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THE NEXUS BETWEEN INVESTORS' SENTIMENT AND HEDGE FUNDS RISK PREMIUMS

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Abstract: In this study, we analyzed how the systematic risk of hedge funds affects different portfolio strategies. Using monthly returns data from a sample of developed market hedge funds grouped by five strategies, we identified the systematic factors influencing returns variation from January 2003 to December 2023. Market, size effect, momentum, investment effect, and bond spread were found to be the main risk factors explaining hedge fund returns dynamics. We proposed an enhanced version of the Fung and Hsieh (2004a) model, which demonstrated improved representativity with Baker and Wurgler sentiment index included as a risk premium. The quantile regression revealed that for most strategies, the estimated models performed better for the bottom quantiles.

JEL Classification: G11, G12, C58

Keywords Hedge funds, Risk premiums, Sentiment index, Asset pricing

1. Introduction

Modern capital markets represent a complex and interconnected financial ecosystem, where economic cycles, geopolitical events, and technological developments profoundly influence the return-risk characteristics of securities. In this dynamic context, investors and professionals strive to identify investment strategies - ranging from simple to sophisticated - to outperform the market, often combining fundamental, technical, or quantitative analysis. The diversity of financial instruments available in the market adds an additional layer of complexity, necessitating a deep understanding of market mechanisms and their respective risk factors.

To navigate this complexity, researchers and practitioners have developed various asset pricing models aimed at identifying and quantifying the risk factors that influence asset returns. Given the complexity and high risk associated with these financial instruments, such studies are crucial in enhancing our understanding of managing risky assets. The ongoing debate between passive market positioning, which replicates index performance, and actively developing sophisticated portfolio management

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strategies to achieve higher returns, highlights the need for a reasonable justification for the additional costs and risks associated with active strategies.

This study helps in identifying the relevant sources of systematic risk based on the broad strategy approached, further complementing our capacity to understand and manage the dynamics of such risky assets.

2. Literature review

The initial asset pricing model, known as the Capital Asset Pricing Model (CAPM), was introduced by William Sharpe in 1964. CAPM is a unifactorial model that asserts a security's return is strongly related with the overall market movement, rewarding investors for selecting riskier assets characterized by a beta coefficient greater than one. Despite its extensive practical use, CAPM is criticized for its overly simplistic assumptions: all market participants are rational, manifesting risk adversity; they have equal access to information and the same time to evaluate it, all at no cost; they construct portfolios using only the mean and variance of return distributions; they can borrow unlimited capital at a risk-free rate; markets are perfect with no taxes, inflation, or transaction costs and assets are fully negotiable and infinitely divisible. In response to these criticisms, alternative models have been developed to more realistically address the return-risk characteristics of securities. One notable approach is the Arbitrage Pricing Theory (APT), proposed by Stephen Ross in 1976. APT extends CAPM by suggesting that a security's return can be explained through a linear relationship involving multiple systematic factors. Unlike CAPM, which assumes that markets are efficient with all information reflected in asset prices, APT allows for short-term imbalances between an asset's fundamental value and its market value, offering arbitrage opportunities for above-market returns. However, APT's limitation lies in its lack of specificity regarding which factors to consider, giving investors the flexibility to determine the tailored factors for the asset in question. Later on, Fama and French (1993) proposed a three-factor model as an extension of the CAPM, providing a better explanation for the systematic component of securities returns. In addition to the market risk premium, they introduce two additional risk factors: a size factor and a value factor. The size factor, SMB (small minus big), represents the excess return of a portfolio of small-cap companies over large-cap companies. The value factor, HML (high minus low), captures the excess return of a portfolio of high book-to-market stocks over a portfolio of low book-to-market stocks. This model opens new avenues in financial research and contributes to a deeper understanding of the sources of risk in securities. By incorporating these two additional factors, the Fama and French model enhances the prediction accuracy of asset returns and encourages further exploration of market behavior dynamics.

Carhart (1997) builds on the Fama-French three-factor model by adding a momentum factor, originally developed by Jegadeesh and Titman (1993). This momentum factor, WML (winners minus losers), reflects the tendency for an asset's return to follow its previous return trend, whether upward or downward, thereby enhancing the Fama and French model's explanatory power. Using a mutual funds database devoid of survivorship bias, Carhart formulates the WML factor by adopting a strategy of buying top-decile (winner) funds and selling bottom-decile (loser) funds, based on their performance over the past 12 months, excluding the most recent month.

