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**The Federal Reserve's Monetary Policy Effect on Financial Markets
and Investors**

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and Investors**

by

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Report

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Dedication

This paper is dedicated to my wife, Amelia; thank you for your unending support and encouragement.

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I want to acknowledge and thank Professor James Galbraith and Professor Keith Brown for their guidance and direction as I crafted this report.

Abstract

The Federal Reserve's Monetary Policy Effect on Financial Markets and Investors

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The University of Texas at Austin, 2017

Supervisor: James Galbraith

This paper explores the short and long-term effects of the Federal Reserve's post-recession monetary policy. Since 2009, in the wake of the Great Recession, the Federal Reserve took unprecedented action by lowering the federal funds rate to zero. This zero-interest rate policy persisted until late 2015, when the Federal Reserve increased rates for the first time in 7 years. While rates have increased slightly, the economy continues to operate in a low interest rate environment. By keeping the federal funds rate near zero for such an extended period of time, the Federal Reserve precipitated significant effects on the economy and investors. This paper analyzes the short-term, intermediate, and long-term effects of the Federal Reserve's post-recession monetary policy on the financial markets and institutional investors; specifically, we examine the federal funds rate effect on the economy, equity markets, interest rates, private equity industry, and investor portfolios.

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Federal Reserve System and Monetary Policy

INTRODUCTION

The federal funds rate has a measurable effect on financial markets and investors. In this paper, we explore this effect through statistical and historical data analysis. We examine federal funds rate changes' effects on equity markets by conducting a statistical event study of Federal Open Market Committee meetings and announcements and S&P 500 returns. We also explore the federal funds rate's effect on interest rates by conducting correlation and statistical significance analysis. This analysis allows us to enumerate the federal funds rate effect on financial markets and clarify the rate's impact on investors.

Specially, we explore the near zero interest rate policy effects on investor portfolios and investment decisions by examining portfolio returns and conducting a case study of the private equity industry and its growth in the wake of the zero-interest rate policy. Lastly, we conclude with a qualitative study of the long-term and potentially unforeseen effects of the Federal Reserve's unconventional monetary policy.

Our results indicate that federal funds rate change announcements do not have an immediate impact on equity prices. Additionally, we demonstrate that while the federal funds rate does not have a significant impact on long-term interest rates, it does have a quantifiable influence on consumer and short term interest rates. Lastly, we expose that this influence has meaningfully affected the private equity industry and encouraged investors to take on more risk in their search for increased portfolio returns.

THE FEDERAL RESERVE

Before we explore the effects of monetary policy, we should understand the government agency that dictates and implements this policy. The Federal Reserve System

("Fed") was created by Congress in 1913 to serve as a central bank that enacts monetary policy to stimulate and encourage economic expansion while minimizing volatility in the commercial banking system. The Fed's triad, the Board of Governors ("Board"), regional Reserve Banks, and Federal Open Market Committee ("FOMC") operate under Congressional purview and are officially charged with fostering economic conditions that achieve the Fed's dual mandate of price stability and full employment. The Board of Governors is a federal agency consisting of seven board members who are appointed by the President of the United States and are confirmed by the Senate. These board members must act independently and remain nonpartisan in executing the Fed's dual mandate.

The second component of the Fed is the Federal Reserve Banks. These 12 regional banks provide services to commercial banks, enact monetary policy, provide the Board regional perspectives, distribute currency, and operate as the government's fiscal agents. The final component, the FOMC, is comprised of seven Board of Governors members, the New York Federal Reserve Bank President, and four additional regional bank presidents. The FOMC typically meets eight times per year to monitor the economy and dictate monetary policy.

The first component of the Fed's dual mandate, price stability, is attained by maintaining a 2% inflation rate that is measured by the annual change in the price index for Personal Consumption Expenditures ("PCE"). The second component, full employment, is affected by numerous nonmonetary variables and can be challenging to measure accurately. The Fed strives to maintain 2% inflation and full employment by manipulating three levers: (i) the discount rate, the rate at which commercial banks can

borrow from the government; (ii) reserve requirements, the minimum amount of capital commercial banks must keep on hand in reserve; and (iii) open market operations.^{1,2}

MONETARY POLICY

This paper explores the primary lever used by the Fed to stimulate the economy since 2009: setting the target federal funds interest rate (“fed funds rate” or “funds rate”) and then driving the effective funds rate towards this target through open market operations. The fed funds rate is the rate banks charge one another to lend money overnight. Banks often take overnight loans to ensure they meet reserve requirements, which is a minimum amount of capital determined by the Fed that a bank must have on hand and hold in reserve. The Fed sets an upper and lower funds rate limit and then attempts to hit the target funds rate by buying and selling U.S. government securities on the open market primarily from/to financial institutions, brokerage companies, and pension funds. By controlling the funds rate, the FOMC controls how expensive it is for banks to meet reserve requirements and thus how willing banks are to borrow and lend. FOMC open market operations are labeled either expansionary, if the Fed is purchasing securities or contractionary if the Fed is selling securities.

Expansionary monetary policy, or the Fed buying U.S. government securities such as treasury bills, notes, and bonds, introduces cash into the economy and increases the amount of cash banks have available to lend. This in turn puts downward pressure on the federal funds rate by increasing liquidity and stimulates the economy by encouraging lending and borrowing. Conversely, contractionary policy which is the Fed

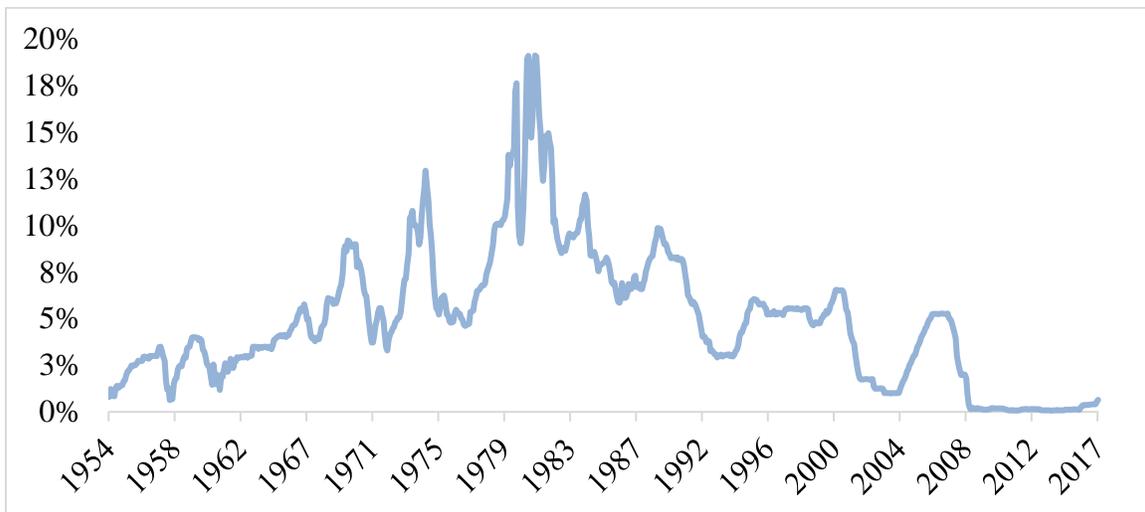
¹ “Introduction to the Board of Governors,” *Federal Reserve Bank of St. Louis*, accessed April 20, 2017, <https://www.stlouisfed.org/in-plain-english/federal-reserve-board-of-governors>.

² Catherine Bourke, “The Federal Reserve’s Dual Mandate,” *Federal Reserve Bank of Chicago*, April 4, 2017, <https://www.chicagofed.org/research/dual-mandate/dual-mandate>.

selling U.S. government securities, tightens the amount of cash banks have available to lend, thereby placing upward pressure on the federal funds rate and dampening the economy by constricting lending and borrowing.

The Fed applied expansionary monetary policy to push the economy out of the Great Recession by pursuing a zero interest rate policy. Historically, the funds rate has averaged 4.9% since the 1950s, however the Fed began lowering the fed funds rate target in early 2008 and set a target of zero in December 2008. Figure 1 reveals that the Fed maintained this zero interest rate policy for 7 years and made the first interest rate hike since 2006 in December 2015. As of March 2017, rates continue to reside at all-time lows, and the economy will continue to operate in this low rate interest environment for the near future.

Figure 1: Effective Fed Funds Rate, 1954-2017

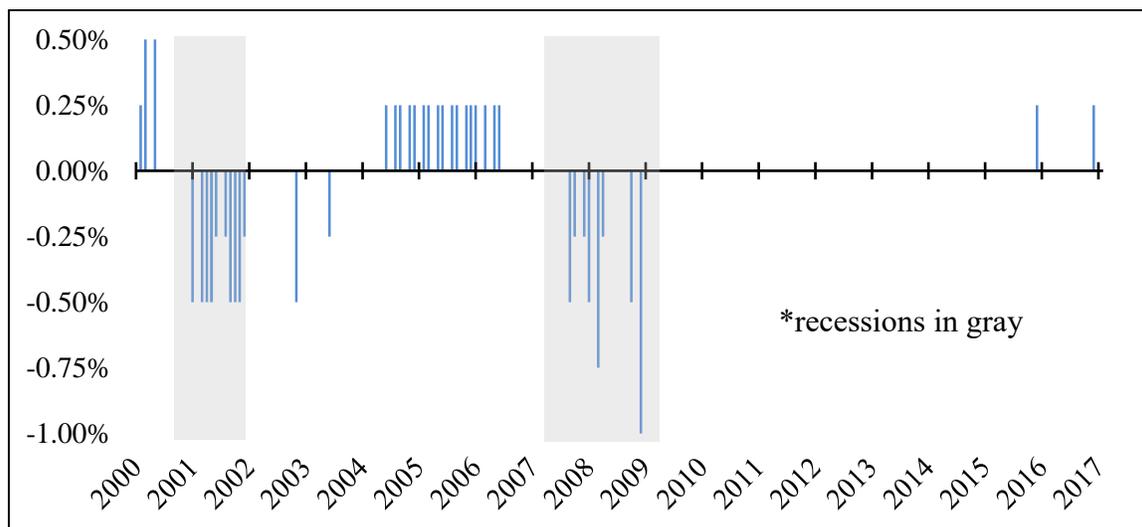


Source: Federal Reserve Economic Data; Federal Reserve Bank of St. Louis

The FOMC has adjusted the fed funds target rate 44 times since January 2000. A majority of these rate adjustments are +/- 25 basis points (“bps”). A basis point is a

hundredth of a percent, and as Figure 2 depicts, only three adjustments greater than +/- 25 bps have occurred outside of a recession.

