Funding Risk, Patient Capital, and the Dynamics of Hedge Fund Lockups

Adam L. Aiken
Elon University

Christopher P. Clifford
University of Kentucky

Jesse A. Ellis
North Carolina State University

Qiping Huang
University of Kentucky

This Draft: August 31, 2015

Abstract:
We take advantage of the dynamic nature of hedge fund lockups and create a novel proxy for funding liquidity risk that is both a fund-level and time-varying measure. Unlike past studies that compare funds with and without a lockup, our measure allows us to identify changes in funding risk within funds, enabling us to better identify the connections between funding liquidity risk, performance, and risk-taking in the cross section of hedge funds. Fund performance increases following decreases in funding risk, as measured by the proportion of fund capital that is restricted from investor withdrawals. This effect is not driven by changes in factor risk alone, and is consistent with reduced funding risk improving hedge funds' flexibility to capitalize on risky mispricing. We also find evidence of a lockup fixed effect: lockup funds have lower outflows, lower outflow volatility, and better performance than non-lockup funds, regardless of how much capital they have locked up. Our results suggest that, in addition to directly restricting withdrawals, lockup provisions may also reduce funding risk by encouraging the formation of a patient investor clientele.

Theories of efficient capital markets hinge on the concept that mispricing will be arbitraged away by competitive traders. In the real world, however, traders are constrained by funding liquidity risk, i.e., their ability to attract and retain the capital necessary to trade against risky mispricing (Shleifer and Vishny, 1997). Funding liquidity risk is a critical friction that reduces a fund manager's ability to take risks, and has wide reaching implications for not only fund performance, but also market stability and efficiency. As such, there is growing interest in understanding how funds can manage funding liquidity risk and overcome limits to arbitrage by placing restrictions on investor withdrawals. For instance, there is evidence in the literature that closed-end mutual funds, which do not offer redeemable shares, are better able to invest in illiquid assets and employ risky arbitrage strategies than are open-end funds, which offer daily liquidity to their investors (Cherkes, Sagi, and Stanton, 2009; Deli and Varma, 2002; and Giannetti and Kahraman, 2014).

In addition, because of the importance of hedge funds as arbitrageurs, much attention has been paid to how withdrawal restrictions could enable hedge funds to take greater risks and capitalize on market mispricing.[1] For example, many hedge funds employ an expiring restriction called a lockup. Lockups are contractual provisions that prevent new capital from being withdrawn for an initial lockup period (typically 12 months), after which time the lockup expires and the shares become fully redeemable. The evidence in the literature points to the lockup provision as a contracting tool that reduces funding liquidity risk, increases managerial flexibility, and ultimately improves fund performance by between 4-7% a year compared to hedge funds that do not impose a lockup (Aragon 2007). These conclusions have come from studies of the presence of a lockup provision in the fund's investment contract, which is chosen at the fund's inception and is fixed through time.

[1] See, for instance, Aragon (2007), Agarwal, Daniel, and Naik (2009), Aragon, Martin, and Shi 2014, Giannetti and Kahraman (2014), and Hombert and Thesmar (2014).

However, the static nature of the lockup provision clouds the inferences we can draw from past studies with regards to the relation between the presence of a lockup and funding liquidity risk, portfolio risk, and fund performance. For one, studies of static lockup presence implicitly characterize lockups as imparting a fixed effect on fund outcomes, making it difficult to disentangle the effects of the lockup from other time invariant omitted factors that may affect fund performance and risk characteristics. For example, it could be that more skillful managers have more bargaining power with investors, and thus their investors are more willing to accept a lockup provision in their contract. Another issue is that the presence of a lockup can only be construed as a static proxy for funding liquidity risk. But lockups expire over time, meaning that the amount of capital a hedge fund has locked up, and thus, its funding liquidity risk, is actually dynamic and varies across funds and through time as a function of lockup periods and capital flows.

In this paper, we focus on the dynamic nature of the hedge fund lockup and create a time-varying measure of capital restrictions for lockup hedge funds. Doing so allows us to disentangle the effects of binding share restrictions from other omitted factors and helps us to better understand the connection between funding liquidity risk, fund performance, and risk taking.

Our sample includes 3,809 lockup funds from five different hedge fund databases over the period 1994-2013. We estimate the proportion of capital locked up in each fund in each month in our sample. Far from being static, we find that the proportion of locked up capital varies considerably across funds and through time. Figure 1 shows the fraction of lockup fund capital that is actually restricted (locked up) over the course of a fund's life. Although new lockup funds begin operations with 100% of their capital locked up, this percentage steadily declines over time. By the time a fund is five years old, the median fund will only have about 10% of its capital locked up with a quarter of these funds having less than 1% of their capital locked up. In fact, more than 70% of the average lockup fund's capital is redeemable at any given time. This raises the question as to whether the lockup premium is truly only attributable to the decreased funding risk created by binding withdrawal restrictions.

We begin by examining the relation between a locked up fund's performance and its proportion of locked up capital (henceforth referred to as dynamic lockup) in a regression framework. Our results indicate that a one standard deviation increase in dynamic lockup is associated with a 16 basis point (bps) increase in monthly fund returns. The difference between a fund with zero capital under lock and a fund that is fully locked is nearly 5% a year. This result continues to hold after controlling for a host of other fund related characteristics and is robust to controlling for delisting and backfill bias.[2] Collectively, our findings are consistent with the idea that funds with more restricted capital have more flexibility to pursue higher expected return strategies.

Because the dynamic lockup is time varying, it enables us to employ a fund fixed effects estimator and control for time invariant factors that could also be driving the outperformance of lockup funds. After including fund fixed effects, we find that within fund variation in dynamic lockup is positively related to future performance. This means that, within a fund, decreases in funding risk (i.e., increases in locked up capital) leads to an increase in performance. This represents a major contribution to the literature, as most of what we currently know about the relation between funding risk and fund performance is derived from comparative studies of time invariant contractual designs (i.e., open versus closed-end mutual funds, lockup versus non-lockup hedge funds, etc.) or time series studies of aggregate funding conditions (such as studies of financial crises).

One potential concern is that our dynamic lockup measure is merely a proxy for a fund's age, size and capital flows, all of which are characteristics that have been shown in the literature

[2] In addition, we find similar results when we specify our dynamic lockup measure as the duration of locked up capital.

to be related to future hedge fund returns. To address this concern, we control for these characteristics in our regressions and also employ the following placebo test. We include non-lockup funds in our analysis and assign each non-lockup fund a placebo value of dynamic lockup based on a random pseudo-lockup period assigned to each non-lockup fund. We then test for a difference in the relation between dynamic lockup and returns for lockup funds versus non-lockup funds. The results of this placebo test confirm that the relation between returns and dynamic lockup is significantly greater for lockup funds as compared to non-lockup funds. In fact, once controls are included in the regression, dynamic lockup is positively related to returns for lockup funds only. This differential effect for lockup funds continues to hold when we include fund fixed effects, meaning it is not driven by time invariant differences between lockup and non-lockup funds. These results support the conclusion that our measure captures the relation between returns and funding risk, and not simply other factors that contribute toward the dynamic lockup calculation.

When we include the non-lockup funds in our analysis, another interesting pattern emerges. Regardless of the proportion of capital the fund has locked up, lockup funds still outperform non-lockup funds by 156 bps/year. This implies that the lockup premium documented in prior literature is comprised of both a time varying component related to binding capital restrictions and a time invariant component related to other differences between lockup and non-lockup funds.

