I present a one period principal-agent model of mutual fund money management with moral hazard. I show that under reasonable assumptions and using conservative parameters, the optimal level of effort for the investor (principal) to induce from the manager (agent) is decreasing in the fund managers initial wealth. This is true even when considering the principals optimal choice of contract because the principals optimal choice of pay-performance sensitivity is decreasing in the wealth of the manager. I empirically test the theoretical predictions using a proxy for mutual fund manager wealth. I find that the managers personal is negatively related to the managers performance as measured by risk adjusted returns and fund flows. A one standard deviation increase corresponds to a one percent decrease in four-factor alpha and a ten percent decrease in fund flows. The results are statistically and economically significant and are robust to fund level and manager level fixed effects.
1. Introduction

Ross (1973) first presented the problem of aligning interests in a principal agent setting. Since then, a very large body of literature has developed to determine what outcomes are optimal and achievable. While the theoretical aspects of this question have been well explored, it has been more difficult for researchers to find empirical evidence of the importance of moral-hazard considerations in contract construction. There are two primary reasons for the dearth of empirical evidence. The first is that databases of contracts between parties that fit the roles of principal and agent are hard to come by. The second is that in order to attribute a result to moral hazard, a researcher must have some way of observing the actions of the agent that are unobservable to the principal. Instead research and principals must reply on state realizations and infer the actions of the agent.

The bulk of the empirical support for the moral hazard literature has come from corporate compensation because of the legal requirement that public companies disclose their compensation structures. For example e. garen (1994) applies principal agent theory to executive compensation and finds that contracts are generally consistent with theory although he finds little evidence of relative performance pay. Indeed, the entire executive compensation literature, which became popular following Jensen and kevin j. murphy (1990) finding that the CEO pay increases by only three cents for every thousand-dollar increase in shareholder wealth, is intrinsically linked to principal agent theory.

There are also empirical studies that make use of contracts from non-corporate settings. For example kaplan and Stromberg (2003) show that contracts between venture capitalists and entrepreneurs are generally consistent with contracting theory. Unfortunately the data for these studies are often hard to access. Banerjee and Duflo (2000) document evidence of the importance of reputation on contract terms using a dataset they collected from the Indian software industry.

If effort were observable by the principal, then moral-hazard wouldn't be an issue because the contract could specify an optimal action set.
Even if contracting data are available, the challenge faced by researchers in most, if not all settings is to determine a reasonable metric for performance. For example, in corporate settings, it is natural to interpret the shareholders as the principal, thus stock return is a common proxy for performance. However a pitfall of this approach is that the true principals are the board members whose incentives are imperfectly aligned with those of the shareholders. A board member may advocate buying a basketball team so he can have court-side seats. Thus in this example, it would be misleading to interpret stock returns as the best proxy for the desired type of effort from the perspective of the principal.

The focus of this paper is to apply some simple insights from contracting theory to the mutual fund industry. In particular, I study the managers moral hazard problem that originates from disutility of exerting effort. I show theoretically that managers with high personal wealth will exert less effort than managers with low personal wealth. This relationship holds even when considering the principals optimal contract, which takes the managers personal wealth into account. Its intuitive that wealthier people value future wealth less and thus make unwise investments. Jensen (1986) presents and justifies his free cash flow hypothesis that firms with excess cash make negative NPV investments. The interesting question is first if contracts can avoid the problem and if not is this effect large enough to be measured and should investors care about it. I show theoretically that contracts will not generally correct for low effort levels of wealthy managers.

I test these predictions using mutual fund data from 1992 to 2008. I use the funds risk-adjusted-returns and the fund flows as measures of the results of managerial effort and find that these two measures are significantly decreasing in the managers personal wealth. All empirical results control for either fund level or manager level fixed effects and are robust to using either specification. I also show that these results are robust to a Heckman specification that addresses selection bias. The theory section also shows that under most conditions the choice of pay-performance sensitivity is decreasing in the fund managers wealth. The intuition is that because it is more costly to induce the manager to exert effort, the principal optimally accepts lower effort levels from wealthier managers.
At this point the reader may be skeptical that a competitive market could sustain managers exerting low levels of efforts and not only keeping their jobs but also keeping investors. Studies on the degree of competition in the mutual fund industry conclude that that industry is highly competitive. Hortacsu and syverson (2004) are able to explain 92 percent of the price variation across mutual funds in their analysis. An unsatisfying answer is that investors dont know about this wealth effect and do not account for it. An alternative explanation is that frictions in the industry can sustain low effort levels of some mutual fund managers to a point. Its difficult to determine the average cost of switching from one fund to another; however in my sample 40 percent of funds have rear loads and 30 percent of funds have front loads. Loads alone admit some inefficiencies but its also important to consider the search costs of finding a new manager and the cost of transitioning from the legacy portfolio to the new portfolio. It is plausible that these costs permit managers exerting low effort levels to keep their jobs.