Figure 2: Fed Funds Rate Adjustments, 2000-2017



Source: Federal Funds Data; Federal Reserve Bank of New York

Table 1: Fed Funds Rate Adjustments, 2000-2017

< -1.00%	-1.00%	-0.75%	-0.50%	-0.25%	0.25%	0.50%	> .50%
0	1	2	12	7	20	2	0

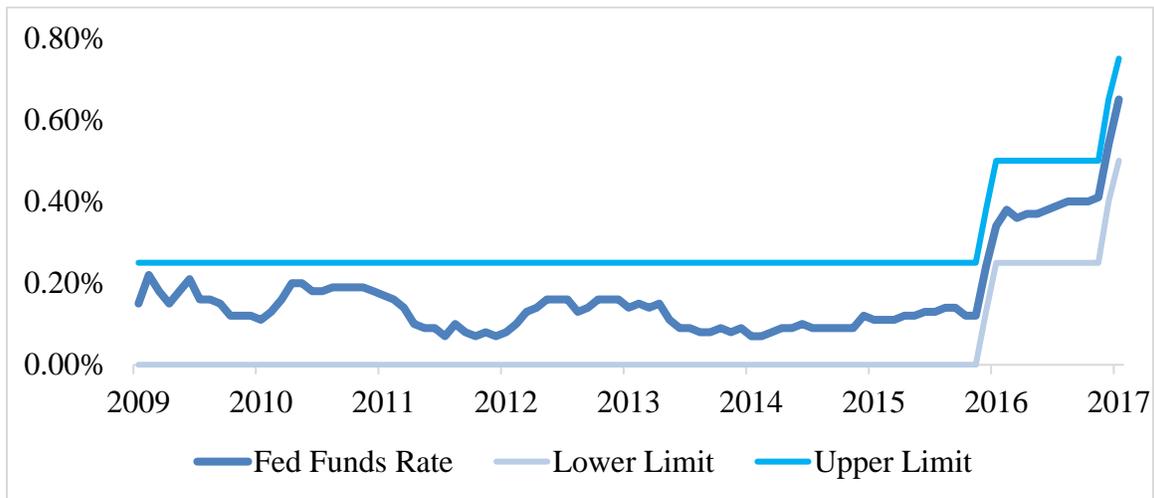
Source: Federal Funds Data; Federal Reserve Bank of New York

Further analysis of fed funds rate adjustments in Figure 2 and Table 1 reveal that since 2000, the Fed only increased rates by more than 25 bps twice, both of which occurred in 2000. Therefore, assuming the Fed pursues normalized rates which are close to historical averages and adjusts the funds rate in 25 bps increments, it may take years for the funds rate to reach historical averages.

Historically, the Fed has been successful in driving the fed funds rate to the desired target through open market operations. Figure 3 displays the Fed’s ability to balance the

effective funds rate, which is the daily observed funds rate, between the established upper and lower limits thereby successfully reaching the target rate. Consequently, the Fed will continue to utilize open market operations as they implement rate hikes, the effects of which we will explore later in this paper.

Figure 3: Fed Funds Rate Limits



Source: Federal Funds Data; Federal Reserve Bank of New York

Fed Funds Rate Effects

Monetary policy changes are diffused through the financial markets (“markets”) via numerous mechanisms, such as the cost of capital which is the monetary cost and interest rate individuals and corporations incur to borrow money. The markets are also forward looking and may efficiently incorporate anticipated policy changes into asset prices; therefore, fully quantifying the fed funds rate effect on markets and investors is challenging. Nonetheless, we attempt to determine the markets’ and investors’ short-term, intermediate and long-term responses to the Fed’s low interest rate monetary policy. In the analysis that follows, we use a statistical event study and regressions to discover and investigate the fed funds rate effects on financial markets.

SHORT-TERM EFFECTS

While a member of the Federal Reserve Board of Governors and just prior to becoming Chairman of the Fed, Ben Bernanke wrote:

The most direct and immediate effects of the monetary policy actions, such as changes in the federal funds rate, are on the financial markets; by affecting asset prices and returns, policymakers try to modify economic behavior in ways that will help them achieve their ultimate objectives. Understanding the links between monetary policy and asset prices is thus crucially important for understanding the policy transmission mechanism.³

As Chairman Bernanke suggests, in exploring the fed funds rate effect on equity prices, we must first understand how the financial markets operate. The financial markets often react strongly to unanticipated events. Investors prefer stability and attempt to build expected economic, political, and global events’ future effect on the markets into today’s prices. When the financial markets turned over in 2009 and started to recover, investors began

³ Ben Bernanke and Kenneth Kuttner, “What Explains the Stock Market’s Reaction to Federal Reserve Policy?” *Board of Governors of the Federal Reserve System*, March 2004, <https://www.federalreserve.gov/pubs/feds/2004/200416/200416pap.pdf>.

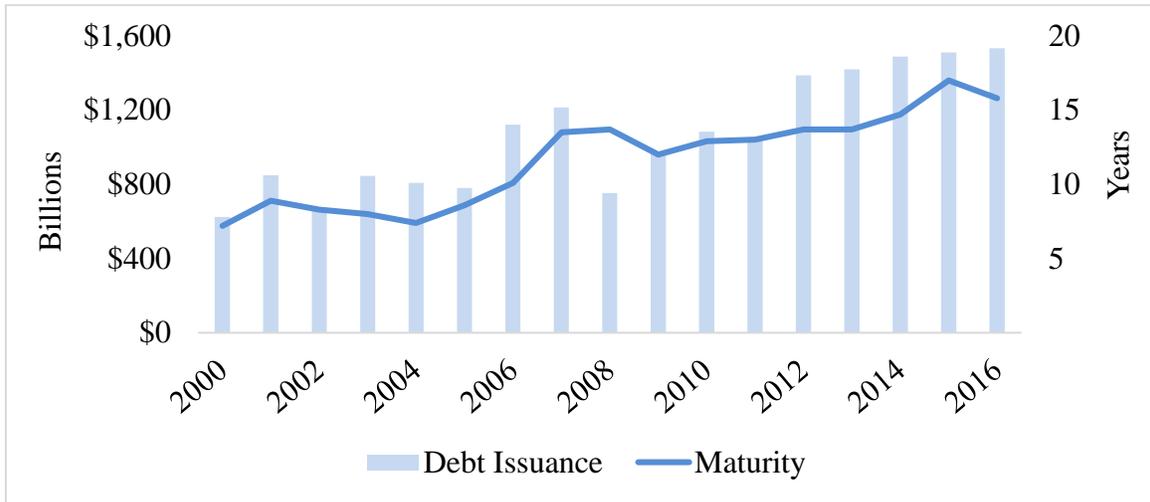
speculating when the Fed would discard the zero interest rate policy and raise rates. As the economy stabilized and showed signs of healthy growth, investors expected the Fed to raise rates. This expectation grew and starting in 2013, many investors anticipated the Fed to announce a rate hike.^{4,5} Corporations and investors began preparing for rate increases by taking advantage of the cheaper cost of capital and preserving liquidity while shortening the duration of investments. A 2016 Fed paper found that the FOMC's unconventional monetary policy led many corporations to issue unusually high levels of long-term debt.⁶ Figure 4 supports the Fed paper's findings and provides an observable effect of markets' anticipation of rate hikes. The figure shows that corporations current debt refinancing and new debt issuance is at all time high levels with increasingly longer maturity.

⁴ Daryl Jones, "5 reasons why the Fed won't raise interest rates in 2015," *Fortune*, August 25, 2015, <http://fortune.com/2015/08/25/fed-interest-rates-stock-market-china/>.

⁵ Kevin Mahn, "Fed On Target To Raise Interest Rates In Spring 2015," *Forbes*, March 27, 2014, <http://www.forbes.com/sites/advisor/2014/03/27/fed-on-target-to-raise-interest-rates-in-spring-2015/#a496f87231cf>.

⁶ Nathan Foley-Fisher, Rodney Ramcharan, and Edison Yu, "The Impact of unconventional monetary policy on firm financing constraints: Evidence from the maturity extension program," *Board of Governors of the Federal Reserve System*, 2016, <https://www.federalreserve.gov/econresdata/feds/2016/files/2016025pap.pdf>.

Figure 4: Corporate Debt Issuance and Average New Debt Maturity



Source: Securities Industry and Financial Markets Association Data

Nonetheless, while investors expected a rate hike as early as 2013, the Fed did not make the first rate adjustment until December 2015 and many investors were surprised as FOMC meeting after meeting passed with no rate hike announcement. To better understand the Fed’s immediate effect on markets we conducted an event study following Stephen Brown and Jerold Warner’s 1985 model, which is regarded as the foundational model for equity price event studies.⁷ The statistical event study attempts to understand how the equity market reacts to FOMC announcements. Specifically, from January 2009 to February 2017, we examine the S&P 500 on the final day of FOMC meetings and the immediate trading day following FOMC meetings to determine if a statistically significant abnormal return is present. This style of event study is also used in some investment strategies, such as event driven hedge funds which conduct statistical studies of a myriad

⁷ Stephen Brown and Jerold Warner, “Using Daily Stock Returns: The Case of Event Studies,” *Journal of Financial Economics* 14, (1985): 3-12.

of corporate events, such as earnings calls, CEO transitions, and mergers and acquisitions to determine if exploitable pricing inefficiencies exist.

Numerous academics and statisticians have conducted event studies of equity market events. Furthermore, numerous event driven studies of the FOMC's immediate effect on equity prices have been conducted. One notable quantitative study was conducted in 2004 by then member of the Federal Reserve Board of Governors, Ben Bernanke.⁸ He confirmed other studies' findings and concluded that the market reacts strongly to unanticipated rate changes and reacts little to expected rate adjustments. The study also found that unanticipated rate cuts generated an immediate rise in equity prices. This conclusion confirms logic, that equity markets react positively to accommodative monetary policy and react negatively to surprise restrictive policy.

A majority of the studies attributing abnormal equity returns to FOMC announcements were conducted prior to 2009. We have been unable to locate a significant, thorough event-driven study of FOMC announcements and equity market returns post 2009. This dearth of studies could be attributed to the lack of FOMC rate adjustments during this time period and expectation that the markets accurately anticipated FOMC rate hike announcements. Nonetheless, we wanted to quantitatively confirm this expectation and conduct an event driven study to determine the short-term effects of FOMC meetings and thus the federal funds rate on equity prices.

Event Study

The null hypothesis for this study is that FOMC announcements between 2009 and 2017 did not generate abnormal returns in the equity markets. The alternate hypothesis is that markets did not fully anticipate FOMC's continuation of the zero interest rate policy

⁸ Bernanke and Kuttner, "What Explains the Stock Market's Reaction to Federal Reserve Policy?"

and abnormal returns are not zero. In the formulas below, μ is the average abnormal return during the final day of FOMC meetings and subsequent trading day.