To better understand the drivers of the returns to both components of the lockup premium, we run portfolio tests using factor models that control for common risks associated with hedge fund investment strategies. We split the sample of lockup funds into terciles of dynamic lockup, and adjust each portfolio’s return for the corresponding placebo funds’ returns. This nets out the characteristics of dynamic lockup that are unrelated to capital restrictions and allows us to identify the differences in risk-adjusted performance and risk loadings between lockup and non-lockup funds.

The portfolio tests reveal that even on a risk- and placebo-adjusted basis, funds in the top tercile of dynamic lockup outperform those in the bottom tercile, meaning that the time varying component of the lockup premium is not only driven by differences in factor risk across funds. However, only the funds in the top tercile of dynamic lockup significantly outperform placebo funds on a risk-adjusted basis. This suggests that the time invariant component of the lockup premium is driven by increased risk taking by lockup funds versus non-lockup funds. In particular, this increased risk taking appears to come in part from greater lagged market exposure, consistent with lockup funds having greater exposure to illiquid assets than non-lockup funds. Moreover, this effect is not driven by the actual degree of locked up capital. In fact, there is no difference in lagged market exposure between low and high dynamic lockup funds, suggesting that the time varying component of the lockup premium is not only driven by increased exposure to illiquid assets. Instead, the placebo-adjusted alphas we find for the high dynamic lockup funds are consistent with greater capital stability that allows funds to more effectively capitalize on mispriced securities.

Why would lockup funds take more risk even if their capital is unrestricted? We argue that the lockup provision may screen for patient investors, and/or create various incentives for investors to remain patient with their capital, even after their lockup expires. For instance, holders of unlocked shares can withdraw at will, but they know that any investments they make in the future will revert to locked-up status. This effectively raises the shadow cost of redeeming unlocked lockup shares. Consequently, the greater risk taking by lockup funds could be due to their having a more stable capital base, beyond that which is induced by the binding restrictions of the lockup. To test this conjecture, we examine the flow pattern of lockup funds versus non-lockup funds, and find that even after controlling for the proportion of locked-up capital, lockup funds have lower outflows and lower outflow volatility than non-lockup funds. This is consistent with patient behavior by lockup investors, and suggests the lockup provision's contribution to capital stability goes beyond merely the strict prohibition of withdrawals.

1. Contribution Relative to Prior Literature

Our work contributes to the growing literature that examines how funding risk affects asset manager performance and risk taking. Agarwal, Daniel, and Naik (2009) argue that hedge funds with redemption restrictions have more flexibility to pursue risky arbitrage opportunities, and find that hedge fund performance is positively related to redemption restrictions. Similarly, Hombert and Thesmar (2014) argue that funds will choose to have more stable capital when they plan to engage in riskier strategies, and find that following low past performance, funds with greater share restrictions and lower flow-performance sensitivity subsequently earn higher returns. Giannetti and Kahraman (2014) find that closed-end mutual funds and hedge funds with greater share restrictions are better able to trade against mispricing than unrestricted funds. Franzoni and Plazzi (2015) find that a hedge fund's ability to provide liquidity is particularly sensitive to funding conditions, but that redemption restrictions mitigate the impact of market-wide funding shocks risk on hedge fund liquidity provision. Collectively, these papers support the idea that redemption restrictions reduce funding risk, which in turn increases a fund's ability to capture higher returns from risky strategies. However, because they focus on static restrictions, these papers do not disentangle the differential effects of time varying capital restrictiveness from the other omitted differences between restricted and unrestricted funds. Our results support this prior work by showing that even within funds, increases in capital restrictiveness lead to increased fund performance.

In addition, our work contributes to the literature concerning the premium of lockup funds. Aragon (2007) finds that funds that institute a lockup earn a substantial premium of between 4-

7% over other hedge funds, and he connects this premium to the lockup funds' ability to more efficiently manage illiquid investments that carry higher returns. Subsequent work has shown that lockup funds are more likely to trade against mispriced securities and provide liquidity than non-lockup funds (Giannetti and Kahraman, 2014; Aragon, Martin, and Shi, 2014), which points to other sources of the lockup premium. By constructing a dynamic measure of locked up capital, we are better able to identify the role that binding capital restrictions play in determining the outperformance of lockup funds, while holding constant omitted fixed effects that may be correlated with the presence of the lockup. Though we find that binding capital restrictions do lead to higher performance, they are not the only factor that differentiates funds with from those without a lockup. Our results suggest that funding risk may also be partially mitigated by simply having a lockup provision in the fund's contract, which can lead to the formation of a more stable capital base.

Our work is also relevant to the debate about the optimal structure of redemption rights in the asset management industry. Fama and Jensen (1983) argue that demand deposits reduce agency problems and improve fund governance because investors can vote with their feet. However, the dark side of unrestricted redemptions is that it hinders managerial flexibility to pursue higher expected return investments (Shleifer and Vishny, 1997). As a result, Stein (2005) argues that competitive pressures to remain open-end lead to an inefficiently low supply of closed-end managers that are free to engage in risky arbitrage, stabilize prices, and contribute to market efficiency. Though the debate concerning redemption rights often centers on the extremes of open- versus closed-end funds, the heterogeneous structure that has emerged in the hedge fund industry may be a more suitable solution to the problem of excessive open-endedness. In addition to directly restricting investor redemptions, our finding of the lockup fixed effect, i.e., that investors behave more patiently with unlocked shares than they do with shares in unrestricted funds, suggests that funds can also combat limits to arbitrage by creating contract mechanisms that screen for and incentivize more patient capital.

2. Data

The hedge fund data in our paper comes from the union of five hedge fund databases: Lipper TASS, BarclayHedge, HFR, Eureka, and MorningStar. Our sample period covers 1994-2013. We follow Joenväärä, Kosowski, and Tolonen (2012) and merge the databases together to remove duplicate funds and share classes through a name matching and returns correlation algorithm. Because each hedge fund database categorizes investment strategies differently, we use the style-correspondence created by Joenväärä et al. (2012) to condense the investment strategy space to 13 different strategies.[3]

We remove funds of funds and non-US dollar denominated share classes. Our final sample contains 13,959 hedge funds with a total of 795,447 monthly return observations. Of these, 3,809 funds (about 29.2% of fund-months) have a lockup in their contract with an average length of 12.5 months.

[Insert Table 1 here]

In Table 1, we present summary statistics for both our full sample (Panel A) and for just those funds with a lockup provision in their contract (Panel B). We note that funds with a lockup have higher average monthly returns than the full sample, which is consistent with prior literature. Interestingly, lockup funds also have more share restrictions beyond just the lockup, with longer redemption notice periods and redemption frequencies than non-lockup funds. This

[3] The 13 strategies are: CTAs, Emerging Markets, Event Driven, Fund of Funds, Global Macro, Long Only, Long/Short, Market Neutral, Multi-Strategy, Relative Value, Sector, Short Bias, and Others.

is consistent with the findings in Aiken, Clifford, Ellis (2015), who argue that different share restrictions can serve a complementary role in hedge fund contracting. However, it is important to point out that, like the lockup, these restrictions are also fixed-contract provisions that are essentially time invariant.[4] As such, we control for these restrictions in our tests to ensure that we are isolating the specific effects of the lockup.