I choose to focus my attention on mutual funds for several reasons. In contrast to the corporate settings, the mutual fund setting is a desirable one for examining the impact of moral hazard because of the straightforward nature of the fund managers objectives. The mutual fund management team is responsible for overseeing and compensating the fund manager. The fund investors pay the management team through a management fee, which is a portion of assets under management. The fee is flexible and is frequently adjusted based on performance. Thus the management team has two objectives, to generate and maintain assets under management and to perform well relative to some benchmark. While the contracts for the fund managers are not available, discussions with a variety of managers has convinced me that the compensation is roughly proportional to the funds raised through the management fee, which is percent of assets under management. Its intuitive and reasonable to conclude that the managers contract rewards him for good performance with respect to

\footnote{Often funds will reimburse some (or all) of the management fee if performance is sufficiently poor. It is not uncommon for the management fee to be negative because of poor performance.}
those two objectives. Therefore, to the extent that a manager can exert effort to drive fund
flows or achieve superior performance, these two measures are reasonable proxies to effort.

Another advantage of using mutual funds to study moral hazard is the relatively simple
and small nature of the mutual fund management teams. For reasons discussed and justified
in more detail below, I analyze only funds with single managers (I omit any funds that
list management teams as the fund manager or multiple manager names). In a corporate
setting a manager might be merely a figurehead with hundreds or thousands of decision
makers working under the managers name. Therefore it is inappropriate to attribute the
performance of the company to a manager or CEO. In contrast, listing a single individual
as the mutual fund manager is a strong signal that this individual plays the largest role in
the funds activities.

Mutual fund managers often have long tenures and can accrue a substantial amount of
wealth throughout the course of a career. This increased personal wealth has the potential
to adversely affect the level of effort that the manager is willing to exert to generate high
fund returns. However the literature surrounding principal-agent theory has examined this
issue and found various conditions for which this accumulation of wealth will not impact
the agents choice of effort. The conditions are fairly stringent. For example Holmstrom and
Milgrom (1987) show that wealth will not affect the agents effort choice if he has CARA
utility (and the disutility of effort must be included in the exponential). A more degenerate
example is if manager has no access to capital markets and cannot shift inter-temporal
consumption. In general for wealth not to affect effort levels, it must be the case that
the optimal contract changes along with the managers wealth increase in such a way that
the resulting contract induces the same level of optimal effort. This could happen because
pay performance sensitivity increases with the managers wealth. But its also possible that
the principals optimal response to the increase in wealth is to decrease pay performance
sensitivity. The principal accepts lower effort levels because it has become more expensive
to induce any particular level of effort and this expense is not offset by the potential upside
of inducing high effort.
To provide some intuition as to why pay performance sensitivity could be positive or negative, consider the two following cases. In case 1 the principal has a large sum of money invested in the fund and the expected return from inducing high levels of effort is much larger than the expected return from low effort levels. The difference is so vast that it is always beneficial for the investor to incentivize the manager to exert maximum effort. In case 2 the difference in expected returns between the high and low state is very small. Additionally, suppose the manager is very averse to exerting more effort. In this case inducing high effort is more costly than the expected upside from good states of the world. Observing differences in effort across wealth requires that the contract is not undoing the wealth effect. This is a complicated problem and parameter values impact the problem. Therefore I spend time discussing a model for the principals decision. I show that using reasonable assumptions and parameters that are appropriate in this setting, pay performance sensitivity is decreasing in the managers wealth. That is, it is optimal for the principal to accept lower effort levels from wealthier managers. To see this mathematically, suppose effort is determined by:

\[ a = f(w, k(w)) \]

Where \( w \) is the agents initial wealth and \( k \) represents the contract offered to the manager. Then the change in effort with respect to wealth is given by:

\[ \frac{da}{dw} = \frac{\partial a}{\partial w} + \frac{\partial a}{\partial k} \frac{\partial k}{\partial w} \]

The first term reflects the change in effort due to an increase in wealth, holding the contract fixed. This term is negative because of the standard assumption of concave utility. The innovation in this paper is in examining the second term, which represents the equilibrium contracting response to a change in wealth. I find that the pay-performance sensitivity is decreasing in wealth (\( \frac{dk}{dw} > 0 \)). The net effect of these two components will therefore be a decreased level of effort as wealth increases.
The contributions of this paper are twofold. First, I develop a theoretical model for contracting between a mutual fund manager and investor with moral hazard. My theoretical results show that effort and pay-performance sensitivity are decreasing with increases in wealth. Second, I present supporting empirical results. My empirical results generally confirm previous findings and, in addition, show that alpha, fund flows, and management fees are decreasing in managerial wealth. The study offers support of several theoretical moral hazard contributions and emphasizes the importance of considering moral hazard issues in contracting decisions.

There are a variety of alternative explanations that immediately come to mind. Managers of large funds will be more wealth and the relationship between fund size and performance is significant. Wealthier people are more experienced, older, and thus potentially bored or dated. Wealth may be measuring some unobservable variable like intelligence. The list of potential explanations is lengthy and interpreting the results correctly is the biggest challenge in the study. I use a variety of control variables to argue that these effects cannot be driving the results. For example I include every variable I think wealth could potentially be measuring via observables and manager fixed effects. I argue that the results appropriately account for all possible explanations and the only remaining interpretation is that the wealth variable measures wealth and does significantly influence fund performance and flows.