Evidence from Titman et al. (2004), Novy and Marx (2013) and others indicates that the Fama-French three-factor model is not complete as it fails to account for a significant portion of return variations linked to profitability and investments. Titman et al. find a negative correlation between overinvestment and returns, while Novy and Marx (2013) identifies a positive relationship between returns and profitability, defined as the ratio of gross profitability (sales minus cost of goods sold) to the value of assets. This suggests that profitability is a key component of value investing, involving the financing of productive over unproductive assets. Inspired by this evidence, Fama and French (2015) introduced a five-factor model that incorporates profitability and investment factors. The profitability factor, RMW (robust minus weak), represents the extra returns of high-profitability stocks over low-profitability ones. The investment factor, CMA (conservative minus aggressive), captures the excess returns of conservatively investing companies over those investing aggressively. This model explains 71% to 94% of return variations for the studied portfolios. However, Fama and French noted its limited accuracy in predicting low returns for small-cap stocks with high investment and low profitability. The five-factor model thus advances asset pricing literature by deepening the understanding of return determinants.

The widespread growth of hedge fund industry since 2000 has led to many studies on hedge fund performance, systematic characteristics, and the timing ability of managers. Hedge funds, which are private investment vehicles that pool money from a limited number of investors, often employ complex strategies to achieve above-average returns, making them high-risk assets.

William Fung and David A. Hsieh (2004a) made a significant contribution to the asset pricing literature by developing a seven-factor model specifically for hedge funds. This model identifies different factors affecting various hedge fund strategies: long/short equity funds are impacted by two equity factors, fixed income funds by two bond factors, and trend-following funds by three trend-following factors. The equity factors consist of the return on the S&P 500 and a size premium, which is calculated as the difference in returns between the Wilshire 1750 Small Cap Index and the Wilshire 750 Large Cap Index. The bond factors are defined by the monthly change in the yield of 10-year Treasury bonds and the change in the spread between the yield of Baa ranked bonds and the 10-year Treasury yield. Fung and Hsieh's (2001) trend-following factors are constructed from portfolios of lookback straddles, reflecting the returns of option portfolios with futures contracts on bonds, exchange rates, and commodities as underlying assets. Thus, the development of asset pricing models reflects an evolving intellectual pursuit, advancing from simple risk-return dynamics to more sophisticated approaches. These models have significantly influenced financial theory, enhancing the understanding of complex securities in dynamic markets. They have also equipped industry professionals with advanced tools and quantitative techniques for asset evaluation and portfolio management.

3. Database and variables

We used the Hedge Funds Research database as a proxy for hedge fund evolution, from which we obtained monthly returns of hedge fund portfolios with global exposure, representing the hedge fund industry well. Each strategy has 252 observations of monthly returns, covering a 21-year period from January 2003 to

December 2023. Hedge funds are grouped based on strategy: Equity Hedge, Event Driven, Macro, Funds of Hedge Funds, and Relative Value. Portfolios are then calculated by applying equal weight to each hedge fund included in the portfolio. Each strategy will be presented below, mentioning the main points drawing investment decisions.

Equity Hedge strategies involve both long and short positions in equities and equity derivatives, utilizing a blend of quantitative and fundamental analysis. These strategies can vary from broad diversification to sector-specific focus, and they differ in terms of net exposure, leverage, holding periods, market capitalizations, and valuation ranges. Generally, Equity Hedge managers maintain at least 50% equity exposure and can be fully invested in both long and short positions.

Event Driven strategies target companies engaged in corporate transactions like mergers, restructurings, or financial distress. Managers invest across the capital structure, from senior to subordinated securities, frequently incorporating derivatives. These strategies are sensitive to both equity and credit markets and are highly dependent on fundamental analysis. Success relies on external events affecting the company's capital structure.

Macro strategies trade based on economic variables and their impacts on equity, fixed income, currency, and commodity markets. Managers use both discretionary and systematic approaches, employing top-down and bottom-up analysis, with varying holding periods. Unlike Relative Value strategies, which focus on valuation differences, Macro strategies anticipate movements in underlying instruments driven by macroeconomic factors. Though both Macro and Equity Hedge strategies might hold equities, Macro is driven by broader economic factors, while Equity Hedge centres on company-specific fundamentals.