2.1 Dynamic Lockup Measure

A primary innovation in this paper is that we create a dynamic measure of restricted capital that takes into account the flow history of the fund to estimate the amount of capital under lockup. This approach differs from the previous literature that relies on a static indicator of the presence of a lockup provision in the fund's contract. For each fund that has a lockup provision, we calculate the fund's dynamic lockup, which captures the percent of assets the fund has under lockup at a given point of time. We calculate dynamic lockup in the following way. We begin by assuming that a lockup fund's capital is fully locked up at the fund's inception (i.e., dynamic lockup = 100%). This new fund is fully locked up until the lockup period ends. For example, if a fund had a 12 month lockup and received no additional investments, the fund would have a dynamic lockup = 100% for months 1 through 12. In month 13, the lockup period would have expired, and the fund would become fully unlocked (i.e., dynamic lockup = 0%). We treat any additional capital inflows the fund receives as new investments subject to the same 12 month lockup period. We track the timing and size of each inflow to create the following asset weighted percentage of locked up capital:

[4] Our database is formed from snapshots of the commercial databases collected in 2013, and thus the contractual terms we can observe truly are fixed through time. It is common in the hedge fund literature to assume these provisions remain fixed in reality, and there is evidence that supports this view (e.g., see Aragon, 2007). Funds can change share restrictions through time, though this happens very infrequently (Hong, 2014).

$$Dynamic\ Lockup = (\sum_{i=1}^{l}(flow_{t-l+i}\prod_{i=2}^{l}R_{t-l+i}))/AUM_t \qquad (1)$$

where *flow* is the positive net flow received by the fund at the end of each quarter, R_t is the gross return in quarter t, and l is the length of lockup period measured in quarters. As gross inflows and outflows are not available in the data, we proxy for the size of new investments (gross inflows) with net capital inflows each month. To the extent that some inflows are masked by countervailing outflows, our dynamic lockup measure would understate the true proportion of locked up capital. Because the lockup only binds once for each new investment, we exclude negative net flows from the calculation based on the assumption that outflows can only come from unlocked capital, which is treated the same regardless of its vintage in the fund.

We find that, on average, only 29% of lockup funds' assets are restricted over our sample period. There is a great deal of variation across funds, however, as the 25th percentile of dynamic lockup is only 1.1%, meaning that in over a quarter of our sample, lockup funds have almost no capital locked up. On the other hand, a fund in the 90th percentile fully locked. A static lockup measure, such as a lockup indicator, is unable to capture this fact, and would treat both the fully locked and unlocked funds the same. The goal of this paper is to use this variation to explore how the amount of restricted capital within a fund affects their returns, as well as the sources of these returns.

3. Dynamic Lockups and Fund Returns

We start by investigating how the returns of funds with lockup provisions vary as their amount of restricted capital increases. As discussed, previous work has focused on the average differences between funds with a closed structure and those that choose to allow investors to withdraw their capital. However, our dynamic lockup measure allows us to study within-fund variation in returns for funds with a lockup feature and learn the effect of an incremental change in the amount of capital locked up. This allows us to more closely identify the link between changes in funding risk and asset manager performance.

3.1 Multivariate Regression

We begin by estimating a pooled, monthly return regression, where we restrict our sample to just those hedge funds that use a lockup. These results are presented in Table 2. Our regression model is given in Equation (2) as,

$$Return_{i,t+1} = \beta_0 + \beta_1 * Dynamic\ Lockup_{i,t} + \sum_{i=2}^{N} \beta_i * Control_{i,t} + \theta_i + \tau_t + \epsilon_{i,t} \qquad (2)$$

where the dependent variable, $Return_{i,t+1}$, is the fund's return in the subsequent month t+1 and the variable of interest, $Dynamic\ Lockup_{i,t}$, is the percentage of the fund's capital under contractual lockup in month *t*.

We control for both time-varying controls, including the fund's past performance, flow, age, and size, as well as time-invariant controls, including the fund's minimum investment, fees and other capital restriction features, such as redemption frequency and notice period. All continuous variables are normalized to mean of zero and a standard deviation of one. The unit of observation is a fund-month and we include time fixed effects in all models. Standard errors are clustered at the fund-level. In Models 1-3, we include style fixed effects. In Models 4-6 we include fund-level fixed effects.

[insert Table 2 here]

We find that the amount of restricted capital (*Dynamic Lockup*) is positively related to future fund returns in all model specifications. In Model 1, we find that a one standard deviation increase in *Dynamic Lockup* is associated with a 16 bps/month (*t*-statistic of 10.68) increase in the fund's performance. In Models 2 and 3, where we control for fund characteristics shown to be related to fund performance, we again find a positive and significant relation between dynamic lockup and future fund performance. For example, in Model 3, a one standard deviation increase in *Dynamic Lockup* is associated with an 8 bps increase in monthly returns (*t*-statistic of 5.05).

One of the advantages of our dynamic lockup measure is its time-varying nature for a given fund. As such, in Models 4-6 we can perform similar tests but include fund-level fixed effects to control for unobservable, time-invariant fund characteristics that may be related to the outperformance of lockup funds. In doing so, we find that an increase in the amount of stable capital leads to better performance.[5] For example, within a given fund, a one standard deviation increase in dynamic lockup leads to a 7 bps/month increase in average returns. Overall, we believe that this result is consistent with a greater degree of asset stability (i.e. a reduction in funding risk) allowing managers to pursue strategies with greater expected returns.

[5] We exclude (include) the lagged dependent variable in Model 5 (6) of Table 2 to test for differences in inference due to dynamic panel bias.

3.2 Robustness

We test the robustness of this result in Table 3 by both restricting our sample and altering our definition of dynamic lockup. In order to ensure that our results are not driven by known hedge fund data issues, we remove young funds (less a year since inception), small funds (funds that never manage more than $20MM in assets during their history), and include a delisting return of -50% when a fund leaves the database. As an alternative to the percentage of assets locked up, we also define dynamic lockup as a duration measure. We use this alternative definition in order to verify that our results are not dependent on the exact specification for restricted capital. This approach addresses the limitation that the percent lockup (Equation 1) will be the same for a fund with 6 month lockup and a two year lockup, *ceteris paribus*. We define duration in this context as the length of time in months that the fund's assets will remain under lockup, or:

$$Duration = (\sum_{i=1}^{l}(i * flow_{t-l+i} \prod_{i=2}^{l} R_{t-l+i}))/AUM_t \quad (3)$$

where, $flow_{t-l+i}$, is the positive net flow received by the fund at the end of each quarter t, R_t is the gross return in quarter t, and l is the length of lockup period measured in quarters.

[insert Table 3 here]

In Table 3, Panel A we include style fixed effects, while in Panel B we include fund fixed effects. The same set of control variables as in Model 3 of Table 2 are included, but omitted for brevity. Our result remains, as dynamic lockup is positive and statistically significant across each robustness check. Amongst funds with a lockup provision, those with less fragile capital structures and more restricted assets under management have greater returns. In Section 4, we explore the return difference between locked and unlocked funds by including the full sample of hedge funds in our sample.

4. Locked Up Funds Vs. Non-Locked Up Funds

In this section, we include all non-lockup funds in our analysis. We do this for two reasons. First, we wish to place our results within the prior literature by comparing the performance of lockup and non-lockup funds. Doing so allows us to understand if the return differences found in Section 3 are driven entirely by our dynamic measure, or if there is a residual, fixed difference between lockup and non-lockup funds. However, including funds without a lockup in our sample also serves as a robustness check for our dynamic lockup measure. Our measure is created using the past flow history of the fund and will mechanically be related to the age, size, and net inflows of the fund. Because these factors have been shown to predict hedge fund performance, one concern could be that our dynamic lockup measure is simply a proxy for these factors. Aggarwal and Jorion (2010), for example, find that young funds outperform older funds. Using our measure, younger funds will have larger dynamic lockup estimates, as much of their initial capital will still be locked. Though we control for these factors in our regression, the effects may be nonlinear.