These results also have important implications for the investments literature. If it is the case that managers can exert effort in order to generate excess returns, then this paper can shed light on the luck versus skill debate in mutual funds. The wealth effect could explain the difficulty to find persistence of mutual fund returns. A manager with skill achieves excess returns and is compensated accordingly. In the next period he is less motivated to generate excess returns. The effect would lead to negative autocorrelation. So even if mutual fund managers were skilled it might still be difficult to find empirical evidence of persistence in mutual fund performance. It is also tempting to interpret the results in the paper as a suggestion of how to make money: invest in funds with poor managers and sell once the manager becomes wealthy. However its unlikely that this effect would lead to a profitable
trading strategy. It is precisely the cost of switching in and out of funds and the cost of finding new fund managers that allows for wealthier managers who exert less effort to still be employed as fund managers. The managers will only be replaced when the difference in expected returns of this manager and a new manager is large enough to justify paying all switching costs.

1.1. Related Literature. As mentioned above this paper is tied to the contracting in the presence of moral hazard literature. This is a large literature so I limit discussion of related to work to studies that are most similar to this paper. There are also few papers that theoretically examine the moral hazard concerns in the context of mutual funds. Roll (1992) finds that when mutual fund managers are compensated relative to a benchmark, it may be optimal for them to choose portfolios that are not mean variance efficient. Golec (1992) develops a principal-agent model for a mutual fund manager and shows that the contract terms are a function of the managers information generating process and the risk preferences of the manager and investor. Starks (1987) shows theoretically that symmetric contracts dominate bonus contracts for aligning interests of the fund manager and investor. The theoretical portion of this paper differs from the theoretical contributions in the field by incorporating the managers initial wealth into the analysis.

Empirically, little has been documented about the effect of wealth in moral-hazard settings primarily because there is no data on personal wealth. Becker (2006) employs data of Swedish CEOs to show that wealthier CEOs have stronger incentives; he argues that wealth does not proxy for power or skill. In a relatively new paper Core and Guay (2010) point out the importance of considering CEOs person wealth when discussing optimal compensation schedules.

My empirical results are tied most closely to the investment literature examining managerial characteristics. Golec (1992) finds that investors can expect larger risk-adjusted returns from young managers with MBAs who have had a lengthy tenure at the fund. My findings are somewhat consistent. I find that the managers years of experience are positively related
to performance; however, his tenure at the fund is negatively related. Golec’s finding about young managers is consistent with the idea that less wealthy managers outperform wealthier ones because presumably wealth is related to age. Prather, Bertin, and Henker (2004) find that performance is negatively related to the number of funds of which the manager is in charge. Using fixed effects for the number of funds under a manager’s control, I find that the coefficients are generally decreasing as the number of funds increases. Their finding is also meaningful because it implies that the effort a manager devotes to a fund matters. If the manager is spread too thin, the fund’s performance suffers. In another study Almazan, Brown, Carlson, and Chapman (2002) document evidence that mutual fund managers are more constrained when monitoring is costly; moreover, the returns of highly constrained mutual funds are not statistically different from the returns of funds that are easily monitored suggesting the existence of contracting equilibrium.

Nearly all of the studies examining managerial characteristics explore effects on fund performance. However, the manager’s compensation is tied to performance relative to a benchmark and fund size. It is reasonable to conclude that the manager would exert effort to achieve high performance and to drive fund flows. Thus, I also use fund flows as a proxy of managerial effort. I measure fund flows following Sirri and Tufano (1998). I am able to confirm their result that fund flows are driven by performance and are sensitive to fees. Like their study, I also find that flows are more sensitive to over-performance than to under-performance. Consistent with my theoretical prediction, I find that wealthier managers have lower fund flows and thus presumably exert less effort to drive flows.

Finally, Brown, Harlow, and Starks (1996) find that mutual fund managers that are likely to be losers increase fund volatility for the latter part of the assessment period. If there is a relationship between wealth and fund volatility we would expect that decreased risk aversion for wealthier managers would result in a positive relationship between fund volatility and managerial wealth. If managers of the loser funds view themselves as less wealthy, this study implies the opposite relationship between wealth and fund volatility. In a similar study, Chevalier and Ellison (1999) find that younger managers are more susceptible to
termination and therefore hold less nonsystematic risk. This would imply that younger managers (and generally less wealthy managers) would achieve higher risk adjusted returns. I was inspired by these findings to examine portfolio variance and holdings as related to wealth. My empirical results show that wealthier managers hold a larger percentage of equities and a lower percentage of cash and fixed income securities than their less wealthy counterparts. However, there is no significant relationship between managerial wealth and the variance of fund returns.

2. Theoretical Results

2.1. Motivation. In this section, I model the optimal contract between the fund investor and the fund manager and the resulting level of effort induced. In a one period setting with moral hazard due to the misalignment in objectives of the fund manager and the fund investor. The fund manager is risk averse, while the investor is risk neutral. I model a partial equilibrium; I abstract away from a general equilibrium in which a competitive market for fund managers exists and mutual funds compete for an investor’s capital. Instead I solve for the optimal contract in a setting in which the manager is already chosen and investors have already committed their funds. Because the model is much simpler than might be the case in the real world, it is worth taking a moment to describe why the results from this simple setting might still be applicable and provide intuition in a more realistic setting.