$H_0 : \mu=0$ null hypothesis that abnormal returns are 0

$H_1 : \mu \neq 0$ alternative hypothesis that abnormal returns are not 0

Following the Great Recession, as Table 2 exposes, the FOMC met a total of 74 times, including two unscheduled meetings: one in 2013 and one in 2014. The FOMC also held 7 conference calls: three in 2009, two in 2010, and two in 2011. To further explore the markets anticipation and reaction to FOMC announcements, we intended to conduct the same event study on the day of Fed President public speeches. Unfortunately, we could not calculate a reliable expected return for the day of Fed President speeches due to proximity of speeches to one another and to FOMC meetings.

Table 2: FOMC Meetings and Fed President Speeches, 2009-2017

Year	Number of Fed President Speeches	Number of Fed Meetings
2017	2	1
2016	6	8
2015	11	8
2014	14	9
2013	16	9
2012	16	8
2011	18	10
2010	24	10*
2009	22	11**
TOTAL	129	74

Source: Federal Reserve FOMC Data

*May 9, 2010 conference call was held on a non-trading day

** February 7, 2009 conference call was held on a non-trading day

The average daily return of the S&P 500 and annualized standard deviation of these returns on the final day of FOMC meetings, the trading day following FOMC meetings,

and a combined two day event window of the final day of FOMC meetings and subsequent trading day is shown in Table 3. At first glance, market returns are abnormally positive during FOMC meetings and abnormally negative immediately following FOMC meetings, while returns during the two day event window are similar to historical S&P daily returns and annualized volatility.

Table 3: Event Study Daily Returns

	2009-2016 S&P 500	Final Day of FOMC Meeting	Trading Day Following FOMC Meeting	Two Day Event Window: Final Day of FOMC Meeting and Subsequent Trading Day
Average Daily Return	0.05%	0.36%	-0.237%	0.06%
Annualized Volatility	17.32%	19.08%	24.353%	20.76%

Source: S&P 500 Returns and Author Calculations

To verify that these abnormal returns are statistically significant and attributable to the FOMC announcements, we began our study by calculating the expected returns for three separate event windows; (i) the final day of FOMC meetings, (ii) the subsequent trading following FOMC meetings, and (iii) a two-day event window combining the final day of FOMC meetings and subsequent trading day. Event window expected return is calculated by averaging the previous 25 trading days' returns. We chose 25 days due to proximity of FOMC meetings to one another and to avoid including the previous FOMC meeting days' returns in calculating expected return. In some cases, due to unscheduled FOMC meetings, we had to use less than 25 days to calculate expected return to ensure prior event windows were not included in subsequent expected return calculations.

The formula used to calculate expected return is below; k is the event window's S&P 500 return and $R_{e,t}$ is the expected return at time t :

- $R_{e,t} = 1/n \sum_{k=-1}^{-26} (k)$ for single day FOMC meetings and an event window of the final day of a FOMC meeting
- $R_{e,t} = 1/n \sum_{k=-2}^{-27} (k)$ for two day FOMC meetings and an event window of the subsequent trading following a FOMC meeting or a two day event window of the final day of a FOMC meeting and the subsequent trading day

Using the event window's expected return, we calculated the event window's abnormal returns by subtracting actual return from expected return. The formula used is below, where A_t is abnormal return, R_t is the actual return at time t , and $R_{e,t}$ is the expected return at time t : $A_t = R_{e,t} - R_t$. To determine the statistical significance of these abnormal returns, we conducted a t-test. Given that the null hypothesis average abnormal return is zero, we then calculated the standard deviation and mean of the abnormal returns. By dividing the abnormal returns' mean by the abnormal returns' standard deviation, we calculated the t statistic. Using this t statistic, we calculated a p value of a two-tailed t distribution test with 71 degrees of freedom - Table 4 summarizes the results.

Table 4: Event Study Statistical Data

	Final Day of FOMC Meeting	Trading Day Following FOMC Meeting	Two Day Event Window: Final Day of FOMC Meeting and Subsequent Trading Day
Average Abnormal Return	0.36%	-0.22%	0.06%
Abnormal Returns Standard Deviation	1.35%	1.45%	1.34%
T Statistic	0.264	-0.154	0.045
P Value	0.793	0.878	0.964

Source: Author Calculations

The t statistics are close enough to 0 to attribute the difference from 0 to random estimation error. Based on this and the accompanying p values, we fail to reject the null hypothesis, and returns observed on the final day of FOMC meetings and subsequent trading days are not statistically significant abnormal returns.

Investors often try to attribute significant market moves immediately following FOMC meetings to specific factors and our research rules out monetary policy announcements as a primary factor. For example, the market fell following the September 2015 FOMC's decision to maintain a zero fed funds rate. Investors expected the market to react positively to this accommodative monetary policy announcement, and a St. Louis Fed article discussed market observers' perplexity when the market fell. The article concludes qualitatively what our research concludes quantitatively, that the downturn may have been "much to do about nothing and had nothing directly to do with monetary policy".⁹

By failing to reject the null hypothesis that FOMC announcements create immediate abnormal returns in the equity markets, we conclude that the FOMC and funds rate short-term effect on financial markets is minimal.

INTERMEDIATE EFFECTS

While short-term effects of FOMC meetings and fed funds rate changes on the financial markets and equity prices were determined to be minimal since 2009, the zero interest rate policy has had significant intermediate effects on the financial markets. We will explore the effect on interest rates, longer term equity prices, investors' portfolios, and conduct a case study of the Fed's unconventional monetary policy effect on the private equity industry.

⁹ Christopher Neely, "Why Did Markets Drop after the FOMC Meeting?" *Federal Reserve Bank of St. Louis*, September 28, 2015, <https://www.stlouisfed.org/on-the-economy/2015/september/markets-drop-fomc-meeting>.

Interest Rates

Interest rates are directly affected by the fed funds rate and open market operations. By buying and selling U.S. treasuries, the Fed can generate supply and demand necessary to reach the target funds rate. In turn, this supply and demand controls the availability of many U.S. treasuries, such as the three-month U.S. treasury bill which is used by most investors as a proxy for the risk-free rate due to the minimal default risk of the U.S. government. The New York Federal Reserve Bank summarized the relationship between interest rates and the fed funds rate:

Movements in the fed funds rate may have implications for the loan and investment policies of financial institutions, especially for commercial bank decisions concerning loans to businesses, individuals and foreign institutions. Financial managers may compare the fed funds rate with yields on other investments before choosing the combinations of maturities of financial assets in which they will invest or the term over which they will borrow. Interest rates paid on other short-term financial securities—commercial paper and Treasury bills, for example—often move up or down roughly in parallel with the funds rate. Yields on long-term assets—corporate bonds and Treasury notes, for example—are determined in part by expectations for the fed funds rate in the future.¹⁰

Therefore, as the Fed continues to normalize interest rates by shrinking its balance sheet and selling securities to restrict liquidity banks have available to lend, the supply of U.S. treasuries in the market increases. This in turn increases the fed funds rate and drives the prices for these treasury notes, bonds, and bills down and yields up. This government manipulation of the fixed income market also has effects on other interest rates. Specifically, the fed funds rate has influence on consumer, short-term, and long-term interest rates. The relationship the New York Federal Bank described above between the funds rate and other interest rates leads us to expect increasing short-term, consumer, and

¹⁰ “Federal Funds and Interest on Reserves,” *Federal Reserve Bank of New York*, March 2013, <https://www.newyorkfed.org/aboutthefed/fedpoint/fed15.html>.

long-term interest rates as the Fed implements contractionary policy and raises the funds rate.

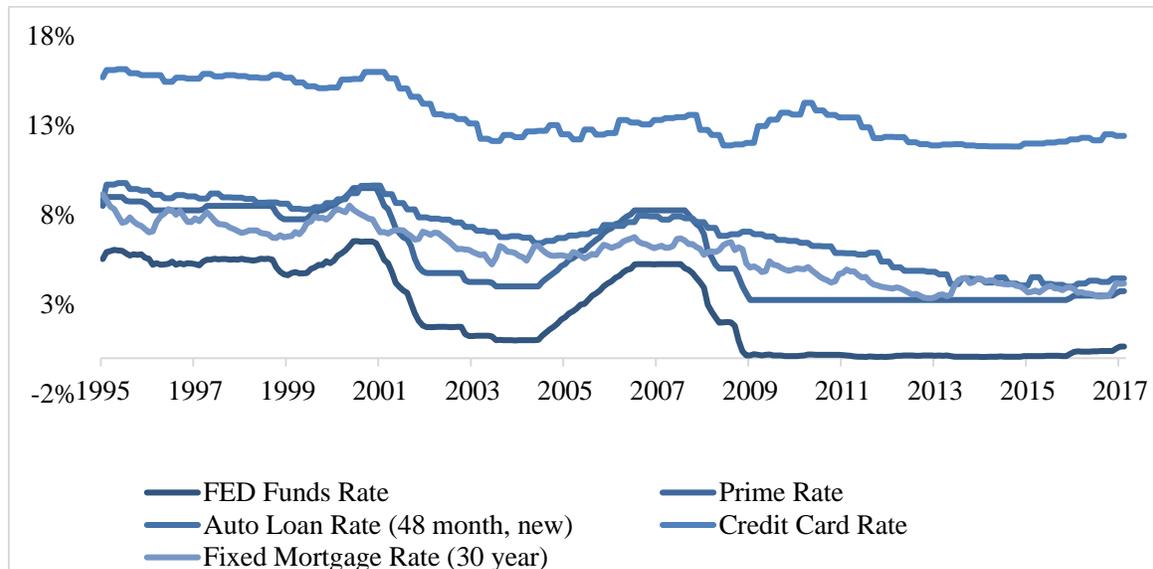
We attempted to quantify the relationship between interest rates and the funds rate by calculating historical correlations. Because the funds rate remains between an upper and lower bound set by the FOMC, the market observes only minor daily changes in the funds rate; however, when a rate change is announced, the market observes a significant change in the funds rate. To understand the effect fed funds rate changes have on interest rates, we regressed the funds rate change during a month when a fed funds rate change was announced with select interest rates' changes during the same month. Additionally, we regressed the fed funds rate change during the month prior and following a fed rate change announcement with interest rates' changes during the same months to determine if the interest rate markets anticipated fed funds rate changes. The sample size consisted of 56 rate changes between 1995 and 2017, and correlations were considered statistically significant when $p < 0.05$.

Consumer Interest Rates

By restricting the amount of liquidity in the economy, the Fed can alter consumer interest rates, including prime rates, credit card rates, deposit rates, car loan rates, mortgage rates, and bank loan rates. Of these rates, the prime rate is the most noteworthy, because it is an interest rate set by individual banks for the bank's most creditworthy customers. The prime rate is considered a reference rate because it is the base rate for many other types of personal and consumer loans. Although the Fed does not set the prime rate, individual banks set their prime rate based on the federal funds target rate. When the fed funds rate increases, the prime rate also increases due to banks passing the higher cost of borrowing from one another to meet reserve requirements through to the consumer. Figure 5 depicts

the fed fund rates and consumer interest rates from 1995-2017. The prime rate and auto loan rate appear to move in tandem with the fed funds rate, while the auto loan and credit card rates appear to move independently of the funds rate.