Relative Value strategies seek to capitalize on valuation discrepancies between multiple securities, using a mix of fundamental and quantitative techniques. These strategies can involve equities, fixed income, and derivatives. Fixed income strategies within this category often depend on quantitative analysis to spot favourable risk-adjusted spreads. In contrast to Event Driven strategies, which hinge on the outcomes of corporate transactions, Relative Value strategies focus on profiting from pricing differences between related securities.

The factors for the Fama and French models were sourced from the Kenneth R. French website, corresponding to developed markets. The SIZE factor included in the Fung and Hsieh models was constructed as the return difference between the Russell 2000 index and the S&P500, with returns obtained from the Bloomberg database. The YLDCHG and BAAMTSY factors were constructed as per their definitions detailed later in this study, using data downloaded from the Federal Reserve Bank of St. Louis website. Trend-following factors - PTFSBD, PTFSFX, and PTFSCOM - were downloaded from David A. Hsieh's website, and the BW_SENT index was taken from Jeffrey Wurgler's website.

Table 1. Summary Statistics Overview

The table provides a summary of descriptive statistics for hedge fund portfolio returns and risk premiums utilized in estimating asset pricing models. According to the Sharpe ratio, the Relative Value portfolio provides the best excess return per unit of total risk. The Augmented Dickey-Fuller (ADF) test applied to the time series indicates the presence of a unit root; *** denotes the rejection of the null hypothesis at a 99% confidence level.

Variable	Observations	Mean	Standard deviation	Sharpe ratio	ADF Test
Equity hedge	252	0.51%	2.48%	16.30%	-13.00***
Event-driven	252	0.56%	1.97%	22.77%	-11.48***
Macro	252	0.37%	1.42%	18.48%	-15.51***
Funds of HF	252	0.31%	1.50%	13.53%	-12.13***
Relative value	252	0.45%	1.33%	25.65%	-10.68***
RF	252	0.11%	0.14%	-	-2.21
Mkt-RF	252	0.75%	4.49%	-	-14.50***
SMB	252	-0.01%	1.56%	-	-14.50***
HML	252	0.05%	2.31%	-	-12.70***
WML	252	0.30%	3.29%	-	-12.93***
RMW	252	0.28%	1.28%	-	-11.95***
CMA	252	0.09%	1.61%	-	-7.28***
SIZE	252	-0.03%	4.24%	-	-21.35***
YLDCHG	252	0.00%	0.26%	-	-14.60***
BAAMTSY	252	-0.01%	0.24%	-	-12.85***
PTFSBD	252	0.07%	20.04%	-	-13.76***
PTFSFX	252	-0.67%	19.50%	-	-15.08***
PTFSCOM	252	0.02%	14.68%	-	-14.58***
BW_SENT	234	-0.02%	0.49%	-	-1.77

Source: Author's Computation

4. Methodology

In evaluating risk premiums in hedge funds, we adopted the methodologies of Fama and French (1993, 2015), Carhart (1997), and Fung and Hsieh (2004a) to identify the most important components of systematic risk.

Therefore, the first model estimated was Fama and French (1993) 3-factor model as presented below:

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \varepsilon_{it} \quad (1)$$

Where R_{it} represents the return of hedge fund portfolio i over period t, R_{Mt} is the market portfolio return composed of stocks listed on NYSE, NASDAQ, and AMEX, weighted based on market capitalization, R_{Ft} represents the risk-free rate, specifically the rate of 1-month T-bills issued by the Fed, SMB_t represents the excess return of a portfolio of low capitalization stocks over a portfolio of high capitalization stocks, and HML_t is the excess return of a portfolio of high book-to-market stocks over a portfolio of low book-to-market stocks.

The second model is the improved version suggested by Carhart (1997) with the addition of momentum factor:

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}WML_t + \varepsilon_{it} \quad (2)$$

Where WML_t is the return difference between a portfolio of stocks that were top-performing during the previous year and a portfolio of stocks that were bottom-performing during the previous year.

