"YOU CAN'T FIGHT THE FED": THE EFFECTS OF QE ON HEDGE FUND RETURNS

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I.   Abstract

The power of the Federal Reserve and the effects of its monetary policy decisions on financial markets has given rise to the adage, "you can't fight the Fed." That is, taking any investment thesis in contraposition to the Federal Reserve's actions will lead to dissatisfactory returns. In carrying out an ordinary multivariate regression, I find statistically significant evidence at the 5% level that this conventional wisdom holds true by investigating the effect of Quantitative Easing on hedge fund returns. I make a novel contribution to the extant literature by showing that Quantitative Easing did negatively affect hedge fund returns. These results indicate the need for further research and analysis in understanding the effects of monetary policy and asset pricing.

II.   Introduction and Background

During the Great Financial Crisis of 2008, the Federal Reserve (the Fed) utilized a new, unconventional monetary policy tool called Large Scale Asset Purchases, more commonly referred to as Quantitative Easing (QE). I will discuss the details of these programs below, but in essence, the Federal Reserve went on to use various forms of QE over the next 14 years, dumping trillions of dollars into financial markets.

In terms of the effect on asset prices from monetary policy, conventional wisdom holds that in economic environments characterized by expansionary monetary policy like QE, asset prices generally rise. This is exactly what we saw in the post-crisis period. From November 2008, when the Federal Reserve first announced the implementation of QE, to March 2022,

when QE officially ended and Quantitative Tightening (QT) began, the average annual nominal compound return of the S&P 500 was an astounding 14.49%.

A possible consequence of the general increase in asset prices, however, was that managers of active investment strategies, such as hedge funds, struggled during this period. The thinking goes – because the prices of all assets were rising, finding opportunities to earn outsized returns relative to broader asset markets was much more challenging. Further, if an investment strategy usually involves shorting, as some hedge fund strategies do, it would then follow that those strategies may have even performed worse over the 2008-2022 period relative to periods of tighter monetary policy. The market adage, "you can't fight the Fed," gets at this exact idea. It suggests that holding an investment that sits in contraposition to current central bank policy is inadvisable. The idea being, in periods of expansionary (contractionary) monetary policy, asset prices rise (fall) in general. So, to hold any investment strategy that sits in contrast with this generalization should thus result in low or negative returns.

The idea that "you can't fight the Fed," is what I explore in this paper within the specific context of hedge funds and QE. I ask, do hedge fund returns differ between the pre- and post-QE periods? I address this question from a stylistic point of view in using indices representing different hedge fund styles constructed by Hedge Fund Research Inc. (HFR). Empirically, I answer this question by regressing the monthly returns of each index during the sample period on multiple macroeconomic factors along with a dummy variable that controls for QE. I find that 11 of the 14 indices in my data set exhibit statistically significant differences at the 5% level in their pre- and post-QE returns. More specifically, all 11 of these indices have negative coefficients with respect to the QE control variable, suggesting that QE negatively impacted the average

monthly returns of these hedge fund strategies, thus affirming the underlying thinking of this conventional wisdom.

My contribution to the extant literature is three-fold. Primarily, my findings are novel in empirically verifying the existence of QE's effect on hedge fund returns. My results also show the need for further research regarding QE's long-term effects on asset pricing, which is important for policymakers to understand in thinking about how monetary policy decisions affect financial markets. Lastly, my analysis provides evidence for the fact that hedge fund investors must be meticulous, cautious, and comprehensive in their analysis of hedge fund returns.

III.   Literature Review

The Details of Quantitative Easing

Quantitative Easing is an unconventional monetary policy tool the Federal Reserve created and utilized during the Great Financial Crisis. This policy tool was "unconventional" in the sense that the Fed traditionally changes the level of reserve requirements for banks, changes the discount rate, which is the rate at which the Federal Reserve lends to banks, or conducts open market operations, which changes the Federal Fund Rate or the rate at which banks lend to each other. Amid the crisis, the Federal Reserve used these tools and cut the Federal Funds Rate to zero in order to help stimulate the economy and encourage lending. To help further stimulate the economy and provide more liquidity into the financial system during the Great Financial Crisis, the Federal Reserve began QE in November 2008. This new policy tool is similar to conducting normal open market operations in that the Federal Reserve went into the market to purchase securities. What differed and made QE unconventional, however, was that the Federal Reserve

purchased longer maturity securities as well as non-government issued securities in attempt to provide liquidity to financial markets and push down long-term interest rates.

Over the next 14 years, the Federal Reserve would carry out multiple different forms of QE programs (e.g., QE1, QE2, etc.). As described by the Federal Reserve Bank of New York: From November 2008 to March 2010 during QE1, the Federal Reserve purchased $175 billion in agency debt, $1.25 trillion in agency mortgage-backed securities (MBS), and $300 billion in longer-term Treasury securities. During QE2, which took place from November 2010 to June 2011, the Federal Reserve purchased $600 billion in longer-term Treasury securities. Then in what was called "Operation Twist," the Fed sold $634 billion of Treasury securities it held with maturities of less than three years and purchased $667 billion in Treasury securities with maturities between 6 to 30 years. From September 2012 through October 2014, the Federal Reserve purchased another $823 billion in agency MBS and $790 billion in Treasury securities. The Federal Reserve announced its most recent iteration of QE in March 2020, which was set as a $700 billion program (CoinDesk, 2020). Finally in March 2022, we saw the end of QE, as the Fed shifted firmly to a contractionary monetary policy stance and began QT in response to rising inflation. In all, the Federal Reserve's balance sheet ballooned from roughly $890 billion in November 2008, to $4.20 trillion in March 2020, and finally to a staggering $8.97 trillion in April 2022 (Fed Balance Sheet).

Williamson (2017) provides a brief synopsis of one underlying argument for how QE affects market interest rates. Essentially, Portfolio Balance Theory posits that assets of different maturities are not perfect substitutes for each other due to, among other things, trading costs and investor preferences. Therefore, the relative supply of assets, which the Federal Reserve was

changing in its QE programs, matters. The actions of the Federal Reserve, then, should have put upward and downward pressure on short- and long-term rates, respectively, through QE.

Jarrow and Li (2014) estimate the impact of QE from 2008 to 2011 on the term structure of interest rates using an arbitrage-free term structure model. They find that for maturities less than 12 years, forward rates were reduced by QE but longer-term forward rates felt little impact. Similarly, Fratzscher, Lo Duca, and Straub (2012) found that QE1 was effective in lowering sovereign yields and supporting US equity markets. QE2, at least up until the publishing of their paper in 2012, had not been effective in achieving similar results. The literature on the effects of asset pricing as a result of QE from 2008 to 2022 is basically non-existent. The reason for this lack of research could be that disentangling the true effects of QE on asset pricing from data that already has a low signal-noise ratio to begin with undoubtedly makes this a difficult empirical endeavor. In their working paper, however, Caballero and Simsek (2023) provide a model in which to understand how the Federal Reserve's response to macroeconomic needs can affect asset prices, just as the Federal Reserve did in 2008. Their model affirms conventional wisdom, in that the Federal Reserve will push asset prices upwards to restabilize the macroeconomy faster.

Characterizing Hedge Funds

Hedge funds are investment vehicles that provide different risk-return profiles compared to traditional stock and bond investments (Stefanini 2015). First to give a very broad overview, investors hand their capital over to hedge fund managers, who then have the freedom to invest that money into any financial security or strategy with the expectation of earning returns for the risk they bear. These managers then charge fees on the amount of capital invested as well as on a portion of the profits they earn. Unlike traditional investments, however, investors' capital is not

easily withdrawn from a hedge fund. These features I have listed thus far are, generally speaking, the defining characteristics of hedge funds. I now discuss the details and literature of investing in hedge funds.

To begin, the idea of investing in hedge funds can be quite attractive for a capital allocator. As I mentioned above, hedge funds can deliver different risk-return profiles from traditional investments. Thus, a portfolio manager looking for investment opportunities yielding attractive returns that also provide diversification benefits in their portfolio may find an investment in hedge funds suitable for their clientele.

The unique risk return profiles of hedge funds arise out of the lack of regulation surrounding them. Unlike other investments such as mutual funds, hedge funds are exempt from the Investment Company Act of 1940. This gives hedge fund managers substantial latitude to execute various strategies, as the Investment Company Act of 1940 restricts leverage and requires financial reporting standards for mutual fund managers. Hedge fund managers are allowed to sell securities short, take on a substantial amount of leverage, and use any financial instrument as they see fit in order to earn returns (Stefanini 2015). Managers often utilize this freedom in investment strategy to construct asymmetric payoff structures, in which either the upside or downside is limited while the downside or upside is disproportionately larger (Leib et al. 2023). This means that many hedge fund strategies should have non-linear relationships, and thus a lower correlation, to the market's returns than that of stocks and bonds (Cowan, et al. 2011).