Figure 5: Consumer Interest Rates and Fed Funds Rate



Source: Federal Reserve Economic Data; Federal Reserve Bank of St. Louis

To test the correlations and statistical significance of our observations, we performed regression analysis. Table 5 contains the fed fund rates and consumer interest rates' regression data. The table exposes that the prime rate has a statically significant relationship with the funds rate with a p value < 0.05 and moves in tandem with the funds rate prior, during, and after a FOMC rate change announcements. Mortgage, auto loan, and credit card rates do not have a statistically significant correlation with the funds rate. Therefore, we can conclude that these consumer rates are driven by idiosyncratic factors and are not directly impacted by the funds rate. The data also reveals that these consumer interest rates do not anticipate FOMC rate adjustments and do not adjust prior to a fed funds rate change.

In simpler terms, of the rates studied the Fed only directly influences the prime rate through the funds rate. By increasing or decreasing the funds rate, the FOMC can adjust the rate consumers encounter when applying for lines of credit that are based on the prime rate.

Table 5: Consumer Interest Rates and Fed Funds Rate Regression Data

Month Prior to Fed Funds Rate Change				
	30 Year Mortgage Rate	Credit Card Rate	Auto Loan Rate (48 month)	Prime Rate
Correlation	0.113	0.138	0.262	0.881
R Squared	0.013	0.019	0.069	0.776
P-value	0.405	0.312	0.051	0.000
Month of Fed Funds Rate Change				
	30 Year Mortgage Rate	Credit Card Rate	Auto Loan Rate (48 month)	Prime Rate
Correlation	0.264	0.101	0.211	0.705
R Squared	0.069	0.010	0.044	0.498
P-value	0.050	0.459	0.119	0.000
Month Following Fed Funds Rate Change				
	30 Year Mortgage Rate	Credit Card Rate	Auto Loan Rate (48 month)	Prime Rate
Correlation	0.035	0.068	0.133	0.824
R Squared	0.001	0.005	0.018	0.679
P-value	0.796	0.619	0.330	0.000

Source: Author Calculations

This analysis demonstrates that the Federal Reserve has significant effect on the economy by impacting the prime rate and controlling the amount of capital consumers can borrow.

Because of this, the Fed closely monitors consumer interest rates and explains the relationship between consumer rates and the economy:

When short- and long-term interest rates go down, it becomes cheaper to borrow, so households are more willing to buy goods and services and firms are in a better position to purchase items to expand their businesses, such as property and equipment. Firms respond to these increases in total (household and business) spending by hiring more workers and boosting production. As a result of these factors, household wealth increases, which spurs even more spending.¹¹

Conversely, when rates increase, borrowing becomes more expensive which can have a dampening effect on economic expansion. When consumers are faced with higher mortgage, personal loan, and construction rates they are less likely to borrow and contribute to economic growth through spending and consumption. Hence, the Federal Reserve has substantial influence on the economy and consumer consumption.

Short-term Interest Rates

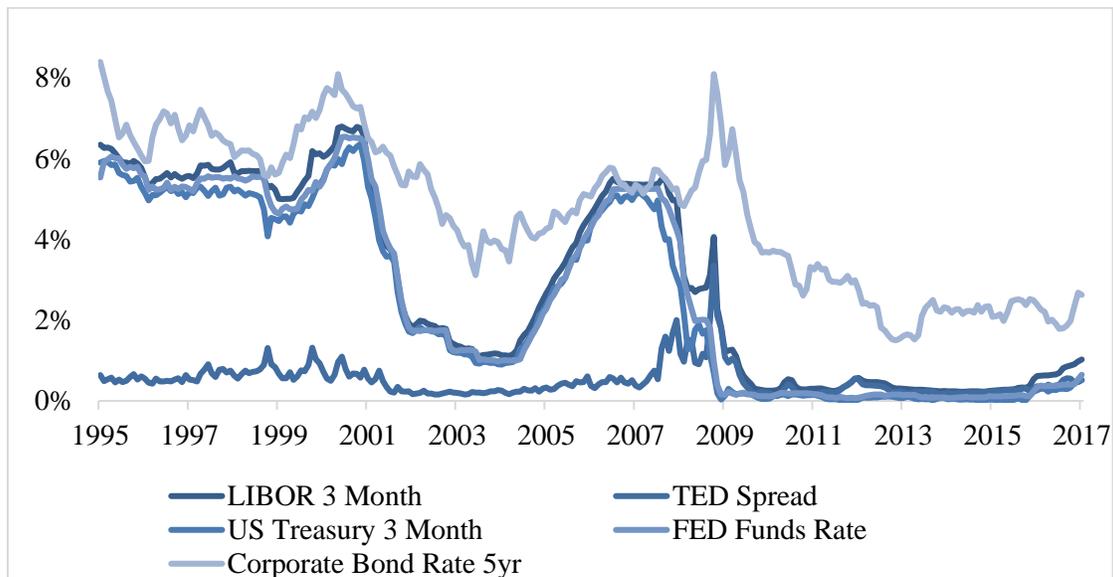
The fed funds rate has a stronger effect on short-term interest rates than it does on consumer rates. One of these short-term interest rates is the London Interbank Offered Rate (“LIBOR”), which is a global benchmark rate that many of the world’s leading banks charge one another for short-term loans. LIBOR serves as a benchmark reference rate for debt instruments such as government and corporate bonds and mortgages. Two other noteworthy short-term rates are the U.S. three-month treasury, which is a proxy for the risk-free rate, and the TED spread, which is the spread between the three-month LIBOR rate and the three-month U.S. treasury bill rate. Goldman Sachs describes the TED spread as the “difference between the rate at which large, money center banks borrow and the rate

¹¹“How doe monetary policy influence inflation and employment?” *Board of Governors of the Federal Reserve System*, December 16, 2015, https://www.federalreserve.gov/faqs/money_12856.htm.

at which the U.S. Treasury borrows”.¹² This rate is affected by market sentiment and as investors flee to quality, demand for U.S. treasuries increases while simultaneously raising LIBOR rates and thereby increasing the TED spread. Consequently, the TED spread is considered a proxy for general credit and liquidity risk in the economy.¹³

Figure 6 exhibits selected short-term interest rates and the fed funds rate. The three-month treasury rate and three-month LIBOR rate appear to closely follow the funds rate, while short-term corporate bond yields appear to loosely follow the funds rate by either preempting or lagging behind funds rate changes.

Figure 6: Short-term Interest Rates and Fed Funds Rate



Source: Federal Reserve Economic Data; Federal Reserve Bank of St. Louis

Table 6 displays the correlation between the fed funds rate and the TED spread, the three-month LIBOR, three-month U.S. treasury bill rate, and short term AAA/AA corporate bond

¹² “An Explanation of Short-term Credit and Liquidity Risk Measures,” *Goldman Sachs*, accessed April 30, 2017, <http://www.goldmansachs.com/gsam/glm/education/investor-education/articles/liquidity-risk-measures/index.html>.

¹³ “An Explanation of Short-term Credit and Liquidity Risk Measures,” *Goldman Sachs*.

yields. The regression analysis confirms our observations of Figure 6: a majority of fluctuations in short-term LIBOR is driven by the funds rate while short term U.S. treasuries are inconsistently correlated with the funds rate. Interestingly, the three-month U.S. treasury only changes in tandem with the funds rate following a funds rate adjustment, while the TED spread is uncorrelated in the month prior to and during a funds rate change but is significantly correlated following a rate change. Given that the fed funds rate is closely correlated with short-term LIBOR and U.S. treasury rates exposes that the funds rate effects not only domestic short-term interest rates but also global interest rates.

Table 6: Short-term Interest Rates and Fed Funds Rate Regression Data

Month Prior to Fed Funds Rate Change				
	LIBOR 3 Month	U.S. Treasury 3 Month	TED Spread	Corporate Bond Rate 5yr
Correlation	0.845	0.194	0.019	0.131
R Squared	0.714	0.038	0.000	0.017
P-value	0.000	0.151	0.891	0.337
Month of Fed Funds Rate Change				
	LIBOR 3 Month	U.S. Treasury 3 Month	TED Spread	Corporate Bond Rate 5yr
Correlation	0.447	0.911	0.089	0.125
R Squared	0.200	0.830	0.008	0.016
P-value	0.001	0.000	0.514	0.357
Month Following Fed Funds Rate Change				
	LIBOR 3 Month	U.S. Treasury 3 Month	TED Spread	Corporate Bond Rate 5yr
Correlation	0.873	0.255	0.393	0.075
R Squared	0.761	0.065	0.154	0.006
P-value	0.000	0.058	0.003	0.582

Source: Author Calculations

Long-term Interest Rates

Long-term interest rates, meaning credit with a maturity beyond 10 years, are influenced by a number of underlying forces. Some of these forces have temporary impact on long-term rates, such as energy prices, while other factors have a more foundational lasting impact on long-term rates.¹⁴ Former Fed Chairman Ben Bernanke described these variables and the FOMC's ability to influence long-term rates during a speech in 2004:

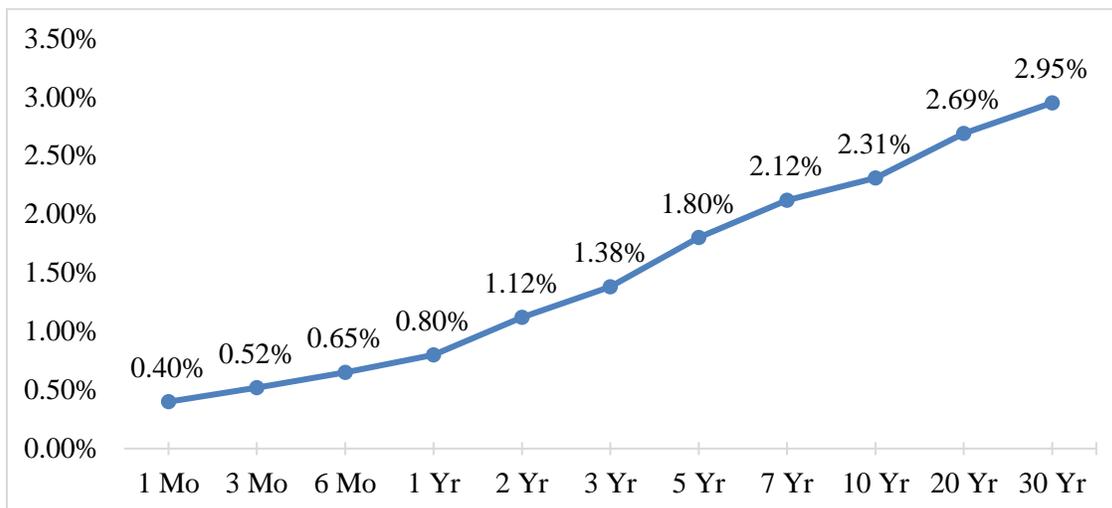
Although the relation between the FOMC's setting of the federal funds rate and the more economically relevant long-term yields is hardly direct or mechanical, a critical connection does exist. The connection operates less through the current value of the funds rate, however, than through the interest-rate actions that the FOMC is expected to take in the future. Specifically, financial theorists and market practitioners concur that, with risk and term premiums held constant, long-term yields move closely with the expectations that financial-market participants hold about the *future* evolution of the funds rate and other related short-term rates. For example, all else being equal, if short-term rates are expected to be high on average over the relevant period, then longer-term yields will tend to be high as well. Were that not the case, investors would profit by holding a sequence of short-term securities and declining to hold long-term bonds, an outcome inconsistent with the requirement that, in equilibrium, all securities must be willingly held. Likewise, if future short-term rates are expected to be low on average, then long-term bond yields will tend to be low as well.¹⁵

The relationship between short-term rates and expected long-term rates is exhibited in Figure 7, the current upward sloping yield curve. This curve depicts the risk free U.S. treasury rate an investor can expect for a given maturity. Rate of return increases as the maturity date of the security increases. Thus, investors can expect to be rewarded a higher rate of return for accepting more long term risk by purchasing a longer dated security.