The last version of the model presented is the Fama and French (2015) 5-factor model, which includes two additional factors to account for other market anomalies:

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}RMW_t + \beta_{5i}CMA_t + \varepsilon_{it} \quad (3)$$

Where RMW_t is the excess return of a diversified portfolio of high-profitability companies over a portfolio of low-profitability companies, and CMA_t is the excess return of a diversified portfolio of companies investing conservatively over a portfolio of companies investing aggressively.

Additionally, we continued our analysis with a model designed specifically for evaluating hedge fund performance, which is the Fung and Hsieh (2004) 7-factor model:

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SIZE_t + \ + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \varepsilon_{it} \quad (4)$$

Where $SIZE_t$ represents the excess return of the Russell 2000 index over the S&P500 index, YLDCHGt is the monthly change in the ten-year Treasury constant maturity yield issued by Fed, $BAAMTSY_t$ is the monthly change in the yield spread of Baa ranked bonds and the previous mentioned factor, $PTFSBD_t$ is the trend following factor quantifying return of a portfolio of lookback straddles on bonds, $PTFSFX_t$ is the return of a portfolio of lookback straddles on foreign exchange, and $PTFSCOM_t$ is the return of a portfolio of lookback straddles on commodities.

Lastly, we suggest an improved version of Fung and Hsieh (2004a) model adding Baker and Wurgler sentiment index as a risk premium as presented below:

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SIZE_t + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \beta_{8i}BWSENT_T^{\perp} + \varepsilon_{it} \quad (5)$$

$$BWSENT_t^{\perp} = -0.198CEFD_t^{\perp} + 0.225TURN_{t-1}^{\perp} + 0.234NIPO_t^{\perp} + 0.263RIPO_{t-1}^{\perp} + 0.211S_t^{\perp} - 0.243P_{t-1}^{D-ND,\perp}$$

Where $BWSENT_t^{\perp}$ is the orthogonlized value of Baker and Wurgler (2006) sentiment index, $CEFD_t^{\perp}$ is the close-end funds discount, $TURN_{t-1}^{\perp}$ represents a proxy for the volatility of NYSE, $NIPO_t^{\perp}$ represents the number of IPOs in period t, $RIPO_{t-1}^{\perp}$ is the average first day returns of IPOs listed during period t, $S_t^{\perp}$ represents the equity share in new issuance, $P_{t-1}^{D-ND,\perp}$ is the dividend premium, calculated as the log difference of dividend payers and dividend nonpayers.

5. Empirical results and discussions

Table 2 presents estimations for Fama and French (1993) three-factor model. The market is the primary variable explaining return variation for all strategies, while the size effect is significant for all strategies except the Macro portfolio. The regression demonstrates good explanatory power, especially for Equity Hedge, Event-Driven, and Funds of Hedge Funds portfolios, but it fails to explain the variation of Macro funds, illustrating the complex dynamics of this strategy. Event-Driven, Macro, and Relative Value portfolios have generated significant alpha, suggesting the value added by the skill of hedge fund managers.

Table 2. Fama and French 3-factor model

The table presents the estimated parameters of model 1, applying OLS method for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Variable	Equity hedge	Event-driven	Macro	Funds of HF	Relative value
α	0.036	0.182***	0.194**	0.013	0.181***
β_1	0.492***	0.350***	0.089***	0.257***	0.209***
β_2	0.352***	0.356***	0.089	0.243***	0.192***
β_3	0.017	0.136***	0.041	-0.024	0.072***
R^2 adj	0.907	0.819	0.093	0.720	0.615

Source: Author's Computation

Carhart (1997) model, represented in table 3 adds momentum factor, which captures the inertia effect in returns. This factor proves to be statistically significant for Equity Hedge, Macro, and Fund of Hedge Funds portfolios, improving the regression's representativity for 4 out of 5 strategies. In the Macro portfolio, the adjusted R-squared coefficient improves from 9.3% to 16.5% with the addition of the momentum factor.