 Hedge funds avoid regulation by marketing themselves only to sophisticated investors, which generally means institutional or high net worth investors, instead of the general public as mutual funds do (Black 2009). In other words, since hedge funds are not offered to the general

investing public, they are not subject to the same strict oversight and regulations that publicly traded securities are.

One cost, however, of investing in hedge funds is illiquidity, as hedge funds subject investor capital to capital controls and illiquidity. Generally, investors can withdraw their capital from a hedge fund after giving roughly a 30 or a 90-day notice, depending on the fund. Fund managers can, however, impose tighter liquidity restrictions in the form of lockups, infrequent withdrawal periods, and occasionally, additional discretionary liquidity restrictions, which can be applied by fund managers to prevent investor redemptions from forcing the fund to exit from their illiquid assets (Aiken, Clifford, and Ellis (2013)). The discretionary liquidity restrictions can be quite inconvenient for portfolio managers, as hedge fund managers can apply these restrictions at times in which their investors desire liquidity the most, such as during the Great Financial Crisis. The jury is out on whether discretionary liquidity restrictions can benefit investors via improved performance, though all else being equal, investors generally would prefer easier access to their capital than indefinite periods of illiquidity. The one upshot to the liquidity restrictions is that hedge funds enforce a long-term horizon on investors' capital, and longer investment horizons are generally thought to lead to more positive outcomes.

There is another substantial cost to investing in hedge funds, however. Structured as limited partnerships, hedge funds typically charge a 1-2% fee on invested capital and a 20% fee on profits earned above a certain required rate of return or above the highest historical portfolio value, otherwise known as a "high water mark." While the latter fee helps to align managerial and investor interests, it comes at a material cost. Ben-David, Birru, and Rossi (2020) analyze the fees and returns of 6,000 funds from 1997 to 2016. They find that investors in hedge funds,

after deducting management fees, receive 36 cents for every dollar of gross excess return on their invested capital.

In terms of the risks hedge funds expose themselves to, a common misconception is that they all attempt to "hedge," their risks. Agarwal and Naik (1999) note that the first hedge funds did seek such a risk-return profile by taking positions in their portfolio equally long and short. In the current market environment, however, the term "hedge funds," refers to many different investment strategies. Hedge fund managers can invest in anything, including convertible securities, distressed debt, and complex derivatives. The plethora of securities available to managers along with the freedom to employ significant degrees of leverage and to take short positions invariably leads to heterogeneity in terms of how individual funds generate returns. Therefore, constructing a taxonomy of hedge funds is important in order to better understand how they might fit into a portfolio.

One way to construct a taxonomy of hedge funds it to take the top-down approach of Agarwal and Naik (1999). This method involves categorizing the funds as directional funds, which seek to earn returns generally correlated with broader equity markets movements, and non-directional funds, which aim to deliver returns uncorrelated with the market. From there, the funds can further be broken down into various strategies. This approach makes sense, as a hedge fund's return correlation with broader equity markets is important to investors in understanding what role such an allocation will play in their portfolio. An allocation to directional hedge funds could be similar or even tantamount to owning equity risk with lower expected downside risk, for example. For the sake of this paper though, I will adopt the taxonomy established by Hedge Fund Research Inc., which is the database I used to pull return data from, for the sake of convenience and consistency. This taxonomy begins with separating the funds into different

strategies and then into different sub-strategy buckets. So for example, the strategy "Equity Hedge," refers to funds that take both long and short positions primarily in equities or equity derivatives. The Equity Hedge sub-strategy of "Equity Market Neutral," is just one example of an Equity Hedge sub-strategy in which the net market exposure maintained by the fund is plus or minus 10%. HFR's description for each of the relevant strategies and sub-strategies to this paper can be found in Appendix A.

IV. Discussion of Data

Issues in Hedge Fund Data

Required by the Investment Act of 1940, mutual funds must publicly report their returns on a quarterly basis. Hedge funds, on the other hand, are not required to do so. As a result, empirical inquiries into hedge funds are not as straightforward as would be for a publicly traded security that is priced daily. One consequence in particular is the entrance of biases into return datasets that are constructed by research databases like Hedge Fund Research Inc. or Lipper TASS, as managers self-report (or do not self-report) their returns to such databases, which then aggregate fund returns into indices. Agarwal, Mullally, and Naik (2015) note that each of these databases will therefore naturally suffer from biases like survivorship bias, self-selection bias, backfill bias, and stale price bias.

Joenväärä, Kauppila, Kosowski, and Tolonen (2019) compile a data set from multiple commercial hedge fund databases, such as Hedge Fund Research and Morningstar, in order to re-examine fundamental hedge fund research questions. In doing so, they find that returns are biased upwards if the researcher chooses to use data from a single commercial database. This finding is the result of discrepancies between each of the database's coverage of

underperforming funds. I chose only one database, as my research question pertained, in part, to particular styles of hedge funds, and while the definition of each style is generally uncontroversial, differences in how each commercial database defines the conditions for a style could exist, making the data difficult to reconcile. Further, this upwards bias is not of much concern to this paper, as I do not seek to make claims about the magnitudes of hedge fund returns in relation to other asset classes.

Another possible bias to address is survivorship bias. This is the idea that databases retain only return data for "surviving," funds, meaning funds that are liquidated or cease to exist no longer influence the aggregate return data of the database. In their literature review, Agarwal, Mullally, and Naik (2015) see that the estimates of survivorship bias across the survivorship bias research is dependent on the "type of database, sample period, and fund characteristics." HFR keeps the return data of such funds in constructing their indices, thus insulating the aggregated return data from this bias. This is not to say, however, that the data of each of the indexes I use is complete, as, again, managers only voluntarily self-report their returns.

This need to only voluntarily self-report also introduces self-selection bias. The thinking is that from an advertising perspective, out-performing managers have an incentive to report their returns while under-performing ones have a disincentive. At the same time, however, it is also possible that top performing hedge funds stop reporting to commercial databases once they close themselves off to new investors and thus no longer seek to advertise their returns. Edelman, Fung, and Hsieh (2013) attempt to examine the impact of these contrasting forces on commercial databases, concluding that they counterbalance and find no statistically significant evidence of this bias. Thus, I am not worried of such bias materially impacting my empirical conclusions.

Backfill bias occurs when managers choose to begin reporting their returns to a database. In doing so, the manager must "backfill," all their returns since the inception of their fund to present day. This backfilling of returns would allow for the possibility for managers to overstate their historical returns. Using the TASS database, Ibbotson, Chen, and Zhu (2011) find backfill as well as survivorship bias to be a serious issue. After controlling for both, the authors find that the compound return over their roughly 14-year sample period fell from 14.88% to 7.70%, both net of fees. Thus, backfill bias is an issue to keep in mind moving forward, though there is not much to be done without possessing the true fund-level return data.

Stale-price bias arises as a result of managers having to price their illiquid investments which, by definition, do not have publicly traded equivalents. The worry is that the pricing volatility of any illiquid holdings of a hedge fund could be artificially reduced as compared to a similar asset that's publicly traded instead. This volatility smoothing would inherently bias hedge fund performance analyses, reducing the perceived risk from a volatility perspective. Cassar and Gerakos (2011) find that managers with greater pricing discretion are more likely to produce returns exhibiting characteristics of intentional smoothing. They also find, however, that the greatest driver of smoothing is not a fund's pricing controls but rather the illiquidity of the underlying assets and investment style of the fund. Other literature however, like Huan, Liechty, and Rossi (2009), find upward and downward biases in returns and their volatility, respectively. Thus, stale-price bias is another issue to keep in mind, though again, not much can be done to address it.

Details of the Hedge Fund Return Dataset

My dataset consists of data from 14 Hedge Fund Research Inc. indices. Each index is representative of either a strategy or sub-strategy of a strategy. There are many more indices

available on HFR's website, however, the nature of my analysis constrained my dataset to these 14 indices in particular, because only these indices have return data for the period before 2008. Of the 14 indices, 12 have return data starting in Feb 1990, leading to 224 pre- and 171 post-QE monthly observations (395 total). Note that I use "post-QE" to refer to the period of Nov 2008 to March 2022 in which QE was occurring. Data collection for the HFRIMB Index and HFRISE Index started later with the former providing 190 pre-QE observations while the latter has 178 (361 and 349 total, respectively). Summary statistics for each index can be found in Appendix B. Lastly, a naive analysis that looks purely at the pre- and post-QE nominal compounded annualized mean returns shows there are material differences between the mean returns of each period (see Appendix B).