To make this point, imagine the opposite setting in which the markets for mutual funds and managers are perfectly competitive. If it is indeed more expensive to incentivize wealthier managers, then perhaps they will work less hard in equilibrium. However unless the funds also lower their fees, then investors will move their money from funds from wealthy managers to funds with less wealthy managers. So the manager who is less valuable to the investor is compensated less, and investors are indifferent between all fund choices. If it

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3A risk neutral principal is a common assumption in principal-agent theory. The motivation is to consider the difference in risk preferences between the agent and the principal. Because the agent is over-exposed to his own fund while the principal can diversify, its reasonable to assume the agent is more risk averse than the principal. This simplifying assumption is an extreme version of this effect.
becomes prohibitively expensive to incentivize the manager to a level where the fund can be competitive, the manager is replaced with a new manager, a change that is costless for the fund and investors.

In my model, the manager and the fund have monopoly power. Although this is an extreme assumption, it can provide intuition to the extent to which the transaction costs that impede perfect competition create some level of monopoly power. For example, suppose it is incredibly expensive to find a new fund manager. In such a case, the current manager has monopoly power because he can provide services at a cost lower than all potential competitors. It is reasonable that costs creating some degree of monopoly power for the manager. Search costs are certainly non-zero, but more importantly, it can be incredibly expensive to transition the fund’s portfolio from the legacy manager’s allocation choice to the replacement manager’s allocation choice. Similarly, the cost for investors to move money from one mutual fund to another can be substantial. It’s possible that even if an investor knew that another fund with slightly higher returns existed, he might nonetheless choose to stay with his current fund.

Both perfect competition and perfect monopolies are inappropriate models for the mutual fund industry. However to the extent that transaction costs create monopoly power, we can gain insight from analyzing the solution in the monopoly setting. Reality would be somewhere between the two scenarios; flows are sensitive to managerial wealth, but not sensitive enough to mitigate the effects of wealth completely.

2.2. The Model. Consider a mutual fund management team’s (henceforth referred to as the "principal") problem of appointing a manager and offering an optimal contract to induce the manager to exert an optimal level of effort. The principal can either stay with the incumbent manager with private wealth $w$ and reservation utility $u$, or hire a new entrant manager with expected wealth $\bar{w}$ who also has reservation utility $\bar{u}$. There are two possible outcomes for the fund return $R = \{r_H, r_L\}$. A fund manager can exert effort $a \in \mathbb{R}^+$ to increase the probability of the high state. Define the function $p(a) : \mathbb{R}^+ \rightarrow [0,1]$
where \( p(a) = \Pr(R = r_H|a) \) and \( p(0) = 0, p(\infty) = 1 \) and \( p'(a) > 0, p''(a) \leq 0 \). Because there are only two states of the world, the manager’s contract can be specified by two parameters without loss of generality. Let the contract \((S,B)\) be the manager’s contract, where the manager earns a salary, \( S \) regardless of the outcome and if \( R = r_H \) he earns an additional bonus, \( B \). The principal chooses \( S, B > 0 \) conditioning on the agent’s wealth, \( w \), in order to induce the optimal level of effort \( a \). Finally, the manager dislikes exerting effort. Define his disutility of effort as \( g \) where \( g'(a) > 0 \) and \( g''(a) > 0 \).

**Lemma 1.** Given a fixed contract, \((S,B)\), a manager with a high level of private wealth will exert a lower level of effort than a manager with less private wealth.

**Proof.** Given a bonus, \( B \), the agent chooses effort, \( a \), by solving

\[
\max_a \mathbb{E}[u] - g(a) = \max_a p(a)u(w + S + B) + (1 - p(a))u(w + S) - g(a)
\]

The first order condition shows that \( a \) satisfies

\[
p'(a)(u(w + S + B) - u(w + S)) = g'(a)
\]

Define

\[
f(a) = \frac{g'(a)}{p'(a)} \Rightarrow a = f^{-1}(u(w + S + B) - u(w + S))
\]
To find the change in effort with respect to wealth given a fixed salary and bonus we take the partial derivative of the above equation with respect to $B$ yielding

$$\frac{\partial a}{\partial w} = \frac{\partial}{\partial w} f^{-1}(u(w + S + B) - u(w + S)) = \frac{1}{\frac{\partial}{\partial w} f(u(w + S + B) - u(w + S))} = \frac{u'(w + S + B) - u'(w + S)}{f''(u(w + S + B) - u(w + S)} < 0 \quad \forall B > 0$$

The last inequality follows from the fact that $u'(w + S + B) < u'(w + S)$ by concavity of $u$ and from

$$f'(.) = \frac{p'(.)g''(.) - g'(.)p''(.)}{p'(.)^2} = \frac{(+) (+) - (+) (-)}{(+)} > 0$$

This result is intuitive because it follows naturally from a concave utility function. The wealthier an individual is, the less value he places on additional wealth.