Table 3. Carhart 4-factor model

The table presents the estimated parameters of model 2, applying OLS method for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}WML_t + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Variable	Equity hedge	Event-driven	Macro	Funds of HF	Relative value
α	0.017	0.17***	0.124	-0.034	0.181***
β_1	0.502***	0.356***	0.124***	0.279***	0.209***
β_2	0.35***	0.355***	0.082	0.239***	0.192***
β_3	0.033	0.146***	0.099***	0.015	0.073***
β_4	0.038**	0.023	0.134***	0.089***	0.001
R^2 adj	0.909	0.820	0.165	0.748	0.613

Source: Author's Computation

Table 4. Fama and French 5-factor model

The table presents the estimated parameters of model 3, applying OLS method for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}RMW_t + \beta_{5i}CMA_t + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels

Variable	Equity hedge	Event-driven	Macro	Funds of HF	Relative value
α	0.092*	0.216***	0.182**	0.042	0.195***
β_1	0.464***	0.328***	0.1***	0.231***	0.181***
β_2	0.312***	0.331***	0.099*	0.221***	0.18***
β_3	0.088***	0.207***	-0.027	0.074**	0.207***
β_4	-0.074*	-0.023	-0.026	0.011	0.078
β_5	-0.198***	-0.167**	0.131	-0.203***	-0.244***
R^2 adj	0.915	0.826	0.095	0.738	0.654

Source: Author's Computation

The five-factor Fama and French model presented in table 4 reveals the significance of the profitability effect only in the Equity Hedge portfolio, suggesting that funds in these portfolios generally do not have significant exposure to profitable companies and investment decisions are driven by other criteria. However, the investment effect is much more visible and significant for 4 out of 5 strategies. In the presence of RMW and CMA, the value factor becomes significant for Equity Hedge and Funds of Hedge Funds, indicating that the information contained in this variable is better reflected when these two additional factors are included. Overall, this model has better representativity, explaining more effectively the systematic component in the evolution of hedge funds. According to this model, 4 out of 5 portfolios have generated alpha. The regression estimation results for the seven-factor model of

Fung and Hsieh are presented in table 5. The explanatory power is considerably improved for Macro and Relative Value portfolios, indicating their exposure to risk factors more specific to hedge funds. The representativity, measured by adjusted R-squared, increases by 14.5 percentage points for Macro and 11.8 percentage points for Relative Value portfolios. Compared to other estimated models, this one best suits the Macro strategy, indicating statistically significant coefficients for all trend-following factors, reflecting dynamic exposure across multiple asset classes based on the economic situation.

Table 5. Fung and Hsieh basic model

The table presents the estimated parameters of model 4, applying OLS method for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + + \beta_{2i}SIZE_t + + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Variable	Equity hedge	Event-driven	Macro	Funds of HF	Relative value
α	0.05	0.224***	0.166**	0.029	0.237***
β_1	0.46***	0.278***	0.141***	0.215***	0.106***
β_2	0.029**	0.039***	-0.007	-0.005	0.02**
β_3	-1.526***	-2.426***	-0.349	-1.916***	-3.138***
β_4	0.445	0.28	0.086	0.024	-0.427**
β_5	0.002	-0.003	0.011**	0.001	-0.004
β_6	0.003	0.001	0.02***	0.004	-0.003
β_7	-0.005	-0.01**	0.015**	-0.003	-0.008***
R^2 adj	0.882	0.804	0.24	0.705	0.772

Source: Author's Computation

Table 6. Fung and Hsieh model with Baker and Wurgler sentiment index

The table presents the estimated parameters of model 5 for Equity hedge portfolio, applying both OLS and quantile regression methods for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SIZE_t + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \beta_{8i}BWSENT_T^{\perp} + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Equity hedge	OLS	τ = 0.1	τ = 0.25	τ = 0.5	τ = 0.75	τ = 0.9
α	0.067	-1.08***	-0.397***	0.036	0.58***	1.068***
β_1	0.466***	0.477***	0.482***	0.488**	0.467***	0.422***
β_2	0.026*	0.015	0.035	0.042	0.043*	0.03*
β_3	-1.318***	0.532	0.043	0.539	0.42	0.879*
β_4	0.59**	-0.932	-1.259*	-0.995	-1.001**	-2.029***

β5	0.003	-0.008	-0.003	0.004	0.007	0.013
β6	0.002	0.005	0.007	0.004	0.005	0.003
β7	-0.006	-0.014	-0.004	-0.004	-0.005	0.005
β8	-0.066	0.076	-0.212	-0.218	-0.008	0.051
R^2 adj	0.882	0.7	0.664	0.644	0.62	0.622

Source: Author's Computation

Including the Baker and Wurgler sentiment index as a risk premium in the Fung and Hsieh model further enhances explanatory power compared to the basic model and others. The sentiment index balances the model and better explains the information carried by other variables, even though the sentiment index itself is not statistically significant for any strategy.