IV. Methodology

I use an ordinary multivariate regression to uncover the effect of QE on the returns of each hedge fund sub-strategy. I regress each index's monthly returns on a dummy variable QE_i that equals 0 for each month before November 2008 and 1 afterwards. I also include a set of control variables for different systematic risks and macro-economic conditions, including credit risk, exposure to economic growth, liquidity risk, Emerging Market exposure, equity market exposure, and interest rate risk. Barring *Recession*, which is a dummy variable that equal 1 during recessionary months and 0 otherwise, and *SP500*, these control variables are investable factors constructed and sold by BlackRock. Details regarding these factors can be found in Appendix C.

Regarding my definition of the post-QE period, I chose November 2008 since this was the month in which the Federal Reserve officially announced the Large Scale Asset Purchases

program (Federal Reserve, 2008). Choosing this demarcation of the pre- and post-QE periods should lead to robust results, as the Federal Reserve did not begin purchasing assets until the following week in December. Further, even though there were immediate effects in asset pricing following QE announcements (see Rosa (2012)), there are likely other lagged effects as well, at least according to general consensus and Milton Friedman's famous dictum, "…monetary changes have their effect only after a considerable [and variable] lag" (The Hill, 2023).

I chose to use a multivariate regression to carry out my analysis in following the example of the rest of the financial research community, in which researchers use multivariate regressions as the standard procedure for assessing the risk exposures inherent in a given strategy. Sheik and Qiao (2009), however, note the irregularities of returns in alternative investment strategies, which includes hedge funds. Such strategies can exhibit negative skew, fatter tails, and autocorrelation, which brings into question the efficiency of some statistical tests which are dependent on the underlying normality assumption. To this end, I simply appeal to the fact that so many other, more knowledgeable researchers use linear regressions in analyzing the returns of hedge funds. For this reason, I also limit my analysis to assessing solely the sign and statistical significance of a coefficient. That is, my analysis makes no claims based on the magnitude of the point estimates from the regression, as making such claims on already shaky empirical grounds seems unwise. In any case, the equation form of the regression is as follows:

$$\text{HF}_i = \beta_0 + \beta_1 \text{QE}_i + \beta_{i,j} \text{X}_{i,j} + \varepsilon_i$$

where HF_i is the monthly expected return of Hedge Fund Research sub-strategy index i. β_1 is the estimated effect of QE on the average monthly return on index i. $\text{X}_{i,j}$ is a vector of the control variables. Lastly, $\beta_{i,j}$ is the coefficient of the HFR index i of the j control variable.

V. Discussion of Results

Main Result

From Table 1, we can see that 11 of the 14 observations yield statistically significant coefficients at the 5% level for the dummy variable *QE*. In other words, 11 of the indices exhibit statistically significant differences in their average monthly returns as a result of QE after controlling for other systematic and macro-economic risks. Further, all 11 of the significant coefficients are negative, meaning these indices' average monthly returns in the post-QE environment were lower than their monthly mean returns in the pre-QE environment. This result affirms the thinking underlying the conventional wisdom "you can't fight the Fed" as an active manager in a world in which all asset prices are rising.

In what follows, I discuss the details of the regression analysis on a strategy-by-strategy basis. The level and depth of analysis with respect to each index is limited by the degree of specificity in each strategy. For example, Merger Arb. is a more narrowly defined strategy in regards to what kinds of trades it makes as compared to a strategy like Macro, in which managers have ample degrees of freedom in asset class and security selection.

Table 1: Statistically Significant Regression Coefficient Estimates at the 5% Level

Classification		Regressors									
Strategy	Index	Constant	SP500	RealRates	Inflation	Credit	Economic	EM	Liquidity	Recession	QE
Equity Hedge	EH (Total)	0.0080	0.25	-0.041	N/A	-0.077	0.27	0.17	0.33	N/A	-0.0068
	Market Neutral	0.0064	N/A	N/A	N/A	-0.064	0.072	N/A	0.085	N/A	-0.0049
	Q. Directional	0.0065	0.44	N/A	0.14	N/A	0.16	0.20	0.33	N/A	-0.0082
Event Driven	ED (Total)	0.0085	0.11	N/A	-0.07	0.097	0.17	0.10	0.22	-0.0058	-0.0062
	Distressed	0.0094	N/A	N/A	-0.11	0.14	0.19	0.089	0.18	-0.0059	-0.0059
	Merger Arb.	0.0071	0.049	N/A	N/A	0.044	0.071	N/A	0.13	-0.0039	-0.0046
Macro	Macro (Total)	0.011	N/A	0.057	0.13	-0.11	0.30	0.14	N/A	N/A	-0.010
	S. Diversified	0.0089	0.11	N/A	0.11	-0.17	0.22	N/A	N/A	N/A	-0.0089
Relative Value	RV (Total)	0.0076	N/A	0.031	-0.084	0.043	0.17	0.071	0.12	N/A	-0.0040
	Convertible Arb.	0.0069	N/A	0.040	-0.10	0.096	N/A	N/A	0.11	N/A	N/A
	Corporate	0.0055	N/A	0.058	-0.20	N/A	0.13	0.12	0.073	N/A	N/A
	RV Multi	0.0061	N/A	0.045	-0.073	0.23	0.14	0.077	0.11	-0.0053	-0.0034
	Asset Backed	0.0061	N/A	N/A	-0.061	0.057	0.15	0.067	0.085	N/A	-0.0027
	Yield Alts.	0.0059	N/A	N/A	-0.13	N/A	0.47	N/A	0.21	N/A	N/A

"N/A" means the coeficient of the given factor is statistically insignificant at the 5% level with respect to that index

Table 1 shows the regression coefficient estimates of each of the indices, which are grouped by strategy on the left-hand side of the table. The point estimates are in decimal form. So for example, a one percent increase in the return to *EM* would lead to an 17 basis point increase in the average monthly return of EH (Total). Again though, the magnitude of the coefficients is not relevant to my analysis.

There are strategy-wide observations to note. First, all indices have positive loadings on *Economic*, suggesting the returns of all these strategies rise and fall with the broader economy. Given how *Economic* is constructed though (see Appendix C), it may be difficult for any strategy to *not* have exposure to *Economic*. The macro-economic loadings to Equity Hedge (Total) and Macro (Total) are indicative of these strategies being directly exposed to the market and thus these strategies take what the market delivers. On the other hand, Event Driven (Total) and Relative Value (Total) are exposed to security mispricing, and thus they show a lower degree of macro-economic sensitivity. So, in addition to *QE*, which only tests for mean return differences

as a result of policy changes, these BlackRock factors speak more to the underlying behavior of

the strategy in all states. I now undertake a discussion of strategy specific results.

Effects of QE on Event Driven Strategies

Three of the 11 statistically significant observations are of the Event Driven (ED)

strategy. In this hedge fund strategy, managers earn returns by making investments related to

corporate events. Specifically, HFR characterizes Event Driven strategies as the following:

> "Investment Managers who maintain positions in companies currently or prospectively
> involved in corporate transactions of a wide variety including but not limited to mergers,
> restructurings, financial distress, tender offers, shareholder buybacks, debt exchanges,
> security issuance or other capital structure adjustments. Security types can range from
> most senior in the capital structure to most junior or subordinated, and frequently involve
> additional derivative securities. Event Driven exposure includes a combination of
> sensitivities to equity markets, credit markets and idiosyncratic, company specific
> developments. Investment theses are typically predicated on fundamental characteristics
> (as opposed to quantitative), with the realization of the thesis predicated on a specific
> development exogenous to the existing capital structure" (Hedge Fund Research Inc.).

Thus, HFR believes that because the strategy involves holding securities of a specific

company, including both debt and equity, it makes sense for the strategy to have exposure to

equity markets, credit conditions, and company-specific risks. For all three of the Event Driven

sub-strategies, we can see that the regression results mostly match this characterization.

There are, however, noticeable differences in the statistically significant loadings of each

of the indices within the ED strategy. For example, the HFRI Event Driven (Total) Index (ED

(Total)) and HFRI ED Merger Arbitrage Index (Merger Arb.) both have statistically significant

exposure to *SP500*, but HFRI ED Distressed Restructuring Index (Distressed) does not. One

plausible explanation of this latter result is the following: Distressed hedge funds make

investments in the securities of "distressed," companies, which are firms on the cusp of or

already in bankruptcy. Given that the underlying firms of a distressed investment are in or almost

in bankruptcy, it therefore makes sense for the Distressed strategy to have little to no relation to

the returns of broader equity markets. As, in almost all states of the world, the returns of the securities held by Distressed hedge funds will be mostly a function of the outcome of the bankruptcy process, not the overall market risk inherent in those securities.