**Theorem 1.** When effort is unobservable, the principals optimal contract induces an effort level that is weakly decreasing in the private wealth of the agent.

**Proof.** The risk-neutral principal knows that this is the level of effort the agent will exert given the contract, $(S, B)$. Thus the principal chooses optimal levels of $B$ and $S$ by solving

$$\max_{S,B} \Pr(R = r_H|a)(P - B)$$

subject to

$$\Pr(R = r_L|a)u(w + S) + \Pr(R = r_H|a)u(w + S + B) \geq u$$

and $a \in \text{argmax}_{u \in \mathbb{R}_+} \Pr(R = r_L|a)u(w + S) + \Pr(R = r_H|a)u(w + S + B) - g(a)$

Rogerson (1985) shows that a probability distribution function that satisfies MLRP and CDFC is a sufficient condition for using the agent’s first order condition in the principal’s
problem. The two mass-point distribution satisfies these conditions trivially. Furthermore we know that the optimal contract the agent’s incentive rationality and incentive compatibility constraint will be binding (Mas-Colell, 1995), thus $\lambda, \mu > 0$. Let $u_H = u(w + S + B)$ and $u_L = u(w + S)$. It must be the case that

1. $p(a) = p(f^{-1}(u_H - u_L))$
2. $u_H p(a) + u_L (1 - p(a)) = u(w) + u(w)$

Note that we can write the two utilities as a function of the induced effort level, $a$. Let $R(w) = u(w) + u(w)$ and recall that $f(a) = \frac{g'(a)}{p'(a)}$.

\[
\begin{align*}
    u_L &= u(w) + u(w) - p(a)f(a) \\
    &= R(w) - \frac{p(a)g'(a)}{p'(a)} \\
    u_H &= u(w) + u(w) + (1 - p(a))f(a) \\
    &= R(w) + (1 - p(a))\frac{g'(a)}{p'(a)}
\end{align*}
\]

Now we can write the principal’s problem as an unconstrained optimization over $a$.

\[
\begin{align*}
    \max_a (P - b(a)b(a)) &= v(u_H) - v(u_L) \\
    FOC : ab'(a) &= b(a) \\
    \Rightarrow a^* [v'(u_H^*) \frac{\partial u_H}{\partial a} - v'(u_L^*) \frac{\partial u_L}{\partial a}] &= v(u_H^*) - v(u_L^*) \\
    \Rightarrow a^* [\frac{1}{u'(u_H^*)} \frac{\partial u_H}{\partial a} - \frac{1}{u'(u_L^*)} \frac{\partial u_L}{\partial a}] &= v(u_H^*) - v(u_L^*) \\
    \Rightarrow a^* f'(a^*) &= [v(u_H^*) - v(u_L^*)]u'(u_H^*)u'(u_L^*)
\end{align*}
\]
The object of interest is $\frac{\partial a}{\partial w}$ which can be obtained using partial implicit differentiation and is $< 0$ (see appendix)

If effort were observable, a first best contract is possible and effort will satisfy $g'(a) = P$. The theorem states that when effort is unobservable the optimal contract induces a level of effort that is decreasing in the agent’s private wealth and is weakly less than the effort exerted with perfect monitoring.

3. Data

I test this prediction empirically using mutual fund data and returns. While mutual fund data has several disadvantages, most problematically that I cannot directly observe the fund managers wealth, it is advantageous for measuring performance statistics as a proxy for effort. Returns are reported monthly and the managers objectives are straightforward.

3.1. CRSP Survivorship Bias-Free Mutual Fund Data. I obtain yearly fund summary data consisting of annual observations from 1992-2008 for every mutual fund listed in the CRSP Mutual Fund database. The yearly database includes information about the fund fee structure, the type of fund, the composition of assets, and management information. In addition, I collect monthly returns for the CRSP mutual funds and monthly Fama-French factors (1992) to calculate annual performance metrics. Table 1 displays summary statistics of the fund and manager characteristics, as well as metrics of fund performance. I discuss the methodology for calculating the performance metrics in the methodology section. I also discuss how I use the available variables to build a proxy for manager wealth.

3.2. Sample Restrictions. Mutual funds are heterogeneous along several dimensions ranging from the fund family structure to various fees and loads. For the most part, I attempt to control for various characteristics to see how they impact my findings on the effect of wealthy managers on performance. However I do place some restrictions on the sample to avoid known biases. I limit the study to open-ended funds. I exclude fund-years where the fund is younger than 18 months, as recommended in Evans (2006) to avoid incubator bias,
which results from databases retroactively adding young funds previous returns after they have been successful for a period of time. Finally, Elton, Gruber, and Blake (1996) document a small-fund bias and thus I do now allow a fund to enter the sample until it has surpassed $15M in total net assets. However, once the fund has entered the sample, it remains in the sample until either it is delisted or the sample period ends. I allow these funds to remain in the sample because I am concerned about measuring manager performance. By systematically omitting funds that decrease in size in subsequent years, I am likely only omitting underperforming managers.