4.1 Correlation of Dynamic Lockup and Fund Characteristics

To better see this issue, in Table 4, we sort funds into terciles each month based on the fund's dynamic lockup. We report average assets under management (AUM), age, returns (%), and flows (%) across the terciles. As a reminder, one of the starkest findings in our paper is the variation in locked up capital across funds. As we see from Table 4, the lowest tercile of funds in our sample have almost none (1.62%) of their assets restricted, while funds in the highest tercile have almost three-quarters (74.87%) of their capital under lock. However, we also find that our measure of locked up capital is related to other fund characteristics known to be related to future performance. For example, funds in the top tercile of dynamic lockup are younger, have higher returns, and greater inflows.

[insert Table 4 here]

4.2 Placebo Approach

To mitigate concern that our dynamic lockup measure is a proxy for funding liquidity risk and is not solely a proxy for other fund characteristics, we use a placebo approach and randomly assign a lockup period to funds with no lockup in their contract. By year of fund founding, we obtain the frequency distribution of lockup periods for lockup funds and apply the distribution to non-lockup funds founded in the same year. In 2000, for example, 76% of the lockup funds in our sample have a one-year lockup period. Accordingly, we randomly choose 76% of the non-lockup funds in 2000 and assign them a one-year lockup. We repeat the process for the rest of the non-lockup funds. For each of the pseudo-lockup funds, we calculate our dynamic lockup as their percentage of restricted capital, as given in Equation (1). Therefore, the pseudo lockup that we calculate for non-lockup funds will reflect any potential bias introduced by age, size, or recent inflows. We then seek to net out any measurement error by comparing the differences between lockup funds (treated) and non-lockup funds (placebo).

By pooling all funds and using a similar regression framework, we can estimate how capital stability affects manager returns both within lockup funds and between funds with a lockup and those without. Table 5 reports regression results for monthly hedge fund returns on the lockup indicator (*Lockup Dummy*), our dynamic lockup measure (*Dynamic Lockup*), and the interaction between the two (*Lockup Dummy x Dynamic Lockup*). As discussed, both placebo and treated funds are included when estimating *Dynamic Lockup*, but the interaction term estimates the additional return treated funds receive as their amount of restricted capital increases. The indicator, *Lockup Dummy*, captures any incremental return received by treated funds that is not captured by the dynamic measure. Model 1 includes only these three variables, while Model 2 contains the same controls as our main specification in Table 2 (Model 3). Model 3 again includes fund-level fixed effects. Accordingly, *Lockup Dummy* is dropped from this model. Time fixed effects are included in all models and standard errors are clustered at the fund-level.

[insert Table 5 here]

In Models 1 and 2, both *Lockup Dummy* and the interaction *Lockup Dummy* x *Dynamic Lockup* are positive and statistically significant. The former suggests that funds with a contractual lockup do have greater returns than funds without one (Aragon, 2007), while the latter suggests that lockup funds earn more as the amount of capital under lockup increases. In Model 1, *Dynamic Lockup* is positive and statistically significant, indicating that increasing the amount of capital under lockup is associated with positive returns, even if the fund is part of the placebo group that does not actually have a lockup in their contract. This suggests that a portion of the *Dynamic Lockup* premium is due to characteristics, such as fund age, associated with both more restricted capital and higher returns.

However, when the full set of controls is included in Model 2, *Dynamic Lockup* is no longer statistically significant, while *Lockup Dummy* and *Lockup Dummy* x *Dynamic Lockup* remain so. In other words, the placebo group with a greater dynamic lockup measure is no longer earning a return premium. Only those funds with an actual lockup have higher returns as the amount of restricted capital within the fund increases, supporting our claim of a causal link between a reduction in funding risk and higher returns.

Interestingly, the indicator *Lockup Dummy* also remains positive and statistically significant. This suggests that there is a positive return difference between lockup and non-lockup funds that is not explained by the amount of restricted capital and remains even if the fund has no actual assets under lockup. For example, if we take the coefficient from Model 1 of Table 5, it indicates that a fund that has had its lockup completely expire (Dynamic Lockup = 0%) earns a return premium of 156 bps/year when compared to a fund that is similarly completely off lockup due to never having a lockup in their contract.

[insert Figure 2 here]

This effect is perhaps best seen graphically. Figure 2 shows the growth of $1, starting in the beginning of our sample period, invested in three equally-weighted fund portfolios. The solid line includes all lockup funds, while the dashed line includes all funds without a lockup. The spread between the two is the well-known result that lockup funds outperform non lockup funds. However, our dynamic lockup measure allows us to include a third portfolio (the dotted line) that shows the performance of funds with a lockup provision, but with no actual restricted capital. We rebalance this portfolio monthly, since funds can enter and leave the portfolio as their dynamic lockup changes. As the figure shows, these funds underperform the set of all lockup funds, but they still outperform funds without a lockup. This, of course, raises the following question: Why do funds earn a lockup premium in the absence of locked up capital?

5. Lockup Premiums, Risk, and Patient Capital

We demonstrate that the lockup premium is a function of two separate mechanisms. One is dynamic and related to how much capital the manager has under contractual lockup. The other is time-invariant and associated with the presence of a lockup feature in the fund's contract. In this section, we ask if this return premium is related to manager skill, or if more restricted capital allows funds to take more risk. For example, perhaps managers who are able to negotiate a lockup *ex ante* are also more skilled. If this is the case, then we should observe positive alpha for managers with a lockup, independent of the percentage of capital under contractual restriction. However, perhaps limits to arbitrage are relaxed and managers are better able to engage in more complex arbitrage activities without the fear of investor outflows. In this case, estimates of alpha should increase as the percentage of capital under lockup increases. Finally, managers with less fragile capital might also earn higher returns from increased factor exposures. In this situation, lockup funds would have larger betas and these betas might increase as the amount of capital under lockup is increased.

5.1 Risk Models

In Table 6, we perform calendar-time factor regressions in order to test these hypotheses. Among those funds with a lockup, we form equal-weighted monthly portfolios based upon the fund's lagged dynamic lockup tercile. Furthermore, we adjust each portfolio's return by netting out the average placebo portfolio's return in that tercile. For example, if actual and placebo funds in the high dynamic lockup tercile share certain characteristics that are associated with higher returns (e.g. both are smaller and younger funds), then subtracting placebo returns will adjust for that source of premium. All alpha and factor betas reported in Table 6 are, therefore, in excess of what is earned by the placebo group in that tercile.

For each tercile portfolio, we run three models. The first uses no factors and again demonstrates that fund returns increase with the amount of capital under lockup. For example, funds in the low lockup tercile earn 16 bps/month more than placebo funds in the low tercile. This difference increases monotonically, with funds in the high tercile earning 36 bps/month more. This is consistent with our findings: the fact that all funds, regardless of dynamic lockup tercile, earn a premium indicates the presence of a fixed lockup effect, while the fact that the value of the intercept is increasing in terciles suggests that higher returns are also associated with a greater amount of capital under lockup.

The second model includes the market return as a risk factor, as well as the lagged market return to account for autocorrelation in hedge fund returns (Asness et al., 2001). Autocorrelation in fund returns is often interpreted as a sign of fund exposure to illiquid assets and/or difficult-to-value securities. In this simple model, our alpha estimates are not statistically different than zero for the low and middle terciles. Estimated coefficients for the market factor are positive and statistically significant. Since fund returns are placebo adjusted, these estimates reflect the *incremental* risk taking by lockup funds over placebo funds that are in the same tercile. This suggests that the lockup fixed-effect found in Section 4.2 is related to an increased ability to take risk, independent of the amount of capital locked-up.

We also note that the coefficient on lagged market returns is positive and significant in all models. This suggests that funds with a lockup own more illiquid or difficult-to-price assets with greater transactions costs than the placebo funds in their tercile. However, the factor loading does not increase when moving from the low to the high tercile, indicating that this increase in illiquid assets is independent of the amount of capital under lockup.

