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# Hedge fund contagion and risk-adjusted returns: A Markov-switching dynamic factor approach ☆

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ABSTRACT

We provide an empirical analysis of two important phenomena influencing the hedge fund industry—contagion and time variation in risk adjusted return (alpha)—in a flexible unified framework. After accounting for standard hedge fund pricing factors, we quantify the common latent factor in hedge fund style index returns and model its time-varying behavior using a dynamic factor framework featuring Markov regime-switching. We find that three regimes—crash, low mean and high mean—are necessary to provide a complete description of joint hedge fund return dynamics. We also document significant time variation in the alpha generating ability of all hedge fund investment styles. The period following the stock market crash of 2000 is dominated by the persistent low return state while the long bull market of 1990s is associated with the strongest performance of the industry generating high positive returns. We also investigate drivers of the regime shifts in the common latent pricing factor and find that both flight to safety and large funding liquidity shocks play an important role in explaining the abrupt shift of the common factor to the crash state.

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## 1. Introduction

Hedge funds have become an increasingly important part of the finance industry in the last two decades. Although the financial crisis of 2008 had a negative impact on the performance and assets under management, the industry still manages around $2.13 trillion as of the first quarter of 2012 according to a press release by Hedge Fund Research, Inc.[1]

One of the reasons behind the growth of the hedge fund industry is that hedge fund managers follow an absolute-return strategy, promising a positive return independent of the market conditions. To achieve this, they can pursue highly complex investment strategies that are not available to the other institutions in the investment management industry due to regulatory constraints. Therefore, one would expect a low correlation between hedge fund returns and returns on broad based portfolios as

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well as between different hedge fund investment styles since they invest in a different set of assets and follow different strategies. However, recent financial crises demonstrated that the returns to different hedge fund styles might be more correlated than anticipated during times of distress, indicating a systemic risk in the industry.

Chan et al. (2006) define systemic risk as "*the possibility of a series of correlated defaults among financial institutions—typically banks—that occur over a short period of time, often caused by a single major event*." Systemic risk is important because it impedes the benefits of diversification to hedge fund investors, especially in down market conditions. Moreover, as pointed out by Bernanke (2006), among others, it may affect the whole market through asset price changes, liquidity spirals, and increased uncertainty in financial markets. Khandani and Lo (2011) illustrate how these forces increased systemic risk in the hedge fund industry during the financial crisis of 2008.

In a related context, hedge fund contagion is defined as the dependence that resides after systematic risk factors are accounted for. Boyson et al. (2010) and Dudley and Nimalendran (2011) study residuals obtained from a standard asset pricing model to identify the dependence that cannot be explained by exposure to economic fundamentals. Though they use different methodologies, both studies conclude that funding liquidity is a crucial channel in leading to increased dependence among hedge fund returns during times of distress. Boyson et al. (2010) emphasize money market distress reflected in the form of a higher spread over the risk free borrowing rate while Dudley and Nimalendran (2011) focus on the impact of changing margin requirements on speculators' capital and provision of liquidity. Billio et al. (2010) also analyze hedge fund style index returns and conclude that there is a common latent pricing factor after accounting for observable pricing factors. This factor potentially affects all hedge fund styles during times of extreme turmoil such as those followed by the LTCM failure and the Lehman Brothers bankruptcy. However, they do not quantify this latent factor or make direct inference on its state-dependent behavior.

Another interesting phenomenon regarding hedge funds that has been recently documented is the existence of a downward trend in their risk adjusted returns. Fung et al. (2008) and Naik et al. (2007) show that hedge-fund alpha has been declining since 2000. Both papers argue that this trend is mainly driven by the equilibrium arguments presented in Berk and Green (2004); namely, decreasing returns to scale and higher fees charged by absolute return generating managers.

In this paper we study these two important phenomena influencing hedge fund industry—contagion and time varying alpha—in a unified framework. Our paper contributes to the literature on several grounds. First, we use a novel approach to quantify the common latent factor in hedge fund style index returns and identify its regime-dependent dynamics. Instead of relying on exogenous classifications, crises and other distinct periods are endogenously determined in our dynamic factor Markov-switching framework. Our analysis reveals that a three-regime specification adequately describes dynamics of the latent pricing factor. The first regime is identified as an unusual crash state with large negative mean return and very high volatility. The second regime is a low mean/high volatility state while the last one is a high mean state with minimal volatility in the common latent factor. Second, we provide evidence for declining hedge fund alpha in the context of endogenously determined regimes. Probabilistic inference from our model suggests that the latent pricing factor has been in the low mean/high volatility state during most of the last decade. Third, we show that co-movement in hedge fund style returns is not restricted to times of extreme financial turmoil, although these are the periods during which strongest dependence is observed. Finally, we link funding liquidity and flight to safety (or panic) to the probability of observing the crash state. Our estimates imply that abrupt increases in the TED spread, the margin requirement on the S&P 500 contract, and the VIX index result in a statistically significant elevation in the crash state probability. Our results emphasize the role of panic besides funding liquidity in creating a state of contagion in hedge fund returns.

We show that our results are robust to time variation in exposure to standard risk factors as well as exclusion of the subprime led crisis from the estimation sample. We also find that the distinct periods observed in the median risk adjusted return obtained from individual fund level analysis are in line with the regime classification from our three-state model. Average individual fund exposure after accounting for standard risk factors is also in line with our finding based on style indices.

The rest of the paper is organized as follows: Section 2 introduces the data and summarizes the statistical methodology. We present our findings in Section 3 and consider extensions and robustness analyses in Section 4. We conclude in Section 5.

## 2. Data and methodology

### 2.1. Data

We use hedge fund index returns from the Dow Jones Credit Suisse Hedge Fund Indexes database from January 1994 to December 2010. Specifically, we consider Convertible Arbitrage, Dedicated Short Bias, Emerging Markets, Equity Market Neutral, Event-Driven Distressed, Event-Driven Multi Strategy, Event-Driven Risk Arbitrage, and Long/Short Equity styles to make our findings comparable to the existing research.[2]

Summary statistics for the returns on monthly hedge fund style indices are provided in Table 1 (Panel A). We see that all hedge fund indices have positive average returns in the sample with the exception of Dedicated Short Bias, which has a slight negative average return. The highest average monthly return is provided by the Event-Driven Distressed strategy (0.90%) followed by the Long/Short equity style (0.86%). Dedicated Short and Emerging Markets strategies exhibit the most variability. All hedge fund styles have positive first order autocorrelation. Convertible Arbitrage and Distressed Securities display the highest persistence,

[2] A detailed description of the indices and construction methodology are publicly available at Dow Jones Credit Suisse website www.hedgeindex.com.