For the scope of this study, I limit the sample to US equity funds. The CRSP database contains Lipper Classification codes for some mutual funds from the year 2000 to the present. While it is important to avoid other fund types entering the sample, limiting the sample size to only those funds with Lipper Classification Codes concerns me for two reasons. First, Brown and Goetzmann (1997), among others, have documented self-reported mutual-fund styles to be inaccurate when compared to actual holdings data. Second, I am concerned about introducing bias that might be associated with the differences between the types of funds that receive classification in the CRSP system and the types that do not. Therefore, instead of using Lipper classifications I limit the sample by ensuring that the asset composition of the funds in my sample is similar to the asset composition of the subsample of funds that are identified by Lipper as US equity funds. First, I obtain a subsample of the US equity Lipper identified funds. There are five variables describing asset composition in the CRSP database which give the percent of the portfolio that is composed of 1.) common stock 2.) preferred stock, 3.) fixed income securities, 4.) cash-like securities, and 5.) other asset classes. I then determine cut-offs based on the distribution of these variables within the subsample. For example, it is almost never the case that any fund listed as US equity holds more than 5% cash. In this case, I would omit any fund-years with a percent cash variable that is greater than five. In Figure 1 panels a-e, I display histograms of these five variables comparing the density of observations in the Lipper subsample to the density in my sample. In the fixed income, preferred stock, and other asset figures, it appears that the bucket-size might have
been inappropriately specified, as nearly all of the observations fall in the same bucket. This effect merely results from nearly all of the observations taking a value of zero. One benefit of this approach is that it does not rely on the self-reported fund-style of a fund.

Finally, it’s important to note that for three reasons, I drop any fund year observations that list a team of managers as opposed to a single manager name. The first reason is that I have no way of determining whose incentives will be the driving force behind fund performance. It is plausible that some team leaders who have become quite wealthy over time are simply figureheads while the younger, hungrier managers are the ones actually making decisions and exerting effort. The second reason is that the format of the fund manager variable for a team makes it nearly impossible to follow individual managers across funds. Either teams are listed simply as AIG Asset Mgmt Team or the variable only lists last names of the managers: e.g. Allen/Smith. Finally, even if I were able to follow managers across funds and attribute the amount of wealth and responsibility allotted to the appropriate individual, being associated with a team might bring up significant changes to incentive structures, such as free-loading incentives or inner-team competition.

3.3. **Summary Statistics.** To provide some intuition for how selection issues might impact the results, I display summary statistics for four separate classes of observation: 1.) the observations that make it into my sample, 2.) observations that are excluded because the fund is team-managed, 3.) observations that are excluded because the fund is closed at any time over the sample period, and 4.) observations that are excluded because the fund is less than 15M in total net assets to avoid small fund bias as documented in Elton, Gruber, and Blake (2001). The results are shown in table 2.

The most glaring result is the difference in alpha (net of fees) with respect to the four groups. Funds that close to new investors have higher alphas than funds that never close; this finding is intuitive because the funds likely closed upon reaching some size capacity, which implies that they had high returns necessary to attract money. Very small funds have lower alphas, a result that is consistent with the theory that small funds suffer from decreased
economies of scale. Interestingly, team managed funds also have lower alphas. However, Bliss, Potter and Schwartz (2008) find that the difference in performance of individual versus team managed funds is not significant.

This variation in fund flows is another obvious difference. My sample has a lower level of fund flows than the other groups that have been excluded. This finding is also reasonable as small funds will have large fund flow percentages because they start small, and closed funds must have experienced high fund flows at some point.

4. EMPIRICAL METHODOLOGY

4.1. Performance Measurement. Assuming investors care about risk adjusted returns, an appropriate metric for performance measurement will control for risk factors. I chose alpha and estimate it using the Carhart four-factor model. The level of observation is a fund year, so I must estimate an alpha for each fund year. Using only a single year of CRSPs monthly returns would require fitting a regression with 12 observations to determine five coefficients. To reduce measurement error, I follow Carhart (1997) and use three years of returns to estimate the factor loadings. I calculate alpha for the relevant year by subtracting returns to the factors times the estimated factor loadings from the realized fund return. This approach assumes that factor loadings are stationary over the three year period. The model used to estimate factor loadings is given by:

4.2. Wealth Proxies.

4.3. Econometric Specifications. I have four primary concerns regarding estimation error that I attempt to resolve using various econometric techniques. By far the biggest concern is whether or not the wealth variable is actually measuring wealth. There are a variety of other explanations. For example suppose a manager does well in a particular year and thus fund flows are high. Chen, Hong, Huang, and Kubik (2004) find that fund performance erodes

\[^{4}\text{If a three-factor model or the CAPM model describes the true asset pricing relationship, the four-factor model will estimate the same alphas and obtain insignificant coefficients for the extra factors. Therefore my results are robust to these alternative model specifications.}\]
with fund size, most notably for funds that invest in small and illiquid stocks. By this logic I should expect the successful manager who was compensated well in previous periods to have lower returns by virtue of fund size. In this example, the solution is straightforward control for fund size. However, there are a variety of other possible explanations for what this wealth variable could be measuring: the managers IQ, his experience, his datedness, etc. To the best of my knowledge, I include every control variable that could possibly be picked up by the wealth proxy. I also do a number of other robustness checks to attempt to confirm that I am indeed measuring something related to wealth.