Finally, funds in the high tercile still have positive and statistically significant alpha estimates. While managers with a lockup take more risk, when a manager has incrementally more capital locked up, they are able to earn a return above that gained through the observed increase in market risk. With a more stable capital base, this additional alpha could be related to a reduction in the limits to arbitrage and more subsequent trading opportunities, to an omitted liquidity premium that managers can capture, or perhaps to a greater use of leverage or options (Aragon, Martin, and Shi, 2014). These findings hold when we add the six additional factors from the Fung and Hsieh (2004) model for hedge fund returns.[6] We also note that, in the Fung and Hsieh model, funds with a lockup take on more small stock risk than the placebo funds. Furthermore, the factor loading on *sizespread* increases as the amount of capital under lockup increases. Both facts suggest that at least a portion of the excess returns observed for lockup funds is associated with an ability to earn the size premium when capital is more stable.

5.2 Patient Capital

We find that funds with more capital under lockup earn higher returns than those without a stable capital base, but much of this return premium comes from an increase in the ability of the manager to take risk. Furthermore, fund managers are able to earn a risk-related premium even if very little capital is under contractual lockup. In other words, managers with a static lockup in their contract earn greater returns than managers that do not, even if their investors could withdraw their capital.

In this section, we ask if this additional return could, in part, be due to lockup funds attracting a more patient capital base. These investors, attracted to (or at least not dissuaded by) a lockup feature, might be more likely to stick with a manager and not react as quickly to poor performance. There are several reasons why funds with a lockup might either attract a more patient capital base *ex ante*, or create an incentive for investors to remain in the fund. For example, the initial lockup could act as a screening device to help select investors that will remain patient even after the lockup expire, perhaps because these investors understand that earning a risk-premium entails suffering lower returns in some states of the world. The presence of a lockup also raises the cost to re-enter the fund. Investors may be less willing to pull assets if

[6] The Fung and Hsieh (2004) model includes the following returns: the S&P 500 total return, a size spread return (Wilshire Small Cap 1750 - Wilshire Large Cap 750), a bond market factor (quarterly change in the 10-year constant maturity treasury yield), a credit spread factor (quarterly change in the Moody's Baa yield less the 10-year treasury constant maturity yield), and three trend-following factors for the bond market, the currency market, and the commodities market. See David Hsieh's web page at http://faculty.fuqua.duke.edu/\%7Edah7/HFRFData.htm for a complete description.

they know that any assets given back to the manager are again subject to the lockup. Finally, investors may be more patient with their own unlocked capital if they know that other investors' restricted assets are enabling all investors in the fund to earn a premium.

We test this conjecture in Table 7 by exploring how both our dynamic lockup measure and the lockup fixed-effect relate to flow levels and volatility. By including both the standalone lockup indicator and the indicator's interaction with our dynamic lockup measure, we are again able to separate the effects that having a contractual lockup feature, as well as actual restricted capital, have on a fund's future flows.

The unit of observation is a fund-month. In Models 1-3, the dependent variable is a fund's forward monthly netflow, inflow, and outflow, respectively, where we define a fund's inflow to be max(0, netflow) and a fund's outflow to be min(0, netflow) as in Hombert and Thesmar (2014). In Models 4-6, the dependent variable is the forward 12-month standard deviation of a fund's netflows, inflows, and outflows. We include a number of time-varying (e.g. age and AUM) and time-invariant (e.g. fees and redemption frequency) measures to control for other fund characteristics known to influence fund flows. We also include the fund's cumulative performance over the past 12 months, as well as lagged versions of the dependent variables. All models include time and style fixed effects and standard errors are clustered at the fund level.

We begin by examining the coefficients of the dynamic lockup (and its interaction with lockup dummy) itself. If our dynamic lockup measure has any ability to proxy for funding liquidity risk, we would expect that higher levels of restricted capital will be related to lower outflows and lower outflow volatility. Consistent with these predictions, we find that among funds with a lockup, more restricted capital (*Lockup * Dynamic Lockup*) naturally leads to reduced outflows and outflow volatility. For example, from Model 3 we see that dynamic lockup for treated funds is negatively related to future outflows, and in Model 6, we find that a contractual lockup reduces outflow volatility. As a point of economic reference, the average outflow in our sample is 1.83%/month and the average outflow volatility is 3.62%. Thus, a one standard deviation increase in dynamic lockup for treated funds leads to a 13 bps/month, or a 7.10% decrease, in outflows and a 18 bps/month, or a 4.97% reduction in outflow volatility.

What is perhaps more interesting are the results for *Lockup Dummy*. We find that the presence of a lockup feature is associated with both lower outflows and outflow volatility. Even a lockup fund that has no actual capital under direct restraint, has a 33 bps/month, or an 18.03%, reduction in monthly outflows. The results for outflow volatility are similar. Taken together, these findings suggest that the lockup contract allows funds to retain more stable *unrestricted* capital, even after the lockup expires. This investor patience could be beneficial to both the manager and to other investors in the fund, as there is a reduced likelihood of withdrawals following poor performance, which could put further pressure on the prices of assets held by the fund.

6. Conclusion

Funding liquidity risk, i.e., the risk that traders will not be able to source outside funding to take advantage of attractive investment opportunities, is a central friction in models of financial market disequilibrium and limits to arbitrage. It is crucial that we understand how funding risk influences the performance and risk taking of hedge funds because of their key role as arbitrageurs that provide liquidity, price stability, and help push prices to fundamental value. In this paper, we create a novel proxy of funding liquidity risk that is both a fund-level and time-varying measure, which allows us to better identify the connection between funding liquidity risk and fund performance and risk-taking in the cross section of hedge funds. Our measure, dynamic lockup, is defined as the time-varying proportion of hedge fund capital that is subject to a lockup restriction and cannot be withdrawn by investors

We empirically document a strong link between a hedge fund's locked up capital and its performance and risk taking. This effect is robust to including several fund-level control variables, various hedge fund data biases, and changes in how we measure dynamic lockup. Moreover, our result holds when we include fund-fixed effects in the regressions, meaning that within-fund changes in capital restrictions are associated with improvements in fund performance.

We also find that regardless of how much capital lockup funds have restricted, they still outperform non-lockup funds by approximately 1% per year. This lockup fixed effect appears to be driven by increased risk taking by lockup funds as compared to non-lockup funds, including an increased exposure to illiquid investments. We conjecture that lockup funds take greater risk perhaps because the lockup provision screens for patient investors and incentivizes incumbent investors to stay patient after the lockup expires. This allows lockup funds to retain more stable *unrestricted* capital, even after the lockup expires. Consistent with this conjecture, we find that lockup funds have lower outflows and lower outflow volatility, even after controlling for the proportion of capital that is contractually restricted. Collectively, our results suggest that funds can combat limits to arbitrage by not only directly restricting their investors' withdrawals, but also by creating mechanisms that incentivize a more patient investor base.

References

Agarwal, V., N. D. Daniel, and N. Y. Naik, 2009, Role of managerial incentives and discretion in hedge fund performance. *Journal of Finance* 64: 2221–2256.

Aggarwal, R.K., and P. Jorion, 2010, The performance of emerging hedge funds and managers. *Journal of Financial Economics* 96, 238–256.

Aiken, A., C. Clifford, and J. Ellis, 2015. Hedge Funds and Discretionary Liquidity Restrictions, *Journal of Financial Economics* forthcoming.

Aragon, G., 2007, Share Restrictions and Asset Pricing: Evidence from the Hedge Fund Industry. *Journal of Financial Economics* 83, 33-58.