¹⁴ Kei-Mu Yi, "Real Interest Rates over the Long Run," *Federal Reserve Bank of Minneapolis*, September 19, 2016, <https://www.minneapolisfed.org/research/economic-policy-papers/real-interest-rates-over-the-long-run>.

¹⁵ Ben Bernanke, "Remarks by Governor Ben Bernanke," *Board of Governors of the Federal Reserve System*, October 7, 2004, <https://www.federalreserve.gov/boarddocs/speeches/2004/200410072/default.htm>.

Figure 7: U.S. Government Interest Rate Yield Curve

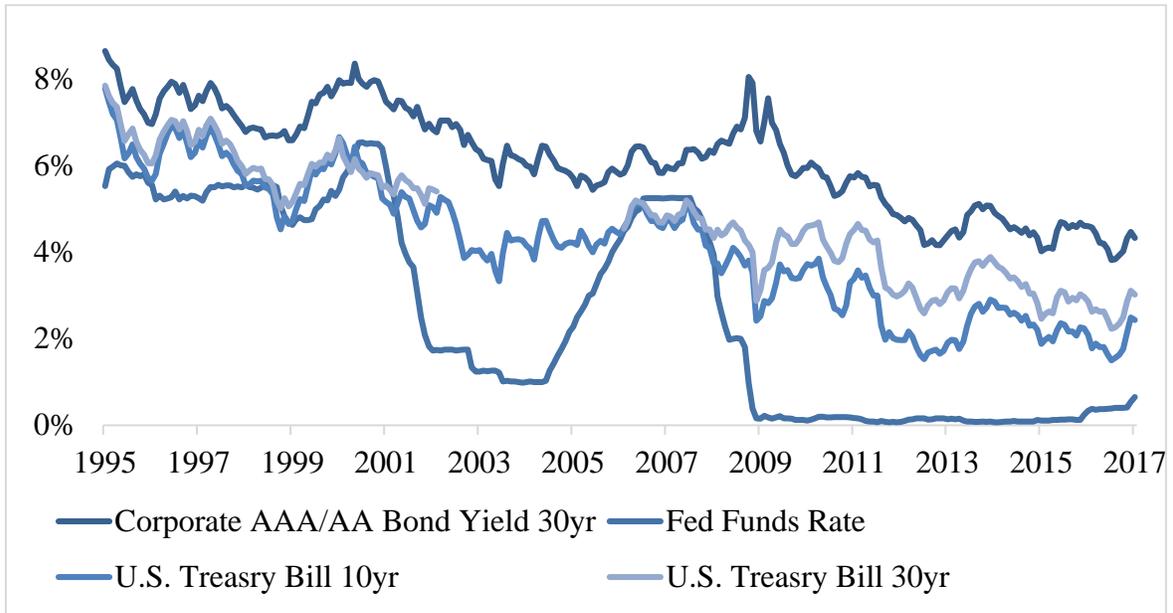


Source: U.S. Treasury Data as of February 24, 2017

As Chairman Bernanke explained, the Fed’s ability to influence and control longer term interest rates is limited. A 2014 International Monetary Fund (“IMF”) study of unconventional low interest rate policy concluded that governments have succeeded in manipulating short-term interest rates to provide stimulus to the economy, which confirms our regression analysis of short term interest rates. The study also stated that while longer term interest rates did decline, the transmission mechanism between monetary policy and long-term interest rates is unclear. The study echoed Chairman Bernanke’s statement by concluding that the Fed’s forward guidance and intentional signaling has succeeded in driving long-term interest rates, but the exact impact of the Fed on long-term interest rates is indeterminable.¹⁶ Figure 8 presents these long-term interest rates from 1995-2017.

¹⁶ Tao Wu, “Unconventional Monetary Policy and Long-term Interest Rates,” *International Monetary Fund*, September 2014, <https://www.imf.org/external/pubs/ft/wp/2014/wp14189.pdf>.

Figure 8: Long-term Interest Rates and Fed Funds Rate



Source: Federal Reserve Economic Data; Federal Reserve Bank of St. Louis

Chairman Bernanke's comments are confirmed by the regression analysis in Table 7. The funds rate does not have a statistically significant relationship with long term corporate bond yields and the 30-year U.S. treasury yield. However, the 10-year U.S. treasury is significantly correlated with the funds rate in the month of a FOMC rate adjustment announcement. These results appear to confirm the IMF study results and Chairman Bernanke's comments; that the Fed is limited in its ability to influence long term interest rates, and the fed funds rate loses its ability to influence rates as you move out the yield curve depicted in Figure 7.

Table 7: Long-term Interest Rates and Fed Funds Rate Regression Data

Month Prior to Fed Funds Rate Change			
	Corp. Invest. Grade Bond Yield 30yr	U.S. Treasury Bill 30yr	U.S. Treasury Bill 10yr
Correlation	0.056	0.182	0.198
R Squared	0.003	0.033	0.039
P-value	0.684	0.256	0.148
Month of Fed Funds Rate Change			
	Corp. Invest. Grade Bond Yield 30yr	U.S. Treasury Bill 30yr	U.S. Treasury Bill 10yr
Correlation	0.084	0.087	0.272
R Squared	0.007	0.008	0.074
P-value	0.539	0.523	0.043
Month Following Fed Funds Rate Change			
	Corp. Invest. Grade Bond Yield 30yr	U.S. Treasury Bill 30yr	U.S. Treasury Bill 10yr
Correlation	0.083	0.083	0.011
R Squared	0.007	0.007	0.000
P-value	0.541	0.131	0.933

Source: Author Calculations

Nonetheless, while the Fed does not have a clear impact on long term interest rates, it can influence these rates through signaling, which is the FOMC’s signaling effect and forward guidance in speeches and announcements. The impact of the signaling effect is presented in Figure 8: long term interest rates remain suppressed below historical averages, even though the long-term rates have temporary peaks and troughs. Consequently, the Fed’s unconventional monetary policy since 2009 and subsequent low long-term interest rates have had a profound effect on investors and portfolio managers that we will explore further.

Equity Prices

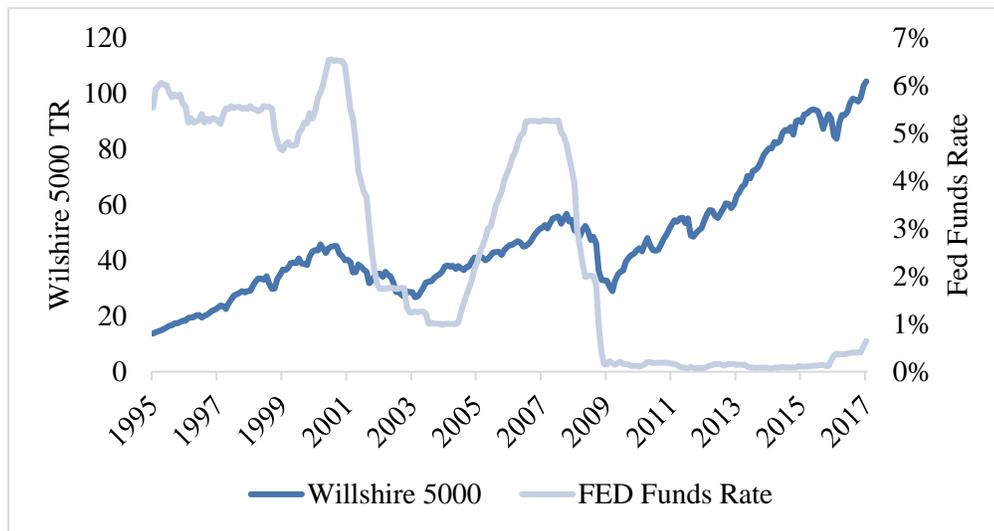
The fed funds rate does not directly affect the stock market, and as we demonstrated, does not have an immediate impact on equity prices. However, as we have discussed, an increase in the fed funds rate makes borrowing more expensive for consumers which limits the amount of discretionary income they have available to spend. This in turn can effect businesses' top line and when combined with the higher cost of borrowing a company faces when the Fed raises rates, companies' stock price can suffer as revenue shrinks and the cost of debt increases. A 2012 McKinsey Global Institute economic study of the distribution effects of low interest rates found that U.S. non-financial corporations' aggregate revenue increased by \$310 billion between 2007 and 2012 due to lower interest expense.¹⁷ While this increased revenue did not necessarily increase the companies' stock price due to numerous other variables affecting equity prices, it certainly provided a boost to these companies and the equity market as a whole. While there are industries that benefit from low rates and industries that benefit from high interest rates, attributing these increases and decreases in corporate revenue to the fed funds rate is difficult. As our event study revealed, equity markets are not directly influenced by the Federal Reserve and are likely propelled by a myriad of factors; thus, attributing market fluctuations and longer term equity prices to a single event or variable such as funds rate changes is challenging to prove.

Figure 9 and 10 display these conclusions, that the federal funds rate does not have a clear impact on longer term equity market returns. The Wilshire 5000 is a stock market index that includes companies of varying sizes; this index is considered the definitive benchmark for the stock market as a whole. Figure 9 shows that equity prices can increase

¹⁷ "QE and ultra-low interest rates: Distributional effects and risks," *McKinsey Global Institute*, November 2013, <http://www.mckinsey.com/global-themes/employment-and-growth/qe-and-ultra-low-interest-rates-distributional-effects-and-risks>.