This discrepancy between statistically significant risk exposures of the ED indices exists with respect to other factors as well. What's more is that this observation holds across the other strategies in the dataset. I call attention to this result to make the point that sub-strategies within a strategy can meaningfully vary in terms of the risk exposures and return profiles they deliver, which is characteristic of the heterogeneity of hedge fund strategies I discussed earlier. Thus, from the perspective of portfolio construction, different hedge funds have different factor exposures, so the choice of fund will necessarily reflect exposure to different risk factors. This means that investors should also think qualitatively beyond summary statics like a Sharpe Ratio in their approach to considering what role a hedge fund strategy could play in their portfolio.

Moving back to the regression results, a possible objection to my analysis of the ED indices, and really of all the hedge fund strategies generally, is that *QE* and *RealRates* could be correlated in affecting returns through the same channel (i.e., interest rates). To that end, *QE* is a dummy variable while *RealRates* is continuous. I would therefore expect the two variables to have a low-to-zero correlation. I would also argue that generally, looser monetary policy leads to more corporate events, thus giving ED strategies more opportunities earn returns. However, it stands to reason that if the strategies are attempting to generate returns around specific, individual corporate events, then movements in interest rates should not affect their returns. In other words, interest rate movements may affect the returns of ED strategies over a longer period of expansionary or contractionary monetary policy though not on a case-by-case basis of

corporate events, as the amount of liquidity in an environment would presumably affect the cost of financing for ED strategies.

I generalize this argument to the rest of the observations in that *RealRates* captures the actual movements of interest rates whereas *QE* assess the difference in returns between the two regimes, where 1990-2008 is reflective a tighter monetary policy environment and 2008-2022 represents a period of much looser monetary conditions. Thus, the worries regarding multi-collinearity are non-material. With that said, it is worth noting that all three of the ED strategies, though, have no statistically significant relationship to *RealRates*, while each of the ED indices have statistically significant coefficients for *QE*.

This statistically significant result is no surprise given the above discussion of each strategy. What bears further explanation, though, is why these strategies exhibit a negative relationship with *QE*. However, to construct a truly causal explication here requires more data beyond what I have now. Namely, such an analysis demands detailed, fund-specific data regarding their trading strategies. Due, however, to the operational opacity of hedge funds and the proprietary nature of their trading strategies, I only give possible, plausible explanations of the results:

To start, Merger Arb., or sometimes referred to as "Risk Arbitrage," attempts to generate returns via the managers' perceived insight into corporate mergers and acquisition (M&A) deals specifically. Black (2009) notes that the "classic," Merger Arbitrage investment involves selling short the stock of the acquiring company while purchasing the stock of the target company. Merger Arbitrage will therefore be sensitive to the number of M&A deals in a period as well as what's called a deal's "spread," or the difference between the valuations in the firms merging or between the value offered for an acquiree and its current market value (Stefanini 2015).

In looking at the post-QE period, then, the frequency of M&A deals actually increased. The average annual quantity of corporate mergers worldwide was 27,200 in the period 1990-2007, whereas the period of 2008-2022 saw an average of 47,700 corporate mergers or acquisitions per year (Institute for Mergers, Acquisitions & Alliances, 2023). A greater number of M&A deals would increase the opportunity set for Merger Arb. hedge funds and should thus lead to better returns, though this is not what the regression results show.

Thus, a more plausible explanation of the negative impact of QE is via changes in the M&A spread. Jetley and Ji (2010) analyze M&A spreads from 1990-2007 and find that spreads declined significantly over the period due to among other things, increased crowding of Merger Arbitrage trades from the growing hedge fund industry, and changes in the characteristics of deals. Stefanini (2015) cites lower interest rates as a factor in lowering M&A spreads as well. Thus, perhaps the post-QE period exhibited a continuation of the trends and factors that Jetley and Ji (2010) describe as well as lower interest rates (which it did), which reduced M&A spreads and thereby reduced the returns of Merger Arb. Again though, I want to emphasize this is only a possible explanation. More research and data are needed in order to construct a causal explanation.

Turning to now to Distressed, a reasonable explanation for the negative impact of QE is that the resulting looser monetary policy environment led to cheaper debt financing, which lowered default rates and thus decreased the number of opportunities for Distressed hedge funds. Federal Reserve Economic Data (FRED) shows just that – the quarterly business loan delinquency rate fell from an average 2.82% per quarter to 1.58% in moving from the period Jan 1990-Oct 2008 to Nov 2008-April 2022. But whether this change materially impacted Distressed returns is uncertain. It presumably did, though I do not have the empirical evidence to make a

causal claim. More research is thus needed in order to understand the underlying causes of this result.

Given both ED sub-strategies faced challenges in earning returns as a result of QE, it is no surprise then that the index representing all ED sub-strategies, ED (Total), experienced a similar negative impact. From this result, I can generalize to the claim that QE, and the ultra-loose monetary environment it helped facilitate, made it more difficult for managers of ED strategies to earn returns during this period. What will be interesting and demand further research, then, is to see the data of ED strategies during periods of tighter, contractionary monetary policy, like the current environment we find ourselves in. In addressing this question, one could examine the differences in capital flows to equities and to hedge funds during different monetary environments.

Effects of QE on Equity Hedge Strategies

The HFRI Equity Hedge (Total) Index (EH (Total)), HFRI EH Equity Market Neutral Index (Market Neutral), and HFRI EH Quantitative Directional Index (Q. Directional) all exhibit statistically significant negative coefficients for QE. These indices are a part of the Equity Hedge (EH) strategy. EH (Total) is representative of the general strategy, while Market Neutral and Q. Directional are sub-strategies of Equity Hedge. EH is more commonly referred to as "Equity Long Short," and accounts for a large portion of the assets under management in the hedge fund universe (Black (2009)). HFR characterizes the EH strategy generally as:

> "Investment Managers who maintain positions both long and short in primarily equity and equity derivative securities. A wide variety of investment processes can be employed to arrive at an investment decision, including both quantitative and fundamental techniques; strategies can be broadly diversified or narrowly focused on specific sectors and can range broadly in terms of levels of net exposure, leverage employed, holding period, concentrations of market capitalizations and valuation ranges of typical portfolios. EH managers would typically maintain at least 50% exposure to, and may in some cases be entirely invested in, equities, both long and short" (Hedge Fund Research Inc.).

Like ED, the regression results vary between the EH indices. In regards to each of the

EH indices' negative loadings to *QE*, one explanation as to how QE affected the returns of these

strategies is the following: in an environment of rising equity prices (like that of the 2008-2021

period) the net long exposure of these strategies would increase, as an EH fund's long and short

positions would gain and lose value, respectively. Thus, in order to maintain a targeted level of

market exposure, managers would have to reduce their long positions and increase their shorts or

else they would become "long-only," funds. Having to continually rebalance their portfolio in

the post-QE equity bull market would surely have been a drag on performance. However, more

research and data are needed to uncover the true causal affect here.

One observation of interest in the regression results is Market Neutral's insignificant

exposure to *SP500*. This seems natural considering the strategy attempts to hold an adjusted net

Beta, or the statistical relation between the market and a risky asset implied by the Capital Asset

Pricing Model, exposure close to zero. However, Stefanini (2015) points out that a small or

insignificant relationship to *SP500* may arise solely in virtue of the strategy's generally low

volatility. This hypothesis is simply a claim regarding the fact that Beta is a function of a

strategy's volatility and correlation to the market, which is usually defined as a broad-based

equity index. This is exactly what the basic summary statistics of Market Neutral show: an

annualized volatility of just 3.04%, and a Pearson correlation coefficient with the S&P 500 of

0.30, which is by no means "market-neutral." This observation is further evidence that great care

must be taken in analyzing hedge fund returns and thinking about how they might diversify a

portfolio.

Another notable observation is that all three strategies lack statistically significant

loadings to the control variable *Recession*, which equals 1 during periods of recessions and 0

otherwise. This observation is indicative of the fact that while these hedge funds invest in equities, their risk-return profiles are by no means the risk-return profiles of equities, as investors expect stock returns to be influenced by recessionary periods. There is a qualification to be made here though, in that my sample period contains only one true recession (the Great Financial Crisis), as the other two recessions were both shallow and short. What is also noteworthy is that the nominal average compounded annualized returns of these indices are also economically significant, as the indices, barring Market Neutral's 5.5% annual mean, yielded returns in the 10-11% range across the entire sample. These returns in combination with their lack of statistical relationship to *Recession* provide evidence that these hedge fund strategies can play interesting roles in portfolio construction. To better understand this strategy's relationship to recessionary periods, however, a larger sample period should be used to establish more robust results before making any investment decisions.