Aragon, G. O., J. S. Martin, and Z. Shi, 2014, Smart Money and Liquidity Provision: Hedge Fund Behavior Through Market Crises, Working Paper, Arizona State University.

Asness, C., R. Krail, and J. Liew, 2001, Do Hedge Funds Hedge? *Journal of Portfolio Management* 28, 6-19

Cherkes, M., J. Sagi, and R. Stanton, 2009, A liquidity-based theory of closed-end funds. *Review of Financial studies*, 22(1), 257-297.

Deli, D. N., and Varma, R. 2002, Closed-end versus open-end: The choice of organizational form. *Journal of Corporate Finance*, 8(1), 1-27.

Fama, E., and M. Jensen, 1983, Agency problems and residuals claims. *Journal of Law and Economics* 26, 327-349.

Fung, W., and D.A. Hsieh, 2004, Hedge fund benchmarks: A risk-based approach, *Financial Analysts Journal* 60, 60-80.

Franzoni, F. A. and A. Plazzi, 2014, What Constrains Liquidity Provision? Evidence From Hedge Fund Trades. Working paper.

Giannetti, M., and B. Kahraman, 2014, Who Trades Against Mispricing? Working paper.

Hombert, J., and D. Thesmar, 2014. Overcoming Limits of Arbitrage: Theory and Evidence. *Journal of Financial Economics* 111:26-44.

Hong, X., 2014, The Dynamics of Hedge Fund Share Restrictions. *Journal of Banking and Finance* 49.

Joenvaara, J., R. Kosowski, and P. Tolonen, 2012, Revisiting stylized facts about hedge funds, Working Paper, Imperial College London.

Shleifer, A., and R.W. Vishny, 1997, The Limits of Arbitrage. Journal of Finance 52, 35–55.

Stein, J. C., 2005, Why are most funds open-end? Competition and the limits to arbitrage. *Quarterly Journal of Economics* 120:247–72.

Fig. 1 Percentage of Capital Under Lock by Fund Age

Figure 1 presents the percentage of capital under lock based on the fund's age (months).

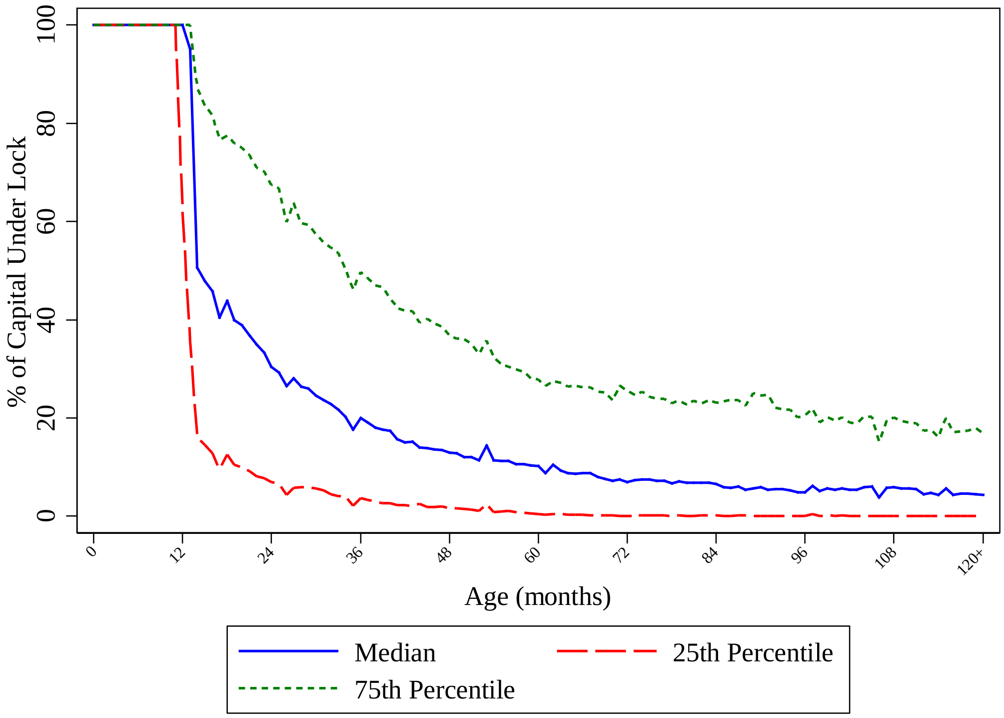

Fig. 2. Cumulative Performance of Locked and Non-Locked Funds

Figure 2 shows the growth of $1 invested in three, equal-weight portfolios from 1994 (beginning of our sample) to the end of 2013. *Lockup* is the portfolio of funds that have a static lockup in their contract. *No Lockup* is the portfolio of funds that do not have a static lockup in their contract. *Zero Lock* is the portfolio of funds that have a static lockup in their contract, but their lagged level of dynamic lockup is zero. We rebalance the *Zero Lock* portfolio monthly.

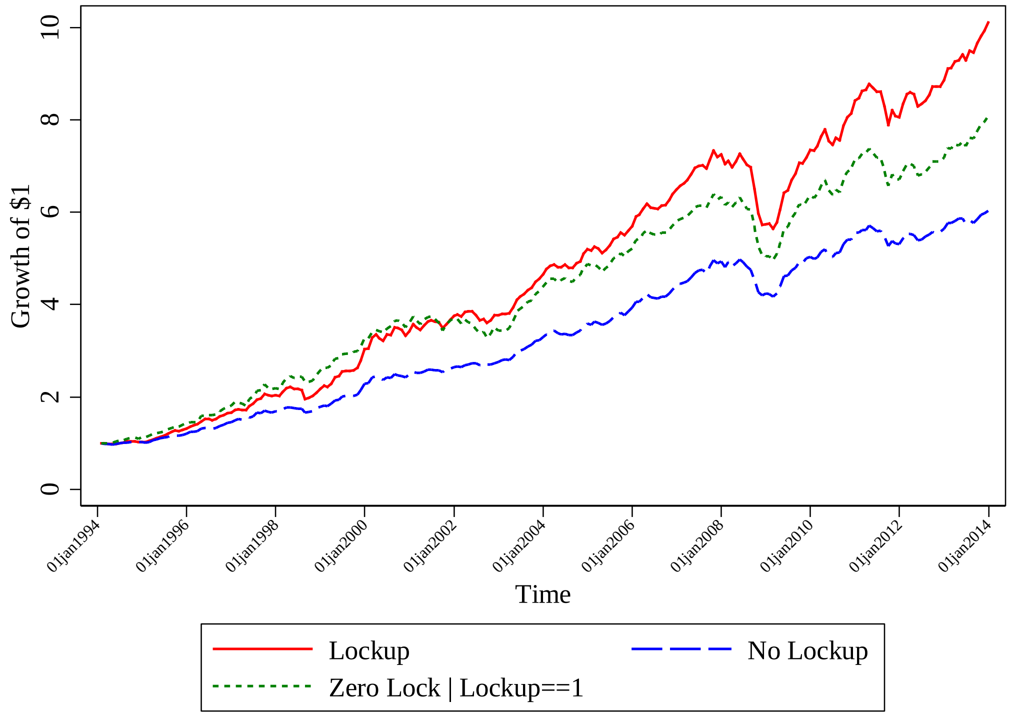

Table 1
Summary Statistics

This table presents the summary statistics for the hedge funds in our sample. The unit of observation is a hedge fund-month. Our time-period of study is 1994-2013. In Panel A we examine the full sample of funds. In Panel B we only examine the sample of funds with a lockup. *Static Lockup* is an indicator variable equal to one is the fund has a lockup, and zero otherwise. *Dynamic Lockup* equals the percent of capital the fund has locked up (see Equation 1). *AUM* is fund's reported assets under management at the end of each month ($ millions). *Age* measures years since fund's inception date. *Return* is the monthly return net of fee (%). *Flow* is fund's implied, monthly net flow scaled by AUM (%). *Management fee* is the annual fee charged to investors as a percent of AUM (%). *Incentive fee* is annual performance-based fee charged to investors (%). *Redemption notice* is the number of days of advance notice an investor must provide the fund to withdraw capital. *Redemption frequency* is the number of days between withdrawal periods. *Minimum Investment* is the minimum investment required to invest in the fund ($ millions). The full sample includes 13,959 funds and 795,447 fund-months.

