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Dynamics and risk factors in hedge funds returns: Implications for portfolio construction and performance evaluation

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ABSTRACT

As conventional asset pricing models have been proven inappropriate to adequately explain hedge fund performance, this study proposes an innovative, flexible and efficient hedge fund multifactor model to explain dynamic risk and return properties of core hedge fund strategies. The proposed model takes into account critical traditional and alternative market factor exposures, incorporates a dynamic variance–covariance framework and is evaluated for its predictive capability. Based on this empirical evidence, a process for optimal hedge fund portfolio construction under the conditional-value-at-risk (CVaR) framework is then developed. The proposed multifactor hedge fund model is concluded to better explain nonlinear hedge fund risk-return properties and to produce superior empirical insight on efficient hedge fund portfolio allocation decisions on selected investment strategies. The widely held reputation of hedge funds delivering superior absolute returns at downward market phases is not empirically justified. At crises times, hedge funds are seen to record a negative performance and even suffer substantial losses.

1. Introduction

During the last decade, hedge funds have gained high reputation as alternative investment vehicles that deliver absolute returns at upward and particularly at downward market phases, supposingly being uncorrelated with traditional financial markets and instruments. The 2008 global financial crisis, however, has tarnished this established perception, as hedge funds experienced severe losses, significant net asset value contraction and portfolio liquidations or even extensive restructuring (Syriopoulos, 2013). More than 600 funds are estimated to have liquidated and closed down in 2009, which was more than double the 10-year average (Hedge Fund Research, 2011). In this background, the complexities in sophisticated hedge fund investment strategies have raised serious concerns about the appropriateness of conventional financial theories, models and risk-return instruments and measures on hedge funds, such as the mean-variance portfolio approach, the standard CAPM framework or the assumption of static variance, correlations and performance indices (Embrechts, McNeil, & Straumann, 2002; Jorion, 2007). Instead, there is a growing convergence that traditional risk-return measures cannot adequately capture

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the dynamic properties of hedge fund strategies, whereas hedge fund returns are not well characterized as fixed linear combinations of traditional asset classes (e.g. Fung & Hsieh, 1997; Amenc & Martellini, 2002).

To overcome the limitations of traditional approaches, a number of studies develop factor models to better explain hedge fund returns, controlling for factors such as liquidity, credit, volatility premium or nonlinear option-like strategies (Fung & Hsieh, 1997; Mitchell & Pulvino, 2001; Agarwal & Naik, 2004; Cai & Liang, 2012). Other studies, furthermore, take into account the time-varying properties of hedge fund return variances and covariances and of asymmetric correlations or employ conditional value-at-risk (CVaR) in hedge fund portfolios (Agarwal & Naik, 2004; Giamouridis & Vrontos, 2007; Huang, Zhu, Fabozzi, & Fukushima, 2010; Harris & Mazibas, 2010).

This paper undertakes an evaluation of the out-of-sample performance of a set of multivariate models to obtain ex-ante expected hedge fund returns based on core hedge fund strategies. The issue of time-varying variances and covariances of hedge fund returns is also addressed and the implications for the construction of optimal hedge fund portfolios are assessed. The proposed approach assumes that systematic variations in hedge fund returns can be explained by a set of linear and nonlinear risk factors, thus producing a highly structured covariance matrix. In other words, the investor in this case designs hedge fund portfolios based on an asset allocation process that takes into account critical risk factors. A number of past empirical studies have pursued a similar approach (e.g. Chan, Karceski, & Lakonishok, 1999; Agarwal & Naik, 2004). The focus in this study, however, is on the response and performance of this empirical setting at times of market crises, that is when hedge funds have been assumed to perform better relative to traditional investment instruments.