To finish my discussion of EH, I want to note one perplexing observation is that all these indices also have significant coefficients for *Liquidity*. This result is intriguing, as these hedge funds invest in publicly traded securities, which are for the most part incredibly liquid assets. Sadka (2010) finds similar results in looking at the illiquidity premium in hedge fund returns. This observation could be the result of the way in which BlackRock constructs the liquidity factor, which is usually a portfolio of equities that is long small cap, or publicly traded stocks with small market capitalizations, and short, large cap, which are publicly traded stocks with large capitalizations. The thinking here is that since small cap stocks trade at lower daily volumes, they are therefore less liquid and can yield a liquidity premium. Thus, it could be that EH strategies load up on small cap firms and/or sell short large cap firms in executing their strategy. BlackRock's liquidity factor is also sensitive to volatility, as higher volatility regimes

generally have lower liquidity. So another explanation is that these EH strategies are sensitive to higher volatility and lower liquidity environments.

Effects of QE on Macro Strategies

The HFRI Macro (Total) Index (Macro (Total)) and HFRI Macro Systematic Diversified Index (S. Diversified) have statistically significant negative coefficients for *QE*. Macro (Total) represents the Macro strategy itself, which HFR defines as:

> "Investment Managers which trade a broad range of strategies in which the investment process is predicated on movements in underlying economic variables and the impact these [variables] have on equity, fixed income, hard currency and commodity markets. Managers employ a variety of techniques, both discretionary and systematic analysis, combinations of top down and bottom up theses, quantitative and fundamental approaches and long and short term holding periods. Although some strategies employ [Relative Value (RV)] techniques, Macro strategies are distinct from RV strategies in that the primary investment thesis is predicated on predicted or future movements in the underlying instruments, rather than realization of a valuation discrepancy between securities. In a similar way, while both Macro and Equity Hedge managers may hold equity securities, the overriding investment thesis is predicated on the impact movements in underlying macroeconomic variables may have on security prices, as opposed to EH, in which the fundamental characteristics of the company are the most significant and integral to investment thesis" ([Hedge Fund Research](#)).

In other words, Macro managers invest broadly across asset classes and use any type of financial instrument they wish. Whereas other hedge fund strategies like Equity Long Short or Distressed typically confine themselves to one or two types of securities, Macro managers have no such constraints. In this respect, Macro funds vary widely in their risk-profiles from fund to fund, meaning there really is no "average," or "typical," Macro strategy or sub-strategy. Therefore, constructing a possible explanation as to how QE negatively influenced these funds returns is untenable.

It is worth noting however, that these Macro indices have significant exposure to *Economic*, *Credit*, and *Inflation*. These exposures are indicative of the fact that Macro strategies attempt to earn returns by making bets on macro-economic variables. The *Inflation* loading is

particularly interesting as well, because none of the other strategies have a positive, statistically significant relationship to *Inflation*. The negative coefficient for *Credit* is also interesting, which suggests that Macro strategies perform worse as credit spreads widen and macro-economic conditions deteriorate. The loadings to all three of these factors indicate that Macro managers are "facing the market." That is, they expose themselves to the directional movements of movements of the macro-economic environment. This is in contrast to other strategies such as Relative Value, in which managers do not hold such risks and instead attempt to profit from mispricings between individual securities.

Effects of QE on Relative Value Strategies

Unlike the other strategies, some of the Relative Value indices actually yield statistically insignificant relationships to *QE*. HFRI RV Fixed Income Convertible Arbitrage (Convertible Arb.), HFRI RV Fixed Income Corporate Index (Corporate), and HFRI RV Yield Alternatives Index (Yield Alts.) exhibit no statistically significant relationship to *QE*, while HFRI Relative Value (Total) Index (RV (Total)), HFRI RV Multi-Strategy Index (RV Multi), and HFRI RV Fixed Income Asset Backed Index (Asset Backed) all exhibit negative statistically significant loadings to *QE*. Before continuing, I note that I rely more heavily on HFR's sub-strategy descriptions in this section, as these strategies are more niche. Thus, to avoid incorrectly generalizing from other characterizations of these strategies in the extant literature, I keep my own description of each of the strategies to what is provided by HFR. For the general RV strategy, HFR describes it as follows:

> "Investment Managers who maintain positions in which the investment thesis is predicated on realization of a valuation discrepancy in the relationship between multiple securities. Managers employ a variety of fundamental and quantitative techniques to establish investment theses, and security types range broadly across equity, fixed income, derivative or other security types. Fixed income strategies are typically quantitatively driven to measure the existing relationship between instruments and, in some cases,

identify attractive positions in which the risk adjusted spread between these instruments represents an attractive opportunity for the investment manager. RV position may be involved in corporate transactions also, but as opposed to ED exposures, the investment thesis is predicated on realization of a pricing discrepancy between related securities, as opposed to the outcome of the corporate transaction" ([Hedge Fund Research Inc.](#)) [emphasis is mine].

That is, RV managers attempt to capture the value between two securities by longing one and shorting the other. This type of trade is similar to the EH strategy, though there are fundamental differences between the two. Namely, RV strategies are not confined to equities. Typically, RV strategies invest in fixed income, attempting to profit from arbitraging away any mispricing by the market. Given this explanation, it therefore makes sense that some of these strategies are not affected by QE, as asset mispricngs can occur across different monetary regimes and macro environments, and QE was a zero-rate environment which compressed rate differentials.

Convertible Arb. does this with convertible bonds. These corporate bonds are often referred to as "hybrid," instruments, as they contain a call option that allows bondholders to exchange their bonds for shares of equity at a fixed ratio (Black (2009)). HFR describes Convertible Arb. as a strategy in which:

> "…the investment thesis is predicated on realization of a spread between related instruments in which one or multiple components of the spread is a convertible fixed income instrument. Strategies employ an investment process designed to isolate attractive opportunities between the price of a convertible security and the price of a non-convertible security, typically of the same issuer. Convertible arbitrage positions maintain characteristic sensitivities to credit quality of the issuer, implied and realized volatility of the underlying instruments, levels of interest rates and the valuation of the issuer's equity, among other more general market and idiosyncratic sensitivities" ([Hedge Fund Research Inc.](#)).

The regression results generally confirm HFR's description of the sensitivities that characterize Convertible Arb. Notably, there is no significant coefficient for *SP500*. This result

suggests that this index is representative of Market Neutral Convertible Arbitrage strategies (Black (2009)).

Regarding QE, given this sub-strategy focuses on capturing mispricing's between related securities, it makes sense that there is no statistically significant loading to *QE*, as there is no obvious channel for which QE to influence the strategy's returns. Convertible Arb. does involve fixed income instruments, as HFR's description implies, but, again, the sub-strategy is attempting to capture the difference in value between securities and thus may not exhibit a direct risk exposure to fixed income investments. A possible explanation, though probably naive and overgeneralized, it that the long and short positions a Convertible Arb. manager takes in attempt to capture the spread between two securities wash out any effect of QE. As, if QE contributes to general asset price inflation, and thus like a rising tide, "floats all boats," then the Convertible Arb. manager will experience gains (from the long position) but simultaneously losses (from their short position). This explanation is speculative, though. Data detailing the specific trading strategies of the funds comprising the index is needed.

Looking now at Corporate, this sub-strategy also has no statistically significant relationship to *QE*. HFR describes Corporate as one in which:

> "… the investment thesis is predicated on [the] realization of a spread between related instruments in which one or multiple components of the spread is a corporate fixed income instrument. Strategies employ an investment process designed to isolate attractive opportunities between a variety of fixed income instruments, typically realizing an attractive spread between multiple corporate bonds or between a corporate and risk free government bond. Fixed Income - Corporate strategies … typically involve more general market hedges which may vary in the degree to which they limit fixed income market exposure" ([Hedge Fund Research Inc.](#)).

Similar to Convertible Arb., the insignificant coefficient for *QE* is no surprise, as the strategy attempts to capture the spread between securities. The regression results also match the

description for the most part, as we can see a lack of statistically significant exposure to the market. A noteworthy observation for potential investors is the lack of significant relationship with *Recession*, suggesting Corporate may provide an interesting portfolio diversifier.

Yield Alts. is the last sub-strategy of RV that does not display a statistically significant coefficient for *QE*. HFR provides the following characterization of Yield Alts.:

> "Yield Alternative strategies employ an investment thesis [that] is predicated on realization of a spread between related instruments in which one or multiple components of the spread contains a derivative, equity, real estate, [Master Limited Partnerships (MLPs)] or a combination of these or other instruments. Strategies are typically quantitatively driven to measure the existing relationship between instruments and, in some cases, identify attractive positions in which the risk adjusted spread between these instruments represents an attractive opportunity for the investment manager. Strategies employ an investment process designed to isolate opportunities in yield oriented securities, which can include equity, preferred, listed partnerships (MLPs), REITs and some other corporate obligations. In contrast to fixed income arbitrage, [Yield Alts.] contain primarily non-fixed income securities, and in contrast to equity hedge strategies, the investment thesis is more predicated on the yield realized from the securities than on price appreciation of the underlying securities.