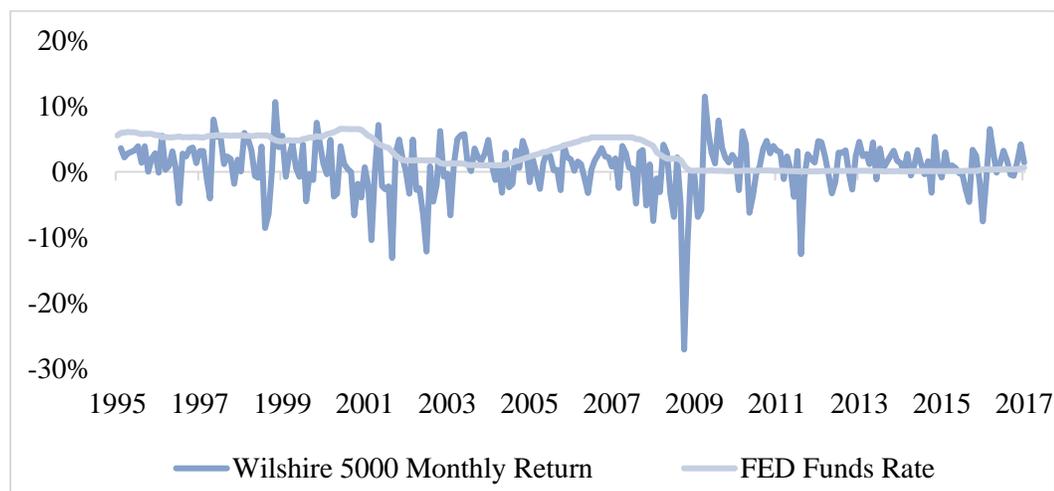
in both high and low interest rate environments; this is further observed by the markets realizing above average returns in a high interest rate environment and below average returns in a low interest rate environment. Figure 10 illustrates that market returns are highly volatile, and that the markets can increase and decrease regardless of an increasing or decreasing fed funds rate.

Figure 9: Wilshire 5000 TR and Fed Funds Rate



Source: Federal Reserve Economic Data; Federal Reserve Bank of St. Louis

Figure 10: Wilshire 5000 Monthly Returns and Fed Funds Rate



Source: Federal Reserve Economic Data; Federal Reserve Bank of St. Louis

These observations are supported by a Federal Reserve Bank of Kansas City statistical study of monetary policy's effect on asset prices. The study concluded that the FOMC's influence on asset prices has declined since 2009 and long-term prices and interest rates sensitivity to short-term interest rates has weakened.¹⁸ Nonetheless, all things being equal and based on a financial perspective, lower interest rates tend to raise equity prices as investors discount the future cash flows associated with equity investments at a lower rate.¹⁹ Fed Governor Powell discussed this phenomenon in a recent speech saying, "Low rates have provided support for asset valuations-indeed, that is part of their design. But I do not see valuations as significantly out of line with historical experience."²⁰

¹⁸ Taeyoung Doh and Michael Connolly, "Has the Effect of Monetary Policy Announcements on Asset Prices Change?" *Federal Reserve Bank of Kansas City*, 2013, <https://www.kansascityfed.org/publicat/econrev/pdf/13q3Doh-Connolly.pdf>.

¹⁹ "How doe monetary policy influence inflation and employment?" *Board of Governors of the Federal Reserve System*.

²⁰ Jerome Powell, "Low Interest Rates and the Financial System," *Board of Governors of the Federal Reserve System*, January 7, 2017, <https://www.federalreserve.gov/newsevents/speech/powell20170107a.htm>.

Governor Powell's statement discloses the Fed's intent when lowering interest rates: to increase prices and inflation, thereby boosting the economy. However, many investors disagree with Governor Powell and believe that the extended low interest rate policy has overvalued equity prices and may trigger a realignment of values and subsequent drop in the equity markets. Currently, equities are trading at all time highs and concerned investors point to growing price to earnings ratios which are well above historical averages.

Institutional Investors

Investors managing a diversified portfolio have been meaningfully impacted by the Fed's low rate monetary policy and consequent low short-term and long-term interest rates.

Historically, a 60/40 portfolio of 60% equity and 40% fixed income or bonds has met many institutional investors 8% nominal return requirement or 5% net fees and inflation return requirement. This was primarily due to the fed funds rate averaging 5% during this time. Table 8 details the 30-year real return of a diversified and 60/40 portfolio. As the table indicates, a diversified portfolio has historically produced less than 50 bps of alpha or above market returns, and investors were able to easily meet return requirements because investment grade fixed income averaged nearly 7%.

Table 8: Historical Portfolio Returns

Asset Class	30yr Return	60/40 Portfolio	Illustrative Diversified Portfolio
Cash	2.60%	0%	0%
U.S. Treasuries	7.84%	0%	10%
Investment Grade Credit	8.07%	0%	10%
Investment Grade	6.34%	40%	15%
Corporate High Yield	8.28%	0%	5%
Large Cap Equities	10.16%	60%	40%
Small Cap Equities	9.62%	0%	5%
International Equities	5.57%	0%	5%
Private Equity	13.30%	0%	10%
30 Year Nominal Return		8.63%	9.11%
30 Year Inflation		2.54%	2.54%
30 Year Real Return		6.09%	6.57%

Source: Bloomberg Indices: Barclays U.S. T-Bills (1-3mo), Barclays U.S. Govt Trsy, Barclays U.S. Credit, Barclays U.S. Agg, Barclays U.S. Corp HY, S&P 500 TR, Russell 2000 TS, MSCI EAFE, Cambridge U.S. PE Index

However, investors now operate in a different environment and must alter their portfolios to accommodate the Fed's unconventional monetary policy. As interest rates remain below average levels and fixed income yields remain depressed, investors have had to increase allocations to other asset classes to yield what used to be easily accomplished by a 60/40 portfolio. Table 9 displays current and expected returns given the low rate environment. The table reveals that meeting return requirements has become more difficult as many asset classes' yields are low in the current near zero interest rate policy environment.

Table 9: Current Portfolio Returns

Asset Class	Expected Long-term Return	60/40 Portfolio	NACUBO Allocation ²¹
Cash	2.20%	0%	4%
Fixed Income	3.35%	40%	9%
Private Debt	8.07%	0%	4%
Large Cap Equities	6.34%	60%	16%
International Equities	8.28%	0%	19%
Private Equity	10.16%	0%	15%
Hedge Funds	9.62%	0%	20%
Real Estate	5.57%	0%	6%
Commodities	13.30%	0%	7%
30 Year Nominal Return		5.54%	6.76%
30 Year Inflation		2.25%	2.25%
30 Year Real Return		3.29%	4.51%

Source: Long-term expected return calculated by Delegate Advisors²²

The traditional 60/40 portfolio no longer meets the minimum 8% nominal return required of many institutional investors. Because of this, investors have had to lower fees, adjust investment policies, lower target returns, and adjust allocations by decreasing exposure to lower yielding assets while increasing exposure to higher yielding assets such as alternatives and high yield fixed income. In particular, we will explore the near zero fed funds rate’s effect on investors’ private equity (“PE”) exposure.

Private Equity

To further explore the Fed’s near zero monetary policy effect on investors, we conduct a case study of the private equity industry, which has been meaningfully

²¹William Jarvis, Kenneth Redd, Kyle Kuhnel, and Kellee Edmonds, “Institutions Increase Endowment Spending Despite Lower Returns,” *National Association of College and University Business Officer*, January 31, 2017, <http://www.nacubo.org/Documents/about/pressreleases/2016%20NCSE%20Press%20Release%20FINAL.pdf>

²² Robert Borden, “The Mirror and the Windshield,” (presentation, University of Texas Private Equity Conference, Austin, TX, February 3, 2017).

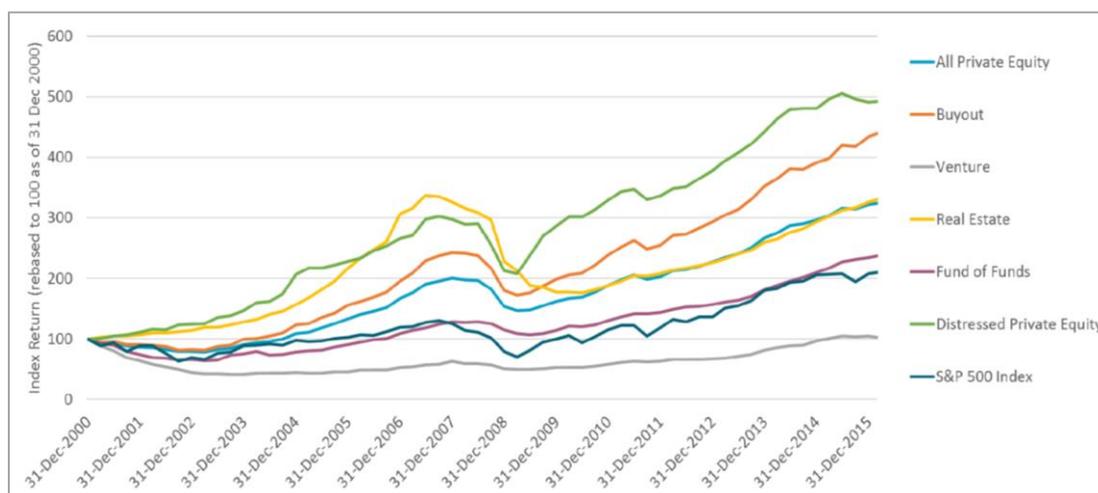
transformed in the wake of the Fed's unconventional policy. In the face of lower interest rates and depressed fixed income and public equity yields, investors have pursued other asset classes with higher yields. This search for yield has pushed many investors to accept more risk and increase exposure to higher yielding asset classes. One such asset class is private equity. To understand why PE has attracted investors, we will provide context - PE is an investment process that involves acquiring a position in a private company through equity or debt acquisition and improving the company to create value. This created value is realized by selling the company to either the public market through an initial public offering, to a larger company through a strategic acquisition, or to a larger private equity firm. Private equity firms who are finding and acquiring these companies typically charge significant fees and require investors to commit money for an extended period of time, typically at least 5 years. These firms fall into 4 categories based on strategy:

- Venture Capital/Growth Equity
- Buyout
- Special Debt (distressed and mezzanine)
- Special Situation Funds

Venture capital and growth equity is investing in the earlier stages of a company's lifecycle in an effort to provide capital to fund business expansion and growth. Buyout includes leveraged buyout, which is using borrowed or raised capital to purchase a majority stake in a company. Special debt is either loaning capital to private companies or purchasing debt in distressed or struggling companies with the expectation of the company improving and the debt increasing in value. Other distressed debt strategies are purchasing debt in a failing company with the intention of gaining control of the company following default. Lastly, special situation funds include real estate and event driven deals where private equity managers attempt to exploit pricing inefficiencies.

Investors have pursued this asset class in the search for yield, because PE has historically outperformed public equities. Figure 11 depicts PE’s consistent outperformance over the S&P 500. This graph exposes that since 2000, PE has provided higher returns of invested capital than the S&P 500 stock market index.

