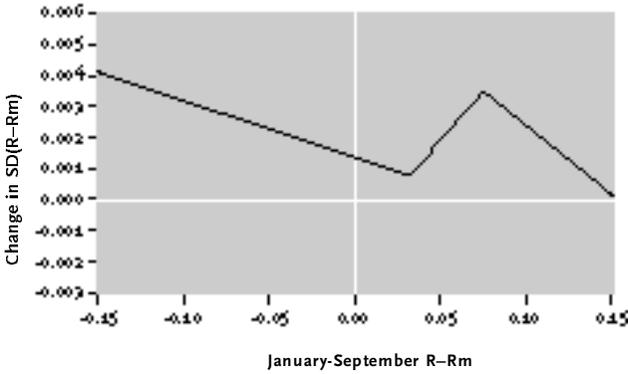
*Estimated standard errors in parentheses.

FIGURE 4: Pattern of Actual Risk Changes

Young Funds' Equity Portfolios



Old Funds' Equity Portfolios



Our analysis of risk incentives for older funds did not reveal a clear pattern. Therefore, it is not surprising that no clear patterns of actual risk changes appear in column 2 of Table 1, which presents estimates of the same piecewise linear function on the subsample of “old” funds. Neither of the turning points are estimated precisely, and only the first of the estimated slopes is significantly different from zero at the 10 percent level. We graphed predicted values from this regression in the bottom panel of Figure 4. One potentially interesting regularity in the figure emerges: Over a wide range of January–September excess return levels old funds do tend to increase their riskiness toward the end of the year. While this is very much in line with the incentives we have identified, we hesitate to emphasize the result because of the possibility that our sample selection biased the results.

Conclusion

We have established the flow-performance relationship as an incentive scheme implicitly given to mutual fund companies by investors. We have shown that the flow-performance relationship can generate incentives for mutual funds to increase or decrease the riskiness of their portfolios. Finally, we have shown that mutual funds respond to this incentive scheme; funds alter their portfolios between September and December in a manner consistent with their incentives to take risk calculated from the flow-performance relationship.

One important issue we ignore is the relationship between the mutual fund company and the mutual fund managers. Here, we assume that managers act to maximize fund profits. But it is quite possible that managers have interests that diverge from the fund's. Obviously, managers want to maximize lifetime income from wages and performance bonuses. However, for young managers, maximizing lifetime income means that the manager may concern himself with avoiding getting fired or with trying to earn a promotion. In subsequent work (Chevalier and Ellison 1996, and Chevalier and Ellison 1997), we examine the careers of mutual fund managers and estimate how the incentives derived from career concerns may affect managers' decision-making.

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