Yield Alts. exhibits the fewest statistically significant loadings of all the indices in my dataset, which makes sense. Given the sub-strategy involves capturing the spread between relatively niche financial instruments the lack of significant results is of no surprise. That is, the diverse universe of securities these managers have access to may engender not an "average," Yield Alts. risk-profile and thus the return characteristics of intra-sub-strategy funds could vary significantly. Additionally, Yield Alts. could just be exposed to risks completely unrelated to most of the factors, though this seems unlikely given how broad these risk factors are. With that said, I draw no informative inferences from these regression results besides the fact that QE did not impact it.

Turning now to the RV indices that did show a statistically significant relationship to QE, Asset Backed is a strategy in which managers invest in asset-backed securities. Such securities

are collateralized, meaning they are loans in which some physical or financial asset is provided by the borrower as a means of incentivizing their payment of the loan and reducing the default risk borne by the lender. HFR defines this sub-strategy as on in which:

> "… the investment thesis is predicated on realization of a spread between related instruments in which one or multiple components of the spread is a fixed income instrument backed [by] physical collateral or other financial obligations (loans, credit cards) other than those of a specific corporation. [Managers] employ an investment process designed to isolate attractive opportunities between a variety of fixed income instruments specifically securitized by collateral commitments which frequently include loans, pools and portfolios of loans, receivables, real estate, machinery or other tangible financial commitments... In many cases, investment managers hedge, limit or offset interest rate exposure in the interest of isolating the risk of the position to strictly the yield disparity of the instrument relative to the lower risk instruments" (Hedge Fund Research Inc.)

The regression results generally confirm these characteristics, as Asset Backed has no statistically significant relation to *RealRates* and *SP500*, while the sub-strategy does exhibit statistically significant exposures to many of the risks we would expect to be exposed to in virtue of holding fixed-income investments such as *Inflation*, *Credit*, *Economic*, and *Liquidity*. Interestingly, there is no significant coefficient for *Recession*, which could make this sub-strategy a useful hedge in a portfolio, though due diligence into how exactly these mangers execute their strategies should be completed first in order to better understand why this strategy is seemingly unaffected by recessionary periods. Given this sub-strategy involves investing in the types of securities that the Federal Reserve sought to purchase through QE, like mortgage-backed securities, it therefore makes sense that Asset Backed has a statistically significant coefficient for QE.

The negative sign of the coefficient, however, sits in contrast with what we might intuitively expect the effects of QE to be on the strategy's returns, as QE should have driven up the prices of these debt securities and thus the strategy's returns. Again though, this sub-strategy

is taking both long and short positions in order to capture a spread. The short positions, then, may have negatively impacted returns more than the long positions positively impacted returns. Another possible explanation is that falling interest rates tend to increase prepayment risk, or the risk lenders face in having to reinvest capital earlier than expected (Stefanini 2015). In such scenarios, borrowers win out by refinancing their debt to borrow at lower interest rates, while lenders suffer due to having to re-lend that capital at a lower rate of interest. These two possible explanations are by no means the only ones, and more data and research are needed in order to empirically determine the true, causal explanation.

For RV Multi, not much can be said about the negative loading to *QE*. Following the characteristics of the RV strategy, this sub-strategy attempts to profit from the spread between securities. In particular though, this sub-strategy is representative of RV multi-strategy hedge funds. Multi-strategy hedge funds employ, like their name suggests, multiple strategies that can be (and often are for the sake of risk management) uncorrelated with each other. In their description of this index, HFR notes that the managers are able to use a wide variety of asset class types and investment instruments, and the portfolios of the funds comprising this index have less than 30% of their assets in one particular RV strategy (Hedge Fund Research Inc.). It is therefore unwise to attempt to draw inferences and conclusions from RV Multi's regression results regarding specific characteristics and risk exposures.

In contrast to RV Multi, the regression results for RV (Total) may provide slightly more informative answers. To see why, note that there are quite a few similarities between the regression results of each of the RV indices: none of the RV indices had statistically significant exposure to equity market returns; all the indices had negative statistically significant loadings to *Inflation* and positive coefficients for liquidity; most, barring Convertible Arb., have positive and

significant coefficients for *Economic*; and finally, only RV Multi had a statistically significant negative loading to *Recession*. This homogeneity gives me comfort in interpreting the regression results of RV (Total) as indicative of the risk exposures that the RV strategy and its sub-strategies hold in general. To clarify and avoid seeming intellectually dishonest with respect to my prior analysis, or really lack thereof, I am saying that these statistically significant loadings to RV (Total) are telling of the RV strategy in general, which refers to strategies seeking to arbitrage the spread between two securities without much, if any, exposure to the direction of equity markets (Stefanini 2015). To end this discussion, I point out that QE seems to have affected RV strategies unequally as some indices were significantly impacted while others were not. More research is needed in order to draw truly informative inferences about this result.

V.   Conclusion

In this paper, I use a multivariate regression to uncover the effects of QE on particular hedge fund strategies. My empirical results indicate the Federal Reserve's Quantitative Easing program had a negative impact on the average monthly return of 11 of the 14 hedge fund strategies I examine. This novel result affirms the underlying thinking of the adage, "you can't fight the Fed," and is my paper's contribution to the extant literature. In navigating the nuances of these hedge fund strategies and their regression results, I provide evidence for the fact that investors must be cautious and meticulous in their due diligence of hedge funds. Looking forward, my results show the need for further research regarding how monetary policy decisions can contribute to asset price inflation.

VII. References & Appendices

Agarwal, Vikas, Mullally, Kevin A., Naik, Narayan Y., "Hedge Funds: A Survey of the Academic Literature," (2015)

Agarwal, Vikas, Naik, Narayan Y., "On Taking the 'Alternative' Route: Risks, Rewards Style and Performance Persistence of Hedge Funds," (1999)

Aiken, Adam L., Clifford, Christophe P., Ellis, Jesse A., "Hedge funds and discretionary liquidity restrictions," Journal of Financial Economics, Volume 116, Issue 1, 2015, Pages 197-218, ISSN 0304-405X, https://doi.org/10.1016/j.jfineco.2015.01.002.

Angelo, David, "Impact of Quantitative Easing on the Term Structure of Interest Rates" (2017). Honors Senior Capstone Projects. 18.

Black, Keith, "Investing in Hedge Funds: A Survey," The CFA Institute, Volume 4, Issue 2, 1 April 2009

Ben-David, Itzhak, Birru, Justin, Rossi, Andrea, "The Performance of Hedge Fund Performance Fees," National Beauru of Economic Research (2020)

Board of Governors of the Federal Reserve System (US), Delinquency Rate on Business Loans, All Commercial Banks [DRBLACBS], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/DRBLACBS, April 10, 2023.

Caballero, Ricardo J., Simsek, Alp, "A Monetary Policy Asset Pricing Model," *Working Paper,* National Bureau of Economic Research, March (2023)

Cowan, David, Wilderman, Sam, "Re-Thinking Risk," GMO (2011)

Edelman, Daniel, Fung, William, Hsieh, David A. "Exploring uncharted territories of the hedge fund Industry: Empirical characteristics of mega hedge fund firms," Journal of Financial Economics, Volume 109, Issue 3, 2013, Pages 734-758, ISSN 0304-405X, https://doi.org/10.1016/j.jfineco.2013.04.003.

Fratzscher, Marcel and Lo Duca, Marco and Straub, Roland, A Global Monetary Tsunami? On the Spillovers of US Quantitative Easing (October 19, 2012). Available at SSRN: https://ssrn.com/abstract=2164261 or http://dx.doi.org/10.2139/ssrn.2164261

Federal Reserve Bank of New York, "Large-Scale Asset Purchases," *The New York Fed*, Federal Reserve Bank of New York, Accessed: March 29, 2023

"HFR Hedge Fund Strategy Classification System," *Hedge Fund Research Inc.*, https://www.hfr.com/hfr-hedge-fund-strategy-classification-system

Cassar, Gavin, and Gerakos, Joseph, "Hedge Funds: Pricing Controls and the Smoothing of Self-reported Returns," The Review of Financial Studies, Volume 24, Issue 5, May 2011, Pages 1698–1734, https://doi.org/10.1093/rfs/hhq139

Jarrow, Robert, and Li, Hao, "The impact of quantitative easing on the US term structure of interest rates," Springer Science+Business Media, August (2014)

Jetley, Gaurav, and Ji, Xinyu, "The Shrinking Merger Arbitrage Spread: Reasons and Implications," The CFA Institute, Volume 66, Number 2 (2010)

Joenväärä, Juha, Kauppila, Mikko, Kosowski, Robert and Tolonen, Pekka, "Hedge Fund Performance: Are Stylized Facts Sensitive to Which Database One Uses?" March (2019)

Kohn, Donald L., "The Federal Reserve's Policy Actions during the Financial Crisis and Lessons for the Future," May 13, (2010)

Leib, Barclay T., Kaminski, Kathryn M., Sherman, Mila Getmansky, "Portfolio Management: Hedge Fund Strategies," Chartered Financial Institute (2022)

Lewitinn, Lawrence. "Qe4 Begins: Fed Cuts Rates, to Buy $700B in Bonds." *CoinDesk Latest Headlines RSS*, CoinDesk, 14 Sept. 2021, https://www.coindesk.com/markets/2020/03/15/qe4-begins-fed-cuts-rates-to-buy-700b-in-bonds/.