The second issue is that the panel is unbalanced; using OLS will more heavily weight some managers and funds than others. Additionally, I do not omit separate share classes, so some portfolios are more heavily weighted. By allowing separate share classes to be unique observations I can more accurately measure the effect of various fee types and loads. While OLS will still give unbiased estimates, the covariance matrix is inconsistent, so I address this by computing clustered standard errors using the fixed effects variable, which is either fund id or manager id for every result. The specification is:

$$\text{Where } \alpha \text{ is the fund alpha at time } t, wM,t \text{ is the wealth of the manager in charge of the fund, and } sM,t \text{ is the managers compensation for managing the fund. The control variables can be seen in table 3.}$$

My third concern is omitted variable bias. There are several manager and fund characteristics that I cannot observe that are likely correlated with the dependent variable and the independent variables. For example suppose returns and fees are positively related to the amount resources available to the fund. I cannot measure available resources; so I will estimate a positive relationship between fund fees and returns even if there is no such relationship. The obvious solution here is to include fund fixed effects, which I ultimately do. However, an alternative lurking variable could be related to the fund manager. Suppose managers with a high IQs have acquired more wealth and perform better, again, I would measure a positive relationship between wealth and performance. I cannot include both fund
and manager fixed effects simultaneously but I do estimate and report each specification twice using the two appropriate fixed effects variables. I also include year fixed effects.

Finally, I would like to correctly control for the number of funds of which a manager is in charge. Prather, Bertin, and Henker (2004) find that a managers performance is negatively related to the number of funds under his management implying that the manager is somehow spread too thinly to obtain the best returns possible. Because I am interested in the level of effort a manager devotes to a particular fund, this issue is particularly relevant to my hypothesis. I correct for the number of funds a manager leads by including a dummy variable for each possible number of funds assigned to a particular manager in a year. Separate share classes within the same fund count as only one fund as the investments are identical across share classes. I use dummy variables instead of simply using the number of funds under management as a regressor because I do not want to take a stance on the correct functional form. For example, it is likely that the change in effort a manager devotes to a particular fund when taking control of a second fund is dramatically different than the change in effort resulting from a manager taking control of his hundredth fund. Another advantage of using dummy variables in this situation is that it reduces the impact of observations where managers are in charge of extreme numbers of funds. These observations are likely suspect because a manager cannot really manage more than a few funds. There is very little (or no) within-group variation for managers in charge of more than five funds, so the dummy variable essentially captures the full effect.

Using the methods described above, I estimate the effect of explanatory variables on alpha net of fees and fund flows as measures of managerial performance. I regress management fees on managerial wealth and control variables to test my theoretical prediction that payoff-performance sensitivity is decreasing in wealth. Finally, inspired by Chevalier and Ellisons (1999) finding that young managers hold less systemic risk, I estimate the impact of wealth and other explanatory variables on portfolio holdings.
4.4. Robustness Checks. I do a several of robustness checks to confirm the consistency of the results. First, I alter the specification to control for selection bias. In the data section I describe and motivate the restrictions I have made to the dataset. Most notably, I omit any funds that are team managed, and any funds that have ever been closed. One option is to claim that the results are applicable to sufficiently large funds that are never closed and are managed by a single person. However, the results can be generalized if they are robust to specifications that account for selection issues. If selection is correlated with the explanatory variables, then ignoring the selection problem will result in biased coefficients for those variables. For example, suppose funds close to new investors because they have reached capacity. The high fund flows likely resulted from superior past performance. By omitting the whole fund history, I omit observations of performance driving fund flows. If I estimate the impact of previous performance on fund flows, the uncorrected coefficient will be biased towards zero. I use Heckman’s two stage approach to correct for this problem. In the second stage, I compute clustered standard errors. The first stage Heckman specification:

I use the first stage to estimate the inverse mills ratio. The second stage specification is:

I would also like to confirm that the effects I’m finding are due to wealth and not due to a manager responding to poor results in the previous year and exerting high levels of effort to avoid being fired. To separate the two effects I include a variable called Change in Wealth which is the managers wealth this period minus the managers wealth last period, scaled by the managers wealth last period. Thus the coefficient on wealth when I include the change in wealth variable captures the effect of the level of wealth. My theoretical prediction is that the level should be significant. When I include the change in wealth variable I still obtain significant coefficients on the wealth level variable. All reported specifications include the change in wealth variable.

Another way to confirming the concept that the level of wealth is actually the driving effect is to run the same specifications and replace wealth with lags of all yearly salaries. If the level of wealth is what matters than all coefficients on previous salaries should be equal.
Therefore I test the null hypothesis that the coefficients are equal and in every specification I fail to reject the null hypothesis.