Panel A: Full Sample

	Mean	10th	25th	50th	75th	90th	sd
Static Lockup %	29.17	0.00	0.00	0.00	100.00	100.00	45.45
AUM ($MM)	166.85	2.88	9.72	34.00	114.99	345.00	635.07
Age (years)	5.39	0.92	1.92	4.08	7.59	11.84	4.63
Return %	0.68	-3.84	-1.00	0.63	2.34	5.20	5.34
Flow %	1.20	-4.98	-0.35	0.00	1.30	7.96	10.20
Management fee %	1.48	1.00	1.00	1.50	2.00	2.00	0.62
Incentive fee %	18.13	10.00	20.00	20.00	20.00	20.00	5.93
Redemption notice (days)	36.55	2.00	15.00	30.00	45.00	90.00	34.33
Redemption frequency (days)	67.58	7.00	30.00	30.00	90.00	90.00	79.44
Minimum Investment ($MM)	1.17	0.10	0.15	0.50	1.00	2.00	3.86

Panel B: Lockup Sample Only

	Mean	10th	25th	50th	75th	90th	sd
Dynamic Lockup %	29.27	0.00	1.10	12.72	47.05	100.00	35.00
AUM ($MM)	156.30	3.00	9.80	33.80	110.00	331.42	490.82
Age (years)	5.30	0.92	1.92	4.08	7.51	11.67	4.39
Return %	0.78	-3.87	-0.90	0.74	2.49	5.35	5.54
Flow %	1.33	-3.44	-0.16	0.00	1.28	7.24	9.31
Management fee %	1.40	1.00	1.00	1.50	2.00	2.00	0.49
Incentive fee %	19.18	17.00	20.00	20.00	20.00	20.00	3.98
Redemption notice (days)	52.09	30.00	30.00	45.00	60.00	90.00	42.05
Redemption frequency (days)	107.18	30.00	90.00	90.00	90.00	180.00	98.53
Minimum Investment ($MM)	1.11	0.10	0.25	1.00	1.00	2.00	1.70

Table 2
Hedge Fund Performance and Dynamic Lockups

We regress hedge fund returns on a dynamic measure of a hedge fund's lockup. The unit of observation is a hedge fund-month. The dependent variable is the fund’s monthly return at time t+1. All control variables are defined in Table 1. All continuous control variables are normalized to mean of zero and a standard deviation of one. We include time fixed effects throughout and style/fund fixed effects where indicated. We cluster standard errors at the fund level. We report t-statistics in square brackets. *** p<0.01, ** p<0.05, * p<0.1.

	1	2	3	4	5	6
Dynamic Lock	0.0016***	0.0009***	0.0008***	0.0015***	0.0007***	0.0007***
	[10.678]	[5.039]	[5.054]	[7.814]	[2.943]	[3.255]
Flow		0.0010***	0.0009***		0.0006***	0.0005***
		[6.600]	[5.954]		[3.880]	[3.679]
Log Age		-0.0005***	-0.0004**		-0.0017***	-0.0011**
		[-2.729]	[-2.218]		[-3.028]	[-2.200]
Log AUM		-0.0011***	-0.0012***		-0.0078***	-0.0078***
		[-6.027]	[-6.956]		[-17.035]	[-17.593]
Minimum Investment		0.0015***	0.0014***			
		[5.334]	[5.732]			
Management Fee		0.0006	0.0005			
		[1.140]	[1.149]			
Incentive Fee		0.0007***	0.0006***			
		[4.008]	[3.965]			
Redemption Frequency		0.0001	0.0001			
		[1.311]	[1.265]			
Redemption Notice		-0.0000	-0.0000			
		[-0.070]	[-0.038]			
Lag Return			0.0064***			0.0049***
			[15.689]			[11.843]
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Style FE	Yes	Yes	Yes	-	-	-
Fund FE	-	-	-	Yes	Yes	Yes
Observations	231,973	231,973	231,973	231,973	231,973	231,973
R-squared	0.166	0.167	0.179	0.192	0.196	0.202

Table 3
Hedge Fund Performance and Dynamic Lockups -- Robustness

We regress hedge fund returns on a dynamic measure of a hedge fund's lockup. The unit of observation is a hedge fund-month. The dependent variable is the fund's monthly return at time t+1. Model 1 of Panel A(B) is intended for reference and is identical to that of Model 3(6) from Table 2. In Model 2, we exclude the fund's first year of returns. In Model 3, we exclude funds that never manage more than $20 million in assets. In Model 4, we alter the dependent variable by adding a delisting return of -50% to the last month the fund reports to a databases. In Model 5, we alter our definition of dynamic lockup using a duration approach (see Equation 3). All control variables are defined in Table 1. All continuous control variables are normalized to mean of zero and a standard deviation of one. In Panel A, we include time and style fixed effects in each model. In Panel B, we include time and fund fixed effects in each model. We cluster standard errors at the fund level. We report t-statistics in square brackets. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Style Fixed Effects

	1	2	3	4	5
	Baseline	Remove Young Funds	Remove Small Funds	Delisting Return	Duration Lock
Dynamic Lock	0.0008***	0.0003**	0.0006***	0.0019***	0.0009***
	[5.054]	[2.064]	[3.479]	[8.440]	[5.505]
Time FE	Yes	Yes	Yes	Yes	Yes
Style FE	Yes	Yes	Yes	Yes	Yes
Observations	231,973	204,427	183,697	231,973	231,973
R-squared	0.179	0.186	0.200	0.101	0.179

Panel B: Fund Fixed Effects

	1	2	3	4	5
	Baseline	Remove Young Funds	Remove Small Funds	Delisting Return	Duration Lock
Dynamic Lock	0.0007***	0.0005**	0.0004*	0.0018***	0.0012***
	[3.255]	[2.048]	[1.939]	[5.898]	[3.775]
Time FE	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes
Observations	231,973	204,395	183,697	231,973	231,973
R-squared	0.202	0.210	0.218	0.136	0.202

Table 4
Summary Statistics by Dynamic Lockup Tercile

We sort funds into terciles each month based on their level of dynamic lockup. This table presents time series averages for each of these three portfolios. We only consider funds with a lockup. Our time period of study is 1994-2013. *Dynamic Lock %* is the fraction of the fund's assets that are under lockup. All other variables are defined in Table 1. We tests for differences in means between the high and low terciles. ***, **, and * indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	Dynamic Lock %	AUM	Age	Return %	Flow %
Low Lockup	1.62	117.1	6.26	0.82	-1.28
Mid Lockup	18.57	159.1	5.41	0.95	1.36
High Lockup	74.87	118.3	2.78	1.16	4.89
High – Low	73.24***	1.17	-3.48***	0.34***	6.17***