"M&A Statistics," *Institute for Mergers and Acquisitions,* https://imaa-institute.org/mergers-and-acquisitions-statistics/

Rosa, Carlo, "How 'Unconventional' Are Large-Scale Asset Purchases? The Impact of Monetary Policy on Asset Prices," Federal Reserve Staff Reports, no. 560, May (2012)

"Recent Balance Sheet Trends." *Federal Reserve Board - Recent Balance Sheet Trends*, https://www.federalreserve.gov/monetarypolicy/bst_recenttrends.htm.

Sadka, Ronnie, "Liquidity risk and the cross-section of hedge-fund returns," *Working Paper*, Federal Deposit Insurance Corporation Center for Research, August, (2010)

Samer, Adra On mergers, monetary policy and output durability, Applied Economics Letters, 22:6, 461-465, DOI: 10.1080/13504851.2014.950787, (2015)

Stefanini, Filippo, "Investment Strategies of Hedge Funds," Wiley (2006)

"Shifting monetary policy lags confuse markets and central bankers," Jayakumar, Vivekanand, *The Hill*, https://thehill.com/opinion/finance/3921016-shifting-monetary-policy-lags-confuse-markets-and-central-bankers/#:~:text=Regarding%20monetary%20policy%20lags%2C%20there,the%20lag%20is%20rather%20variable.%E2%80%9D

Sheik, Abdullah Z., Qiao, Hongtao, "Non-normality of Market Returns," J.P. Morgan Asset
    Management (2009)

The Federal Reserve, "Federal Reserve announces it will initiate a program to purchase the direct
    obligations of housing-related government-sponsored enterprises and mortgage-backed
    securities backed by Fannie Mae, Freddie Mac, and Ginnie Mae," Press Release,
    November 25, 2008

Williamson, Stephen D, "Quantitative Easing: How Well Does This Tool Work?" Federal
    Reserve Bank of St. Lous, August 18, (2017)

Appendix A: Description of HFR Indices

Index	Description
HFRI Equity Hedge (Total) Index [HFRIEHI Index]	Equity Hedge strategies maintain positions both long and short in primarily equity and equity derivative securities. A wide variety of investment processes can be employed to arrive at an investment decision, including both quantitative and fundamental techniques; strategies can be broadly diversified or narrowly focused on specific sectors and can range broadly in terms of levels of net exposure, leverage employed, holding period, concentrations of market capitalizations and valuation ranges of typical portfolios. Equity Hedge managers would typically maintain at least 50% exposure to, and may in some cases be entirely invested in, equities - both long and short. EH is further subdivided into 7 sub-strategies.
HFRI EH Equity Market Neutral [HFRIEMNI Index]	Equity Market Neutral strategies employ sophisticated quantitative techniques of analyzing price data to ascertain information about future price movement and relationships between securities, select securities for purchase and sale. These can include both Factor-based and Statistical Arbitrage/Trading strategies. Factor-based investment strategies include strategies in which the investment thesis is predicated on the systematic analysis of common relationships between securities. In many but not all cases, portfolios are constructed to be neutral to one or multiple variables, such as broader equity markets in dollar or beta terms, and leverage is frequently employed to enhance the return profile of the positions identified. Statistical Arbitrage/Trading strategies consist of strategies in which the investment thesis is predicated on exploiting pricing anomalies which may occur as a function of expected mean reversion inherent in security prices; high frequency techniques may be employed and trading strategies may also be employed on the basis on technical analysis or opportunistically to exploit new information the investment manager believes has not been fully, completely or accurately discounted into current security prices. Equity Market Neutral Strategies typically maintain characteristic net equity market exposure no greater than 10% long or short.

Index	Description
HFRI EH Quantitative Directional [HFRIENHI Index]	Quantitative Directional strategies employ sophisticated quantitative techniques of analyzing price data to ascertain information about future price movement and relationships between securities, select securities for purchase and sale. These can include both Factor-based and Statistical Arbitrage/Trading strategies. Factor-based investment strategies include strategies in which the investment thesis is predicated on the systematic analysis of common relationships between securities. Statistical Arbitrage/Trading strategies consist of strategies in which the investment thesis is predicated on exploiting pricing anomalies which may occur as a function of expected mean reversion inherent in security prices; high frequency techniques may be employed and trading strategies may also be employed on the basis on technical analysis or opportunistically to exploit new information the investment manager believes has not been fully, completely or accurately discounted into current security prices. Quantitative Directional Strategies typically maintain varying levels of net long or short equity market exposure over various market cycles.
HFRI Event Driven (Total) Index [HFRIEDI Index]	Event-Driven: Investment Managers who maintain positions in companies currently or prospectively involved in corporate transactions of a wide variety including but not limited to mergers, restructurings, financial distress, tender offers, shareholder buybacks, debt exchanges, security issuance or other capital structure adjustments. Security types can range from most senior in the capital structure to most junior or subordinated, and frequently involve additional derivative securities. Event Driven exposure includes a combination of sensitivities to equity markets, credit markets and idiosyncratic, company specific developments. Investment theses are typically predicated on fundamental characteristics (as opposed to quantitative), with the realization of the thesis predicated on a specific development exogenous to the existing capital structure.
HFRI ED Distressed Restructuring Index [HFRIDSI Index]	Distressed/Restructuring strategies which employ an investment process focused on corporate fixed income instruments, primarily on corporate credit instruments of companies trading at significant discounts to their value at issuance or obliged (par value) at maturity as a result of either formal bankruptcy proceeding or financial market perception of near term proceedings. Managers are typically actively involved with the management of these companies, frequently involved on creditors' committees in negotiating the exchange of securities for alternative obligations, either swaps of debt, equity or hybrid securities. Managers employ fundamental credit processes focused on valuation and asset coverage of securities of distressed firms; in most cases portfolio exposures are concentrated in instruments which are publicly traded, in some cases actively and in others under reduced liquidity but in general for which a reasonable public market exists. In contrast to Special Situations, Distressed Strategies employ primarily debt (greater than 60%) but also may maintain related equity exposure.

Index	Description
HFRI ED Merger Arbitrage Index [HFRIMAI Index]	Merger Arbitrage strategies which employ an investment process primarily focused on opportunities in equity and equity related instruments of companies which are currently engaged in a corporate transaction. Merger Arbitrage involves primarily announced transactions, typically with limited or no exposure to situations which pre-, post-date or situations in which no formal announcement is expected to occur. Opportunities are frequently presented in cross border, collared and international transactions which incorporate multiple geographic regulatory institutions, with typically involve minimal exposure to corporate credits. Merger arbitrage strategies typically have over 75% of positions in announced transactions over a given market cycle.
HFRI Macro (Total) Index [HFRIMI Index]	Macro: Investment Managers which trade a broad range of strategies in which the investment process is predicated on movements in underlying economic variables and the impact these have on equity, fixed income, hard currency and commodity markets. Managers employ a variety of techniques, both discretionary and systematic analysis, combinations of top down and bottom up theses, quantitative and fundamental approaches and long and short term holding periods. Although some strategies employ RV techniques, Macro strategies are distinct from RV strategies in that the primary investment thesis is predicated on predicted or future movements in the underlying instruments, rather than realization of a valuation discrepancy between securities. In a similar way, while both Macro and equity hedge managers may hold equity securities, the overriding investment thesis is predicated on the impact movements in underlying macroeconomic variables may have on security prices, as opposes to EH, in which the fundamental characteristics on the company are the most significant are integral to investment thesis.
HFRI Macro Systematic Diversified Index [HFRIMTI Index]	Systematic: Diversified strategies have investment processes typically as function of mathematical, algorithmic and technical models, with little or no influence of individuals over the portfolio positioning. Strategies which employ an investment process designed to identify opportunities in markets exhibiting trending or momentum characteristics across individual instruments or asset classes. Strategies typically employ quantitative process which focus on statistically robust or technical patterns in the return series of the asset, and typically focus on highly liquid instruments and maintain shorter holding periods than either discretionary or mean reverting strategies. Although some strategies seek to employ counter trend models, strategies benefit most from an environment characterized by persistent, discernable trending behavior. Systematic: Diversified strategies typically would expect to have no greater than 35% of portfolio in either dedicated currency or commodity exposures over a given market cycle.