Ultimately, we conducted a quantile regression analysis for the Fung and Hsieh model, including the Baker and Wurgler sentiment index, to evaluate how the regression fits across different performance ranks. We divided our analysis into five quantiles: 10%, 25%, 50%, 75%, and 90%. The estimation outputs are presented for each portfolio, starting with Table 6 and continuing through Table 10.

For the Equity Hedge portfolio, the representativity is highest at the bottom 10% quantile and continuously decreases as we move to higher quantiles. A possible explanation could be that bottom performers are more exposed to systematic risks due to the lack of timing and selectivity skills of hedge fund managers.

Table 7. Fung and Hsieh model with Baker and Wurgler sentiment index

The table presents the estimated parameters of model 5 for Event-driven portfolio, applying both OLS and quantile regression methods for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SIZE_t + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \beta_{8i}BWSENT_T^{\perp} + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Event-driven	OLS	τ = 0.1	τ = 0.25	τ = 0.5	τ = 0.75	τ = 0.9
α	0.243***	-0.791***	-0.225***	0.246***	0.649***	1.236***
β1	0.278***	0.26***	0.265***	0.275***	0.285***	0.313***
β2	0.039***	0.03	0.034	0.044**	0.022	0.018
β3	-2.308***	0.657	0.177	0.137	0.176	0.705
β4	0.36	-2.614***	-2.134***	-2.183***	-1.625**	-2.282***
β5	-0.003	-0.01	-0.004	-0.007	-0.003	0.009
β6	0	0.005	0.001	0.002	0.004	-0.001
β7	-0.009**	-0.009	-0.006	-0.008	-0.007	-0.005
β8	-0.076	0.163	-0.228	-0.133*	-0.262**	-0.165
R^2 adj	0.811	0.607	0.569	0.548	0.505	0.48

Source: Author's Computation

For the Event-Driven strategy, we observe a similar pattern of decreasing representativity as we move to higher quantiles. Additionally, we notice the statistical significance of certain coefficients at specific performance rankings compared to OLS. The bond spread, measured by the excess return of BAA-rated bonds over the 10-year constant maturity yield, shows a negative exposure dynamic. Furthermore, for the 0.5 and 0.75 quantiles, the Baker and Wurgler sentiment index is significant, indicating that investor sentiment negatively influences the return variation of hedge funds.

In the Macro portfolio, the significance of trend-following factors in the top quantiles suggests dynamic asset allocation in various situations. Compared to other portfolios, the representativity of the regression increases at higher quantiles, likely due to the more dynamic allocation strategies employed by top performers.

Table 8. Fung and Hsieh model with Baker and Wurgler sentiment index

The table presents the estimated parameters of model 5 for Macro portfolio, applying both OLS and quantile regression methods for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SIZE_t + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \beta_{8i}BWSENT_T^{\perp} + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Macro	OLS	τ = 0.1	τ = 0.25	τ = 0.5	τ = 0.75	τ = 0.9
α	0.191**	-1.212***	-0.624***	0.177	1.001***	1.812***
β_1	0.176***	0.179***	0.159***	0.217***	0.151***	0.141***
β_2	-0.022	-0.026	-0.041	-0.026	-0.039	-0.046
β_3	-0.282	-1.514**	-1.267**	-0.888*	0.347	0.333
β_4	-0.512	-0.851**	-1.159	0.312	0.649	-0.501
β_5	0.012**	0.008	0.011	0.018***	0.012**	0.014
β_6	0.021***	0.014	0.011	0.025***	0.025***	0.035*
β_7	0.014**	0.011	0.007	0.021**	0.027***	0.031*
β_8	-0.013	0.12	0.232	-0.124	-0.124	0.052
R^2 adj	0.317	0.157	0.155	0.173	0.211	0.241