Table 5
Hedge Fund Performance and Dynamic Lockups -- Placebo Approach

We regress hedge fund returns on dynamic measures of a hedge fund's lockup. The unit of observation is a hedge fund-month. The dependent variable is the fund’s monthly return at time t+1. *Lockup Dummy* is an indicator variable equal to one if the fund has a lockup, and zero otherwise. *Dynamic Lock* equals the percent of capital the fund had locked up in the previous month (see Equation 1). All control variables are defined in Table 1. All continuous control variables are normalized to mean of zero and a standard deviation of one. We include time, style and fund fixed effects where indicated. Standard errors are clustered at the fund level. *t*-statistics are reported in square brackets. ***, **, and * indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	1	2	3
Lockup Dummy	0.0013***	0.0007***	
	[8.081]	[3.884]	
Dynamic Lock	0.0006***	-0.0000	0.0001
	[7.249]	[-0.343]	[1.018]
Lockup Dummy * Dynamic Lock	0.0008***	0.0007***	0.0006**
	[5.129]	[4.478]	[2.418]
Controls	-	Yes	Yes
Time FE	Yes	Yes	Yes
Style FE	Yes	Yes	-
Fund FE	-	-	Yes
Observations	795,447	795,447	795,447
R-squared	0.124	0.137	0.137

Table 6
Dynamic Lockup Placebo-Adjusted Performance - Portfolio Approach

This table reports factor exposures for a series of equal-weighted, placebo-adjusted portfolios. Funds are sorted into terciles based on their lagged Dynamic Lock. We consider raw returns, a market model (with a lagged market factor) and the Fung and Hsieh (2004) 7-factor model (with a lagged market factor). Low (high) represents smallest (highest) Dynamic Lock tercile. High-Low represents a long-short portfolio that invests long in high dynamic lockup funds and short low dynamic lockup funds. ***, **, and * indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	Constant	mktrf	$mktrf_{t-1}$	sizespread	bondmarket	creditspread	ptfsbd	ptfsfx	ptfscom	R-squared
Low	0.0016**									0.000
	[2.171]									
Mid	0.0018***									0.000
	[2.793]									
High	0.0036***									0.000
	[4.983]									
High – Low	0.0020***									0.000
	[3.360]									
Low	0.0004	0.1340***	0.0428***							0.351
	[0.728]	[10.298]	[3.287]							
Mid	0.0008	0.1226***	0.0300**							0.343
	[1.508]	[10.381]	[2.542]							
High	0.0023***	0.1530***	0.0416***							0.447
	[4.194]	[12.800]	[3.481]							
High – Low	0.0019***	0.0190	-0.0012							0.009
	[3.048]	[1.424]	[-0.087]							
Low	0.0005	0.1129***	0.0398***	0.0351**	0.7503***	0.6158*	-0.0040	-0.0100***	-0.0140***	0.481
	[0.879]	[8.370]	[3.106]	[2.115]	[3.140]	[1.817]	[-1.028]	[-3.197]	[-3.386]	
Mid	0.0009*	0.0971***	0.0233**	0.0902***	0.5428**	0.4023	-0.0032	-0.0059**	-0.0111***	0.510
	[1.870]	[8.225]	[2.082]	[6.203]	[2.593]	[1.355]	[-0.939]	[-2.146]	[-3.062]	
High	0.0024***	0.1314***	0.0387***	0.0797***	0.2440	0.2537	0.0008	-0.0077***	-0.0106***	0.550
	[4.625]	[10.520]	[3.266]	[5.186]	[1.102]	[0.808]	[0.214]	[-2.648]	[-2.751]	
High – Low	0.0019***	0.0185	-0.0010	0.0446**	-0.5064*	-0.3621	0.0048	0.0023	0.0035	0.063
	[3.058]	[1.235]	[-0.073]	[2.415]	[-1.903]	[-0.959]	[1.101]	[0.668]	[0.752]	

Table 7
Hedge Fund Flows and Dynamic Lockups

We regress hedge fund flows and flow volatility on dynamic measures of a hedge fund's lockup. The unit of observation is a hedge fund-month. In Models 1-3, the dependent variable is the fund's forward monthly netflow, inflow, and outflow, respectively. We assume a fund's inflow to be the max(0, netflow) and a fund's outflow to be the min(0, netflow). In Models 4-6, the dependent variable is the standard deviation of the fund's netflows, inflows, and outflows, respectively, over the next 12 months. *Lockup Dummy* is an indicator variable equal to one if the fund has a lockup, and zero otherwise. *Dynamic Lock* equals the percent of capital the fund had locked up in the previous month (see Equation 1). In Models 4-6, *Lag Flow Volatility* is the standard deviation of the fund's monthly flows over the past 12 months. All other control variables are defined in Table 1. All continuous control variables are normalized to mean of zero and a standard deviation of one. We include time and style fixed effects throughout. Standard errors are clustered at the fund level. *t*-statistics are reported in square brackets. ***, **, and * indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	1	2	3	4	5	6
		Levels			Volatility	
	Netflow	Inflow	Outflow	Netflow	Inflow	Outflow
Lockup Dummy	0.0006	-0.0026***	-0.0033***	-0.0082***	-0.0055***	-0.0040***
	[1.418]	[-6.665]	[-12.024]	[-12.103]	[-8.994]	[-9.272]
Lockup Dummy * Dynamic Lock	0.0006	-0.0007	-0.0013***	-0.0018***	-0.0007	-0.0018***
	[1.091]	[-1.630]	[-4.980]	[-2.880]	[-1.298]	[-4.600]
Dynamic Lock	0.0101***	0.0100***	0.0002	0.0010***	0.0035***	0.0021***
	[33.320]	[41.157]	[1.195]	[2.625]	[9.318]	[9.631]
Log Age	-0.0055***	-0.0049***	0.0005***	-0.0056***	-0.0056***	-0.0013***
	[-23.567]	[-25.261]	[3.190]	[-14.442]	[-16.374]	[-5.334]
Log AUM	-0.0049***	-0.0034***	0.0016***	-0.0072***	-0.0109***	0.0031***
	[-24.619]	[-19.321]	[12.480]	[-20.708]	[-32.941]	[15.650]
Minimum Investment	0.0012***	0.0006***	-0.0006***	0.0010***	0.0018***	-0.0008***
	[4.313]	[3.227]	[-4.324]	[3.149]	[4.543]	[-3.962]
Management Fee	-0.0010**	0.0009**	0.0018***	0.0023***	0.0006	0.0019***
	[-2.307]	[2.385]	[5.774]	[2.829]	[0.957]	[3.804]
Incentive Fee	-0.0001	0.0009***	0.0010***	0.0021***	0.0013***	0.0014***
	[-0.659]	[5.620]	[7.993]	[6.795]	[4.284]	[7.033]
Redemption Frequency	0.0003	-0.0012***	-0.0015***	-0.0026***	-0.0018***	-0.0013***
	[1.165]	[-8.221]	[-8.490]	[-7.701]	[-6.821]	[-5.988]
Redemption Notification Period	0.0006**	-0.0002	-0.0008***	-0.0009***	-0.0002	-0.0010***
	[2.147]	[-1.196]	[-3.952]	[-2.848]	[-0.932]	[-3.817]
Annual Return	0.0097***	0.0060***	-0.0036***	0.0007***	0.0046***	-0.0036***
	[18.019]	[19.063]	[-14.267]	[2.997]	[14.314]	[-13.101]
Lag Flow	0.0096***	0.0092***	0.0055***			
	[31.908]	[36.129]	[36.442]			
Lag Flow Volatility				0.0172***	0.0107***	0.0097***
				[49.222]	[32.606]	[54.964]
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Style FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	629,456	629,456	629,456	629,456	629,456	629,456
R-squared	0.046	0.051	0.037	0.140	0.132	0.112