Index	Description
HFRI Relative Value (Total) Index [HFRIRVA Index]	Investment Managers who maintain positions in which the investment thesis is predicated on realization of a valuation discrepancy in the relationship between multiple securities. Managers employ a variety of fundamental and quantitative techniques to establish investment theses, and security types range broadly across equity, fixed income, derivative or other security types. Fixed income strategies are typically quantitatively driven to measure the existing relationship between instruments and, in some cases, identify attractive positions in which the risk adjusted spread between these instruments represents an attractive opportunity for the investment manager. RV position may be involved in corporate transactions also, but as opposed to ED exposures, the investment thesis is predicated on realization of a pricing discrepancy between related securities, as opposed to the outcome of the corporate transaction.
HFRI RV Fixed Income Convertible Arbitrage [HFRICAI Index]	Fixed Income: Convertible Arbitrage includes strategies in which the investment thesis is predicated on realization of a spread between related instruments in which one or multiple components of the spread is a convertible fixed income instrument. Strategies employ an investment process designed to isolate attractive opportunities between the price of a convertible security and the price of a nonconvertible security, typically of the same issuer. Convertible arbitrage positions maintain characteristic sensitivities to credit quality the issuer, implied and realized volatility of the underlying instruments, levels of interest rates and the valuation of the issuer's equity, among other more general market and idiosyncratic sensitivities.
HFRI RV Fixed Income Corporate Index [HFRIFIHY Index]	Fixed Income: Corporate includes strategies in which the investment thesis is predicated on realization of a spread between related instruments in which one or multiple components of the spread is a corporate fixed income instrument. Strategies employ an investment process designed to isolate attractive opportunities between a variety of fixed income instruments, typically realizing an attractive spread between multiple corporate bonds or between a corporate and risk free government bond. Fixed Income: Corporate strategies differ from Event Driven: Credit Arbitrage in that the former more typically involve more general market hedges which may vary in the degree to which they limit fixed income market exposure, while the later typically involve arbitrage positions with little or no net credit market exposure, but are predicated on specific, anticipated idiosyncratic developments.

Index	Description
HFRI RV Multi-Strategy Index [HFRIFI Index]	Multi-Strategies employ an investment thesis is predicated on realization of a spread between related yield instruments in which one or multiple components of the spread contains a fixed income, derivative, equity, real estate, MLP or combination of these or other instruments. Strategies are typically quantitatively driven to measure the existing relationship between instruments and, in some cases, identify attractive positions in which the risk adjusted spread between these instruments represents an attractive opportunity for the investment manager. In many cases these strategies may exist as distinct strategies across which a vehicle which allocates directly, or may exist as related strategies over which a single individual or decision making process manages. Multi-strategy is not intended to provide broadest-based mass market investors appeal, but are most frequently distinguished from others arbitrage strategies in that they expect to maintain >30% of portfolio exposure in 2 or more strategies meaningfully distinct from each other that are expected to respond to diverse market influences.
HFRI RV Fixed Income Asset Backed Index [HFRIFIMB Index]	Fixed Income: Asset Backed includes strategies in which the investment thesis is predicated on realization of a spread between related instruments in which one or multiple components of the spread is a fixed income instrument backed physical collateral or other financial obligations (loans, credit cards) other than those of a specific corporation. Strategies employ an investment process designed to isolate attractive opportunities between a variety of fixed income instruments specifically securitized by collateral commitments which frequently include loans, pools and portfolios of loans, receivables, real estate, machinery or other tangible financial commitments. Investment thesis may be predicated on an attractive spread given the nature and quality of the collateral, the liquidity characteristics of the underlying instruments and on issuance and trends in collateralized fixed income instruments, broadly speaking. In many cases, investment managers hedge, limit or offset interest rate exposure in the interest of isolating the risk of the position to strictly the yield disparity of the instrument relative to the lower risk instruments.
HFRI RV Yield Alternatives Index [HFRISRE Index]	Yield Alternative strategies employ an investment thesis is predicated on realization of a spread between related instruments in which one or multiple components of the spread contains a derivative, equity, real estate, MLP or combination of these or other instruments. Strategies are typically quantitatively driven to measure the existing relationship between instruments and, in some cases, identify attractive positions in which the risk adjusted spread between these instruments represents an attractive opportunity for the investment manager. Strategies employ an investment process designed to isolate opportunities in yield oriented securities, which can include equity, preferred, listed partnerships (MLPs), REITs and some other corporate obligations. In contrast to fixed income arbitrage, yield alternative contain primarily non-fixed income securities, and in contrast to equity hedge strategies, the investment thesis is more predicated on the yield realized from the securities than on price appreciation of the underlying securities.

Appendix B: Summary Statistics & Pre- and Post- QE Index Return Means

Summary Statistics

Index	Annual Mean	Volatility	Sharpe Ratio*	Skew	Excess Kurtosis	SPX Correlation	Autocorrelation
EH (Total)	10.6%	9.0%	0.9	-0.3	2.4	0.76	0.20
Market Neutral	5.6%	3.0%	1.0	-0.2	1.7	0.30	0.17
Q. Directional	10.3%	11.5%	0.7	-0.4	1.3	0.79	0.18
ED (Total)	9.7%	6.8%	1.1	-1.5	7.2	0.71	0.32
Distressed	9.7%	6.6%	1.1	-1.2	6.3	0.55	0.46
Merger Arb.	7.5%	4.1%	1.2	-2.2	16.1	0.54	0.16
Macro (Total)	9.3%	6.9%	1.0	0.7	1.5	0.29	0.17
S. Diversified	8.3%	7.5%	0.8	0.1	-0.1	0.30	0.01
RV (Total)	8.3%	4.5%	1.3	-2.6	18.6	0.55	0.37
Asset Backed	8.1%	4.4%	1.3	-5.6	52.9	0.26	0.30
Convertible Arb.	7.7%	6.0%	0.8	-3.0	29.6	0.49	0.52
FI Corporate	7.0%	6.2%	0.7	-1.7	11.1	0.56	0.41
RV Multi	7.1%	4.2%	1.1	-2.0	13.3	0.56	0.43
Yield Alts.	7.5%	9.0%	0.6	-0.9	5.4	0.58	0.14
SPX Index	10.2%	14.9%	0.5	-0.6	1.0	1.00	-0.01

*Risk Free Rate assumed for Sharpe Ratio calculation is from the return of the 1 Month Constant Maturity T-Bill over the period which is 2.56%

Pre- and Post-QE Nominal Compounded Annualized Mean Returns

Index	Pre-QE Annualized Mean	Post-QE Annualized Mean	Difference
HFRIEHI Index	14.19%	6.12%	8.07%
HFRIEMNI Index	8.15%	2.26%	5.89%
HFRIENHI Index	13.98%	5.67%	8.30%
HFRIEDI Index	12.64%	6.07%	6.58%
HFRIDSI Index	12.67%	6.01%	6.67%
HFRIMAI Index	9.72%	4.71%	5.01%
HFRIMI Index	14.63%	2.85%	11.78%
HFRIMTI Index	13.19%	2.30%	10.89%
HFRIRVA Index	10.18%	5.94%	4.24%
HFRICAI Index	7.31%	8.21%	-0.91%
HFRIFIHY Index	7.83%	5.99%	1.83%
HFRIFI Index	8.30%	5.67%	2.63%
HFRIFIMB Index	8.84%	7.41%	1.43%
HFRISRE Index	7.57%	7.48%	0.09%
SPX Index	8.15%	12.85%	-4.71%

Appendix C: Description of Control Variables

Factor	Description	Investment Exposure
SP500	Returns of the S&P500	SPX ETF
Recession	A dummary variable that equals 0 during non-Recessionary months and 1 during Recssionary months.	

BlackRock Factors

Factor	Description	Investment Exposure
RealRates	The reward for taking on the risk of interest rate movements. Measured by the surprise in real interest rates.	Global inflation linked bonds.
Inflation	The reward for taking on the risk of changes in inflation. Measured by the surprise in inflation levels.	Return of Nominal bonds over TIPS.
Credit	The reward for taking on default risk. Measured by surprise in default rates.	Long High Yield and short Investment grade.
Economic	The reward for taking on risk of economic uncertainty. Measured by the surprise in GDP: the difference between expected and realized growth.	Equally weighted combination of Global equities, real estate, commodities indices.
EM	The reward for taking on political and sovereign risks. Measured by spread between emerging and developed returns.	Long Emerging Markets and short Developed Markets.
Liquidity	The reward for holding illiquid assets. Measured by the spread between small- and large-cap equities and volatility levels.	Long small-cap and short large cap equities, selling volatility.