Given the lack of well-established asset pricing models in the specific hedge fund context, a factor-based model, termed 'the hedge fund multifactor model' (HFMM) is proposed, estimated and tested in this study. This model adapts and extends benchmark asset pricing models by incorporating a number of 'location factors', that is proxies for different buy-and-hold strategies on equity, bond and commodity markets as well as 'option-based factors' to control for nonlinear risk exposures of hedge fund positions (Agarwal & Naik, 2004). To evaluate the risk-adjusted performance of the proposed hedge fund model, the latter is compared with and contrasted against two well established benchmark asset pricing models, namely the Fama–French (FF) three-factor model (Fama & French, 1993) and the Carhart (1997) four-factor model. The appeal of these models is twofold: (a) they are economically interpretable and theoretically justifiable, as they can provide explicit links between hedge funds strategies and observable asset returns; and, (b) they lead to tractable and parsimonious covariance estimates; hence, they are useful for optimal portfolio construction.

The structure of hedge fund return volatilities and covariance is a crucial issue for efficient asset allocation decisions. Whenever the variation in the covariance matrix is considered to be important, the portfolio needs to be rebalanced dynamically, in order to maintain the optimal risk-return combination. Past empirical evidence postulates that the variance and correlation structures of financial assets can vary dramatically over time (Bessler & Yang, 2003; Antonakakis, Chatziantoniou, & Filis, 2013; Dimitriou, Kenourgios, & Simos, 2013; Wachter, 2013). This issue turns to be even more complex for hedge fund portfolios. The dynamic and sophisticated hedge fund strategies have been argued to invalidate the conventional constant variance and correlation assumptions (Amenc & Martellini, 2002; Giamouridis & Vrontos, 2007; Syriopoulos, 2013). This paper contains the issue of forecasting hedge fund return covariances, based on Chan et al. (1999) and Glabadanidis (2009). More specifically, it is assumed that hedge fund return covariances reflect exposures to common risk factors. Four alternative models are incorporated to model the dynamic variance–covariance matrix of hedge fund portfolios. The first two simple models include: (1) the historical covariance model (HCM); and, (2) the exponentially weighted moving average (EWMA) model (Morgan, 1996). The other two models belong to the multivariate GARCH family; namely, (3) the Dynamic Conditional Correlation (DCC) model (Engle, 2002); and, (4) the Asymmetric-DCC (ADCC) model (Cappiello, Engle, & Sheppard, 2006).

The innovative contributions of the paper can be summarized into the following issues. First, the proposed HFM model is shown to be more attractive, in terms of out-of-sample predictive capability of hedge fund returns compared to the FF 3-factor and Carhart 4-factor models. Contrary to in-sample criteria employed in most past studies, the factor models are evaluated from an out-of-sample perspective. Second, the alpha of hedge fund returns is shown to have declined substantially during the last decade (2000–2011). The 2008 global financial crisis, in particular (initiated in the US subprime mortgage market and transmitted into the European sovereign debt market), is seen to have exerted a severely adverse impact on hedge fund performance. Indeed, seven out of eight hedge fund strategies have underperformed, recording negative alphas during the crisis period (Syriopoulos, 2013). Third, the paper confirms the diverse heterogeneity of hedge funds, when comparing specific risk exposures of hedge fund strategies against traditional investments (stock, bonds, interest rates) and other dynamic trading strategies (commodity futures, momentum). Arbitrage strategies are seen to exhibit low exposure to traditional markets, whereas directional strategies confirm their reputation as 'trend followers'. Shifts in hedge fund risk exposures over time reinforce the perception that hedge fund managers proceed to asset allocation across markets and financial instruments in a dynamic process. Fourth, time-varying volatility and correlation models can contribute to the construction of optimal portfolios with superior performance compared to naive diversification techniques. The HFM model, combined with the ADCC-GARCH framework, is found to be more attractive in supporting hedge fund portfolio construction with lower risk and higher risk-adjusted returns. These empirical results are consistent with relevant past studies (Amenc & Martellini, 2002; Giamouridis & Vrontos, 2007; Harris & Mazibas, 2010). Finally, the paper investigates whether optimal hedge fund portfolios can produce attractive returns under all market conditions and for that distinguishes three critical sub-periods. Hedge fund portfolios are found to