Source: Author`s Computation

Table 9. Fung and Hsieh model with Baker and Wurgler sentiment index

The table presents the estimated parameters of model 5 for Funds of Hedge Funds portfolio, applying both OLS and quantile regression methods for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SIZE_t + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \beta_{8i}BWSENT_T^{\perp} + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Funds of HF	OLS	τ = 0.1	τ = 0.25	τ = 0.5	τ = 0.75	τ = 0.9
α	0.045	-0.988***	-0.391***	0.161***	0.535***	0.897***
β_1	0.229***	0.211***	0.276***	0.256***	0.236***	0.221***
β_2	-0.013	0.006	0.005	-0.007	-0.007	-0.019

β_3	-1.839***	-0.106	-0.343	-0.261	-0.179	0.336
β_4	-0.111	-2.149***	-1.239***	-1.163***	-1.636***	-2.012***
β_5	0	0.004	-0.001	0.006	0.002	0.007***
β_6	0.005	-0.003	0.004	0.006*	0.007**	0.006*
β_7	-0.003	-0.006	0.001	-0.001	-0.003	-0.005
β_8	0.106	-0.062	-0.134	0.165	0.156	-0.056
R^2 adj	0.712	0.477	0.459	0.433	0.443	0.457

Source: Author's Computation

For the Funds of Hedge Funds portfolio, the representativity remains almost constant across all quantiles. However, we observe the significance of the bond spread compared to OLS and the FX premium in the top quantiles.

Table 10. Fung and Hsieh model with Baker and Wurgler sentiment index

The table presents the estimated parameters of model 5 for Relative value portfolio, applying both OLS and quantile regression methods for the following regression: $R_{it} - R_{Ft} = \alpha_i + \beta_{1i}(R_{Mt} - R_{Ft}) + \beta_{2i}SIZE_t + \beta_{3i}YLDCHG_t + \beta_{4i}BAAMTSY_t + \beta_{5i}PTFSBD_t + \beta_{6i}PTFSFX_t + \beta_{7i}PTFSCOM_t + \beta_{8i}BWSENT_T^{\perp} + \varepsilon_{it}$ over the period 01.01.2003 – 31.12.2023, *, **, *** indicates statistically significant coefficients for 90%, 95%, 99% confidence levels.

Relative value	OLS	τ = 0.1	τ = 0.25	τ = 0.5	τ = 0.75	τ = 0.9
α	0.259***	-0.478***	-0.114*	0.269***	0.637***	1.018***
β_1	0.114***	0.115***	0.128***	0.129***	0.136***	0.099***
β_2	0.017*	0.022	0.022	0.014	0.008	0.029**
β_3	-3.136***	-0.761**	-0.719***	-0.861***	0.025	0.175
β_4	-0.519***	-3.272***	-2.822***	-2.502***	-2.163***	-2.372***
β_5	-0.004	-0.009	-0.008**	-0.002	0.004	0.005**
β_6	-0.003	-0.003	0.003	-0.001	-0.002	-0.005*
β_7	-0.008***	-0.003	0.001	-0.004	-0.008**	-0.003
β_8	0.055	0.107	0.019	-0.062	0.069	-0.187
R^2 adj	0.779	0.581	0.48	0.41	0.39	0.409

Source: Author's Computation

Lastly, in the Relative Value portfolio, there is a decrease in representativity as we move to higher quantiles, with 5 out of 8 factors being statistically significant at the 0.9 quantile.

6. Conclusion

Among all risk factors, the market, size effect, investment effect, momentum, and bond spread are the most important in explaining return variation across hedge fund portfolios. In quantile regression, we find that, except for the Macro strategy, the representativity of the Fung and Hsieh model, when including the Baker and Wurgler sentiment index, is better for the bottom quantiles. This may result from a lack of timing and selectivity skills of managers at these ranks. Overall, the sentiment index improves the explanatory power of the Fung and Hsieh model. Although the index itself does not statistically influence most portfolio returns, it helps balance the model and reflect the information present in the other variables. The R-squared of all portfolios increased by an average of 2 percentage points compared to the basic model, with the most significant increase coming from the Macro portfolio, where representativity improved by 7.7 percentage points. The Macro strategy proved to be the most dynamic, with the Fung and Hsieh asset pricing model for hedge funds performing better compared to the Fama and French models and the Carhart model, which is primarily designed for equities.

This study provides more insight into the complex relationship between risk and returns for hedge funds, identifying the most important sources of risk influencing return variation across different hedge fund strategies.

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