Figure 11: Private Equity Excess Returns over S&P 500



Source: Delegate Advisors and Prequin²³

Quantifying this search for yield reveals that most institutional investors have increased their exposure to PE since 2009. The National Association of College and University Business Officers’ (“NACUBO”) surveys found that on average, U.S. endowments increased allocation to alternatives by 5% from 48% in 2009 to 53% in 2016.²⁴ A majority of this increased allocation to alternatives, which includes private equity, real assets, real estate, infrastructure, and commodities, was due to endowments on average increasing private equity allocations from 12.8% of total portfolio in 2009 to 17% in

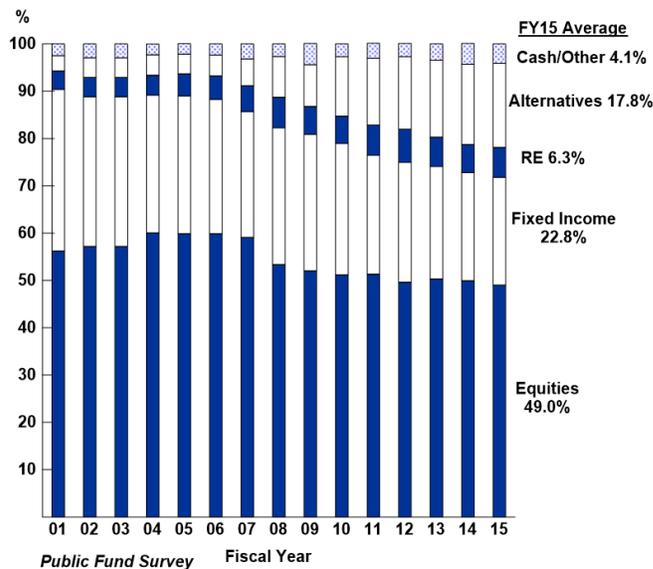
²³ Borden, “The Mirror and the Windshield”.

²⁴ John Griswold, Kyle Kuhnel, Matthew Hamill, and Lisa Jordan, “Educational Endowments Returned -18.7% in FY2009,” *National Association of College and University Business Officers*, January 28, 2010, http://www.nacubo.org/Documents/research/2009_NCSE_Press_Release.pdf.

2016.²⁵ A 2015 Organization of Economic Cooperation and Development (“OECD”) survey of worldwide large pension funds discovered that this strategy was occurring globally. This study demonstrated an average increased exposure to alternatives of 200 bps between 2010 and 2015.²⁶

These studies confirm that one strategy investors have employed to boost portfolio returns is increasing exposure to private equity while decreasing exposure to U.S. equities, fixed income and hedge funds.²⁷ Figure 12 demonstrates the shifting asset allocation of some institutional investors from 2001 to 2016.

Figure 12: Institutional Pension Asset Allocations, 2001-2016



Source: National Association of State Retirement Administration (NASRA) FY2015 Public Fund Survey; alternatives include private equity and hedge funds

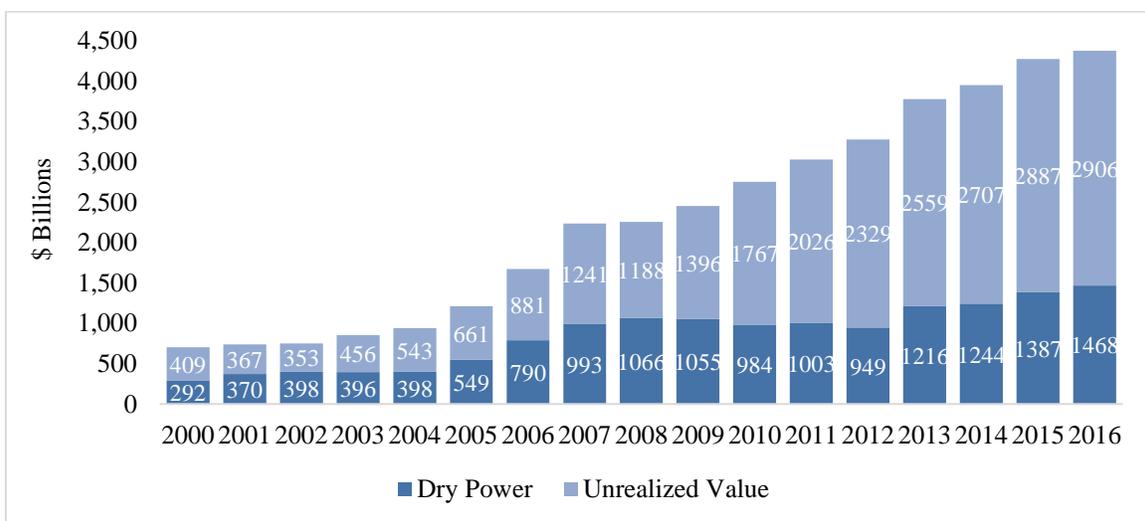
²⁵ Griswold, Kuhnel, Hamill, and Jordan, “Educational Endowments Returned -18.7% in FY2009”.

²⁶ “Low Interest Rates Threaten Solvency of Pension Funds and Insurers”, *Organization for Economic Co-operation and Development*, June 6, 2015, <http://www.oecd.org/economy/low-interest-rates-threaten-solvency-of-pension-funds-and-insurers.htm>.

²⁷ Jarvis, Redd, Kuhnel, and Edmonds, “Institutions Increase Endowment Spending Despite Lower Returns”.

Investors search for yield and increased exposure to PE has meaningful changed the PE landscape. Figure 13 displays the PE industry’s growth and the significant increase in private equity assets under management (“AUM”) during the Fed zero interest rate policy: from \$2.25 trillion in 2008 to \$4.37 trillion in 2016. Dry power is cash held by PE firms that has yet to be deployed or invested.

Figure 13: Global Private Equity AUM, 2000-2016



Source: Prequin Private Equity and Venture Capital Report²⁸

This substantial expansion can be attributed to market appreciation, the outperformance of private vs public companies, the search for yield in the current low rate environment and subsequent investors increased exposure to PE.²⁹ Because existing firms have limits to the amount of money they manage and invest, new private equity firms have opened to

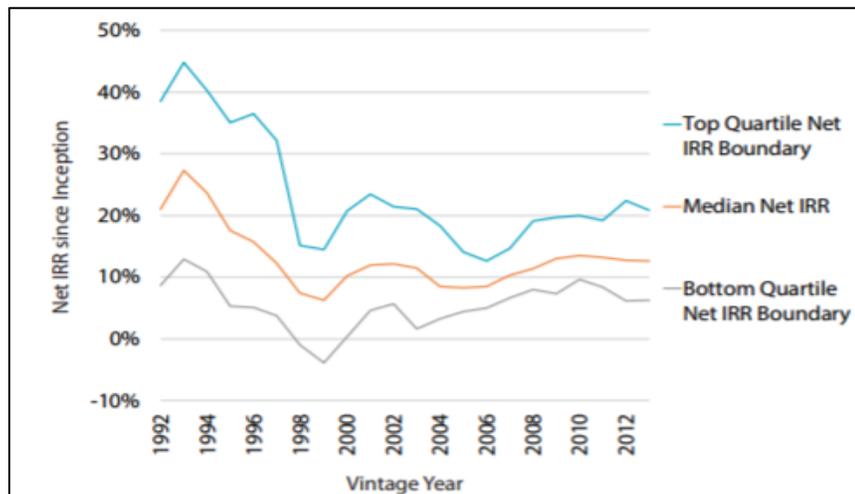
²⁸ “Prequin Global Private Equity and Venture Capital Report”, *Prequin*, 2016, https://www.prequin.com/docs/samples/2016-Prequin-Global-Private-Equity-and-Venture-Capital-Report-Sample_Pages.pdf.

²⁹ “Private Equity Growth in Transition”, *Deloitte Center for Financial Services*, 2016, <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-fsi-private-equity-growth-in-transition.pdf>.

take advantage of the growing demand for private equity investment opportunities. Between 2002 and 2012, the ratio of private companies to private equity firms declined by 61%. This declining ratio unveils the increasing competition in the industry, which has resulted in firms paying more to acquire companies and secure deals.

Additionally, as the industry has expanded, the separation between firms consistently providing investors a quality return and firms losing investors' money remains wide. Figure 14 exhibits the historical return spread between top quartile and bottom quartile private equity managers. As the figure exposes, many private equity firms are not providing investors returns that justify the risk associated with private equity investments. Because of the influx of poorly performing private equity firms and increased competition for deals, the return expectations for the industry as a whole may be compressed. Figure 15 depicts this possible compression of private equity returns. IRR is internal rate of return and is a metric used in finance to measure the profitability of investments.

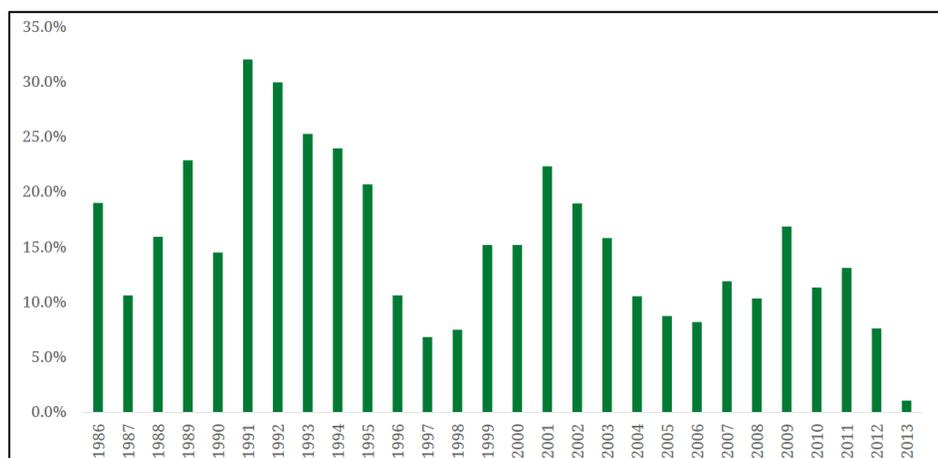
Figure 14: Private Equity Net IRRs and Quartiles by Vintage Year



Source: Prequin 2017 Global Private Equity Report³⁰

³⁰ “Prequin Global Private Equity and Venture Capital Report”.

Figure 15: U.S. Private Equity Pooled Internal Rate of Return by Year



Source: Delegate Associates and Cambridge Associates³¹

As we revealed, many investors have taken advantage of PE's historically high returns to meet portfolio return requirements and in the current unconventional Fed interest rate environment compensate for public equities and fixed income low returns. Interestingly, this increased demand for PE investments causes the industry to become more competitive, and as PE firms pay more for private companies, returns will decrease. Declining PE returns combined with the Fed's low interest rate will further stress investors to meet return requirements and may force investors to accept even more risk in their pursuit of higher yields. As we observed with investors' increased exposure to PE in their search for yield, a consequence of the low fed funds rate may be the addition of risk for investors and the financial system.