5. Results

5.1. The Effect of Wealth on Performance. Table 3 shows the results from the OLS estimation of alpha net of fees. I have adjusted alpha to a yearly level and report it in percent units in an attempt to avoid poorly scaled coefficients. It appears from this regression that the relationship between managerial wealth and alpha is significantly negative using either type of fixed effects at the 1% confidence level. The variable change in wealth is also significant which could indicate that there is some impact from managers responding to shocks in their wealth from last period. Interestingly, experience squared is significant. I included a squared term on experience to account for effects like boredom or datedness of the manager. The coefficients on the dummy variables for the number of funds under a managers control are generally negative, which confirms the finding in Prather, Bertin, and Henker (2004) that managers in charge or multiple funds underperform. The standard deviation of returns is a significant predictor of alpha, which implies that alpha is not completely risk adjusting. Perhaps some of the exposures to other asset classes are to blame. Many of these coefficients are very small and difficult to interpret. Table 5 reports the coefficients side by side with the standard deviation of the dependent variables to provide some insight regarding economic magnitudes.

The results from the estimation of fund flows as the measure of performance are reported in table 4. Wealth is significantly negatively related to fund flows at the 1% level with wealth. Change in wealth does not play a significant role with regard to fund flows. Perhaps managers focus most on return performance when they are sensitive to termination. Another explanation presented in Lynch and Musto (2003) is that investors do not respond as extremely to very poor performance as the strategies that generated the poor performance will be thrown out in subsequent periods. Being in the top quintile of funds is a good predictor
of fund flows, a finding that is consistent with those of Sirri and Tufano (1998). Also consistent with their study is the sensitivity of investors to fees. Its interesting that significance levels vary based on the choice of fixed effects variable. Both types are arguably reasonable. Investors may be drawn to some fund specific aspects such as whether the fund has a household name. On the other hand some managers may have better connections and thus more effective at sales. Its not clear which specification is more accurate; but it is reassuring that the significance of wealth is not sensitive to the choice of fixed effects variable.

Table 5 shows the impact on the alpha, fund flows, and management fee from a one standard deviation increase in various independent variables. The reported coefficients are identical to those reported in previous tables (in other words, the variables listed are not the only control variables). A one standard deviation results in roughly a 1% decrease in alpha and a 10% decrease in fund flows. Interpretations from this table should be limited to the variables that are significant. For example, an additional 4 years of experience is a very negative predictor of fund alpha as a one standard deviation of experience is associated with a decrease in alpha of anywhere between 3 and 7.7 percent. The negative impact of expense ratio on alpha is consistent with many other findings, although this relationship is unsurprising because alpha is reported net of fees. Already being a large fund is associated with increased fund flows suggesting that its easier for funds attract investors after they have already become well known (probably due to past superior performance).

5.2. **Controlling for Selection Bias.** Table 8 reports the estimates that control for selection by using Heckmans two-stage method when alpha is the dependent variable. Selection bias is large and significant when estimating alpha. Comparison with table 3 shows that the magnitudes of the coefficients on wealth are similar and the coefficients are still significant at the 1% level. Fund size is significant when using the Heckman specification. This change is likely because many of the selection variables are closely related to fund size. This finding suggests that future studies of fund size and performance should appropriate account for selection issues. Another interesting change is the increase in R-square which goes from .3
using OLS to .75 using a Heckman specification. These are huge R-squares for a regression with alpha as the dependent variable but this is because the regressions are only explaining within group variation for many very small groups.

Table 9 reports the Heckman estimates for the specification that uses fund flows as the dependent variable. The significance when using manager fixed effects drops from a 1% confidence interval to a 5% interval; however, magnitudes are very similar. All other coefficients and their significance are very similar when using the Heckman specification. There is a large jump in R-squared from .31 to .74 but only for the manager level fixed effects. R-square is unaffected when using the fund level fixed effects.

Table 10 reports the Heckman specification when using management fee as the dependent variable. The results are nearly identical and the R-squares are identical. Thus it seems to be the case that selection is not as large of an issue when considering management fees.

As mentioned above I performed other robustness checks that are not reported here such as including yearly salary lags and confirming that all coefficients are statistically equal. The results are consistent across various specifications and tests. To the best of my ability, I have accounted for every alternative explanation regarding the wealth proxy and the possible driving effect.

6. Conclusions

The paper presents a mutual fund principal-agent model with moral hazard and theoretically demonstrates that the optimal level of effort the agent (fund manager) exerts is decreasing in the fund managers wealth using general parameters. I confirm these results empirically by showing the negative relationship between managerial wealth and effort. I use fund flows and the funds risk adjusted returns as proxies for the managers effort. The findings suggest the importance of considering moral hazard issues when modeling and estimating principal-agent problems.

At the beginning of this paper I mentioned the potential implications of my findings for the existing investments literature. The effect of wealth on fund returns sheds light on the
performance persistence debate of fund manage luck versus skill. If managers can indeed exert effort to obtain superior returns, it is likely the case that at least some managers have stock picking skill. Furthermore the paper explains why it might be difficult to find this effect empirically. Because poor managers do well and become wealthy, they do poorly in future periods. That is, the impact of wealth on effort induces a negative autocorrelation effect on fund returns. Consider a second possible interpretation of the results, which doesn't have implications for the luck versus skill debate: fund managers cannot systematically outperform the market, but there is some critical amount if effort required achieving mean variance efficiency. Then if managers become sufficiently wealth they stop exerting the effort necessary to chose portfolios that are mean variance efficient. Future research can help determine which explanation is more likely.

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