



# Systematic risk and the cross section of hedge fund returns<sup>☆</sup>

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## ABSTRACT

This paper investigates the extent to which market risk, residual risk, and tail risk explain the cross-sectional dispersion in hedge fund returns. The paper introduces a comprehensive measure of systematic risk (*SR*) for individual hedge funds by breaking up total risk into systematic and fund-specific or residual risk components. Contrary to the popular understanding that hedge funds are market neutral, we find that systematic risk is a highly significant factor explaining the dispersion of cross-sectional returns while at the same time measures of residual risk and tail risk seem to have little explanatory power. Funds in the highest *SR* quintile generate 6% more average annual returns compared with funds in the lowest *SR* quintile. After controlling for a large set of fund characteristics and risk factors, systematic risk remains positive and highly significant, whereas the relation between residual risk and future fund returns continues to be insignificant. Hence, systematic risk is a powerful determinant of the cross-sectional differences in hedge fund returns.

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## 1. Introduction

This paper examines the extent to which aggregate risk measures explain the cross-sectional dispersion of hedge fund returns. Despite the fact that hedge funds are marketed as absolute return or market-neutral investments that generate positive returns in both good and bad market conditions, work by Asness, Krail, and Liew (2001), Patton (2009), and Bali, Brown, and Caglayan (2011) show that hedge fund returns are exposed to market factors. However, an important paper by Titman and Tiu (2011) argues that the low *R*-squared funds, those that are truly market neutral, are the ones that generate the greatest alpha. In addition, Fung and Hsieh (1997, 2001), Mitchell and Pulvino (2001), Agarwal and Naik (2004), and Fung, Hsieh, Naik, and Ramadorai (2008) have all shown that the dynamic trading and arbitrage strategies implemented by hedge funds generate significant hedge fund tail risk exposure. Brown, Gregoriou, and

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Pascalau (in press) present results to show that this tail risk exposure might not be diversifiable, which suggests that tail risk could explain hedge fund returns. It is reasonable to believe, then, that these factors can explain a significant fraction of the observed differences in returns across different hedge funds and hedge fund strategies.

We find that both the portfolio-level analyses and the cross-sectional regressions indicate a positive and significant link between total risk (variance) and expected returns, whereas skewness and kurtosis as measures of tail risk do not have any predictive power for future hedge fund returns. After demonstrating the economic and statistical significance of total variance, we divide the total variance into its systematic and unsystematic components and explore the relative predictive power of systematic risk versus unsystematic (residual) risk over future fund returns. We find that systematic risk, not residual risk, has the greatest role in explaining the cross section of hedge fund returns.

Earlier studies provide evidence for a wide variety of macroeconomic and financial factors that predict the time series and cross-sectional variation in asset returns. In this paper, we utilize three different factor model specifications to obtain alternative measures of the systematic and fund-specific or residual risk of hedge funds and investigate their performance in predicting the cross section of future hedge fund returns. First, we use the four-factor model of Fama and French (1993) and Carhart (1997) to generate systematic and residual risk of individual hedge funds. Second, we extend the four-factor model of Fama, French, and Carhart to a six-factor model by including two bond factors originally used by Fung and Hsieh (2004). Third, and finally, to generate comprehensive measures of systematic and residual risk, we use a nine-factor model that extends the six-factor model of Fama, French, and Carhart and Fung and Hsieh (2004) by adding the three trend-following factors (in currencies, bonds, and commodities) introduced by Fung and Hsieh (2001).

We examine the significance of a cross-sectional relation between alternative measures of systematic risk and individual hedge funds using the Fama and MacBeth (1973) cross-sectional regressions as well as the univariate and bivariate portfolio-level analyses. The univariate Fama and MacBeth regressions of one-month-ahead hedge fund returns on systematic risk provide an economically and statistically significant positive link between systematic risk and future fund returns. This result is robust across different sample periods as well as for alternative measures of systematic risk (i.e., whether four-, six-, or nine-factor models are utilized). In multivariate Fama and MacBeth regressions, we control for the residual risk, lagged returns, age, size, management fee, incentive fee, redemption period, minimum investment amount, lockup, and leverage structures of individual hedge funds. Even after controlling for the fund characteristics, the average slope on systematic risk remains positive and highly significant. However, the relation between the unsystematic (or residual) risk and future fund returns proves to be insignificant after controlling for the systematic risk. Hence, we conclude that systematic risk is more powerful

than residual risk in predicting the cross-sectional variation in hedge fund returns.

As an alternative to the Fama and MacBeth parametric tests, we conduct nonparametric portfolio analyses and find that the average raw return on the quintile portfolios of systematic risk increases monotonically moving from the lowest systematic risk quintile (Quintile 1) to the highest systematic risk quintile (Quintile 5), with the average return difference between Quintiles 5 and 1 being 6% per annum and highly significant. We also check whether the positive and significant performance difference between high systematic risk quintile funds and low systematic risk quintile funds also holds true when the analysis is done in terms of risk-adjusted returns (i.e. four-, six-, or nine-factor alphas). The results indicate positive and significant alpha differences between high and low systematic risk quintile funds as well.

A distinct feature of hedge funds is their dynamic management styles. Many fund managers actively vary their exposures to risk factors according to the macroeconomic conditions and the state of the financial markets. Consistent with the factor timing ability of hedge funds, our results suggest that by predicting changes in financial and macroeconomic factors, hedge fund managers can adjust their portfolio exposures up or down in a timely fashion to generate superior returns. We find that hedge funds following directional dynamic trading strategies, such as global macro, emerging markets, and managed futures funds, correctly adjust their aggregate exposure to changes in factors and, hence, a positive and stronger link exists between their systematic risk and future returns. However, the cross-sectional relation between systematic risk and future returns is insignificant for the funds following nondirectional strategies, such as equity market neutral, fixed income arbitrage, and convertible arbitrage funds. These results are supported and can be explained by our finding that the variation of systematic risk across time is much wider for directional strategies and is much smaller for nondirectional strategies, and for this reason a stronger link exists between their future returns and their systematic risk. Lastly, another notable point in our paper is that the cross-sectional spreads in hedge fund returns and alphas are not related to the differences in funds' skewness and kurtosis, and this weak performance of higher moments remains intact across all hedge fund investment styles.

This paper is organized as follows. Section 2 provides a brief literature review. Section 3 describes the data and variables. Section 4 investigates the predictive power of volatility, skewness, and kurtosis for future hedge fund returns. Section 5 presents the factor models utilized in this study to obtain alternative measures of systematic and residual risk. Section 6 examines the relative performance of systematic and residual risk in predicting the cross section of hedge fund returns. Section 7 concludes the paper.

## 2. Literature review

The explosive growth of hedge funds, both in numbers and in assets under management (AUM) over the last two

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