LONG-TERM EFFECTS

The Fed's pursuit of near zero interest rates has also impacted long-term economic and investor expectations. As we discussed, lowering the fed funds rate encourages

³¹ Borden, "The Mirror and the Windshield".

borrowing, increases liquidity, and boosts consumer spending and corporate investment. In turn, this provides lift to the economy and decreases unemployment as firms' revenue grows and consumer demand increases. In addition, low interest rates typically devalue the domestic currency, which can increase domestic exports. However, low interest rates can also have a negative impact on the economy. President Jeffrey Lacker, President of the Federal Reserve Bank of Richmond, stated that poor monetary policy can impede economic growth in a number of ways. Primarily, too much liquidity in the economy can lead to unsustainable inflation that undermines the Fed's goal of price stability.³²

Interestingly, the linkages between monetary policy, domestic production, and unemployment do not show up immediately, which makes it challenging to precisely determine the effect of monetary policy on long-term growth and the economy.³³ According to the Federal Reserve, major effects of monetary policy on domestic output can take up to 2 years, and effects on inflation can take up to 3 or more years. Given this, we may have not observed the full effect of unconventional long term low interest rate monetary policy on the economy, and there may be unrealized negative consequences of the Fed's post-recession unconventional policy, such as a buildup of financial risk.

Financial and Investment Risk

Due to the low fed funds rate, investors have been obligated to seek higher yielding assets. As we discussed, increased yield is coupled with increased risk. The Fed acknowledges the consequences of low interest rates by stating that investors seeking

³² Jeff Lacker, "Can Monetary Policy Affect Economic Growth?" *Federal Reserve Bank of Richmond*, February 24, 2016, https://www.richmondfed.org/press_room/speeches/president_jeff_lacker/2016/lacker_speech_20160224.

³³ "How doe monetary policy influence inflation and employment?" *Board of Governors of the Federal Reserve System*.

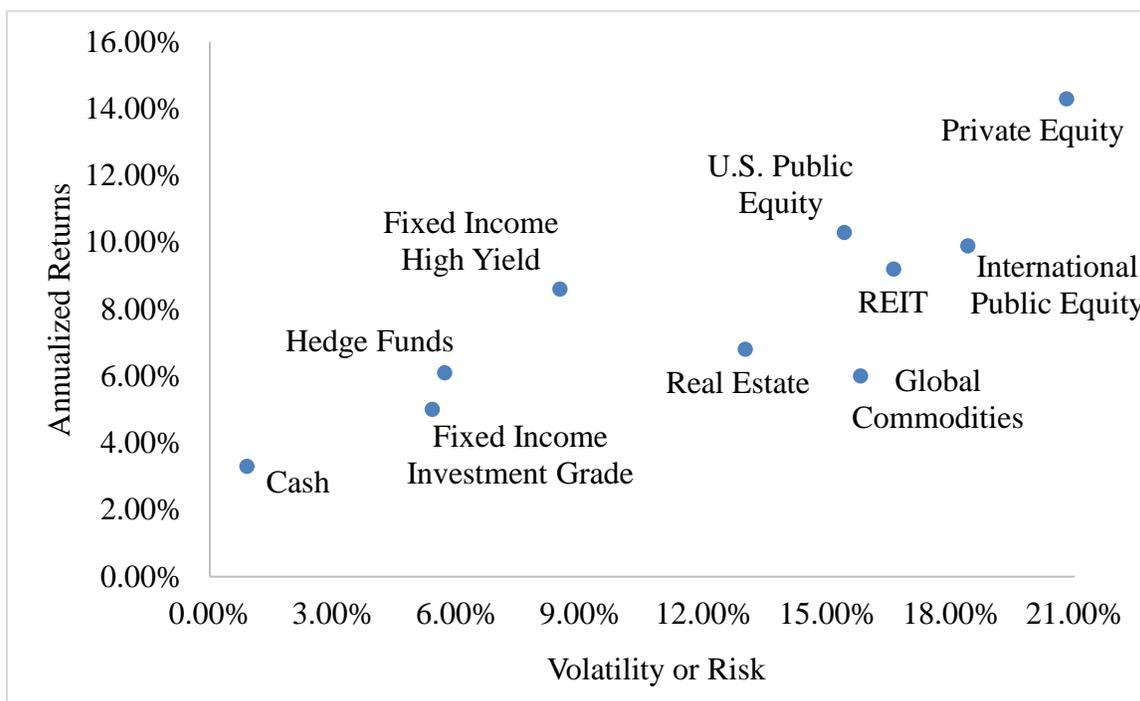
higher nominal rates of return are tempted to pursue speculative, higher yielding investments.³⁴ We have witnessed investors' increased risk appetite and search for yield before: analysis of the recent financial crisis divulges an increased risk build-up in the financial system when low interest rates through the 2000s encouraged risk taking and contributed to the Great Recession.³⁵ As pension funds, insurance companies, endowments and other institutional investors fail to meet required investment returns to cover forecasted expenses based on expected higher returns, these investors must find ways to boost investment returns or risk insolvency. A McKinsey Global Institute report found that U.S. pension funds and insurance companies' collective net interest income shrank by \$270 billion due to low interest rates from 2007-2012. The report also stated that low interest rates could threaten the long-term survival of these institutions.³⁶ These pension funds and insurance companies must bridge this gap between required income and current income. As we explored above, many investors, including some pension funds, have increased allocations to asset classes such as private equity that have a higher risk and return profile. Figure 16 presents the historical risk return profiles of multiple asset classes. As you move up the vertical axis, you increase return; however, as you move right along the horizontal axis, you increase risk measured by volatility and the standard deviation of the returns.

³⁴ Kevin Kliesen, "Low Interest Rates Hve Benefits...and Costs," *Federal Reserve Bank of St. Louis*, 2011, <https://www.stlouisfed.org/publications/inside-the-vault/spring-2011/low-interest-rates-have-benefits-and-costs>.

³⁵ Jon Simon, "Low Interest Rate Environments and Risk," *Reserve bank of Australia*, October 8, 2015, <http://www.rba.gov.au/speeches/2015/sp-so-2015-10-08.html>.

³⁶ Timothy Koller, Jiri Maly, Robert Palter, "Investing When Interest Rates are Low," *McKinsey & Company*, January 2004, <http://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/investing-when-interest-rates-are-low>.

Figure 16: Risk and Return Profile of Asset Classes



Source: Morgan Stanley Analysis: 20 Year Benchmark Returns³⁷

Specifically, by increasing private equity exposure, investors also increase exposure to the risks associated with long capital commitments and exposure uncertainty. This liquidity and exposure risk can be challenging to quantify and is often unobserved by investors, because there is no public market for private equity deals, nothing is traded, and investors only observe cash flowing in and out.³⁸ As investors pursue higher yielding assets, they increase their portfolios' risk and, in aggregate, the risk exposure of the financial system.

³⁷Michael Wilson, Lisa Shalett, Daniel Hunt, ed. "Inputs for GOC Asset Allocation," *Morgan Stanley Wealth Management*, March 2016, <https://fa.morganstanley.com/theoberheidegroup/mediahandler/media/2726/InputsforGICAssetAllocation.pdf>.

³⁸ Ludovic Phalippou, "Private Equity: Performance, Risk, and Fund Selection," *CFA Publications*, September 2010, <http://www.cfapubs.org/doi/pdf/10.2469/cp.v27.n3.1>.

To understand this additional risk, researchers at Massachusetts Institute of Technology and Harvard University conducted a study of the relationship between low interest rates and risk taking. The study concluded that investors demonstrate a greater appetite for risk in low interest rate environments and increase their use of debt.³⁹ Governor Powell explained the Fed's concern with financial risk by stating that low interest rates do invite increased risk and additional debt, but that the current risk levels are sustainable and enhanced risk management have prevented a build-up of risk in the economy.⁴⁰ However, not all economists agree with the Fed. The OECD 2015 Business Outlook Report stated that low interest rates have threatened the solvency of pension funds and insurers due to their search for yield.⁴¹

These disparate conclusions regarding risk reveal the challenges in quantifying investor and financial risk. While many consumers and investors have taken advantage of the Fed's zero interest rate monetary policy to assume additional debt and increase investment risk, the implications of these actions will not be realized in the near future.

³⁹ Chen Lian, Yueran Ma, and Carmen Wang, "Low Interest Rates and Risk Taking: evidence from Individual Investment Decision," *Massachusetts Institute of Technology*, January 25, 2017, <http://economics.mit.edu/files/12105>.

⁴⁰ Powell, "Low Interest Rates and the Financial System".

⁴¹ "Low Interest Rates Threaten Solvency of Pension Funds and Insurers", *Organization for Economic Co-operation and Development*.

Conclusions

The fed funds rate has significant intermediate and long term impact on financial markets and investors. In studying the immediate impact of FOMC meetings and the fed funds rate, we discovered through a statistical event study that the fed funds rate announcements and federal funds rate adjustments since 2009 have not had an observed and quantifiable immediate impact on financial markets and equities. This is likely due to the efficiency of markets, and investors pricing in expected rate adjustments prior to FOMC meetings.

In the intermediate, the fed funds rate has a substantial effect on interest rates, equity prices, and investors. The fed funds rate is highly correlated with the prime rate, the rate banks charge their most credit worthy consumers, and short term LIBOR and U.S. treasury rates. These correlations divulge the Federal Reserve's ability to ease or constrict banks and lenders' liquidity. This manipulation of short-term interest rates can propel the economy towards growth by encouraging lending, borrowing, consumer spending, and corporate investment. The fed funds rate is less correlated with longer term interest rates than short-term rates. While the Fed attempts to drive long-term interest rates through open market operations, the impact on long-term rates is diluted and unclear due to the numerous factors that affect markets expectation of future rates.

These lower interest rates impact investors by decreasing the expected return of their portfolios. Since 2009, many investors have increased exposure to higher yielding assets, such as private equity, in an effort to counteract decreased yields in fixed income and equities. Consequently, the private equity industry has witnessed an influx of capital, increased competition for deals, and compressed returns. If PE yields and internal rate of returns remain compressed, investors may not realize appropriately risk adjusted returns.

By chasing yield and increasing exposure to alternative assets, investors are increasing the risk exposure of their portfolio. While the long-term economic effects of low interest rates may take years to precipitate, investors and the financial system will likely be confronted with the additional risk investors introduced by chasing yield. For example, in the event of an economic downturn, investors requiring capital may be confronted with the liquidity risk they took on when their portfolio increased its exposure to private equity.

While economists and experts disagree on the amount of risk built up in the financial system as a result of the Federal Reserve's unconventional near zero interest rate monetary policy, they do agree that the consequences of a low federal funds interest rate since 2009 will not be fully realized for years to come.

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