

An Empirical Study on the Impact of Fed Rate Hikes: Perspective from Fama-French Three-Factor Model

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Abstract. The Fed's interest rate hike is currently a hot issue of social concern. Some researchers believe that the Fed's rate hike this time is an "urgent cycle" rather than a "long-term cycle". However, there is still no unified explanation for the formation mechanism and scope of influence behind it. Therefore, this paper collects the return data of the US stock industry and conducts a Fama-French three-factor regression analysis. Research shows that the short-term negative impact of the U.S. stock market in the context of the Fed raising interest rates is not conducive to the development of the U.S. stock market, meanwhile, the energy industry benefits from the hike on the long term. The fed rate hike will have a negative impact on the rest of the industry in the short term, with the durable goods sector and business equipment sector having the most severe impact, and the utility sector and non-durable goods sector having a relatively small negative impact.

Keywords: Fed hikes rates, US stocks, Fama-French three-factor model

1. Introduction

In early 2020, the U.S. government adopted flexible fiscal and monetary policies to rescue economic markets in the wake of the COVID-19 outbreak. Loose monetary policy is manifested by reducing the federal funds rate to 0-0.25% in a short period of time; Fiscal policy is reflected in the fact that the US federal fiscal deficit accounts for 15% of the total GDP; The U.S. economy recovered quickly from the recession, driven by the state. The Fed announced a rate hike at its March 16 meeting this year, raising the target range of the federal and funds rates by 25 basis points. Subsequently, the Fed announced the FOMC meeting statement in June and decided to raise the federal funds rate by 75 basis points, the largest rate hike since 1944, highlighting the urgency of the Fed's aggressive tightening of monetary policy [1-2]. At this time, the recovery of domestic consumption was faster than the recovery of production, which intensified inflation in the United States. The three factors of rapid economic recovery, intensified inflation and labor market shortage were superimposed, and the Federal Reserve implemented monetary tightening policy. Some research scholars believe that as the Federal Reserve enters the interest rate hike cycle, the interest rate gap between emerging market countries and the United States will narrow, which is conducive to the return of international capital to the United States. Historical data also shows that the Fed has experienced four distinct rate hike cycles over the past 30 years, all of which have had a positive impact on the U.S. stock market.

After the U.S. stock market has enjoyed a long period of quantitative easing and high liquidity, the valuations of some industries and individual stocks have been significantly inflated. The market may experience short-term fluctuations due to the impact of Fed rate hikes and interest rate hike expectations. After the Fed announced a rate hike this time, the three major U.S. stock indexes plummeted, and the market began to "stagflation-recession" logic. According to the traditional investment cycle model "Merrill Lynch", the overall economic growth rate of the United States will show a downward trend in the future, but its inflation pressure is still at a high level, which is basically in line with the characteristics of the "stagflation-recession" period [3]. But in past Fed rate hike cycles, cyclical and value stocks tended to perform better. In addition, as U.S. inflation remains high and there is no sign of cooling in the short term, anti-inflation themed stocks may perform better. Relatively speaking, after entering the interest rate hike cycle, growth stocks such as technology and commodities will face difficulties [4].

Therefore, this study will use the Fama-French three-factor method to analyze how this round of Fed rate hikes impacted different sectors of the U.S. financial market, and the impact on the U.S. will

focus on stock market returns. Based on the Fama-French three-factor model, this paper takes the U.S. stock market industry as an example to conduct research, specifically analyzes the impact of this round of Fed rate hike cycle on the returns of 12 U.S. stock industry sectors and explores the impact of the three-factor model on the overall and different industry stock returns. Explain changes in strength. Thereby, corresponding suggestions are put forward for the development of the capital market, and the role of the stock market as a "barometer" of the national economy is brought into full play [5]. By comparing the impact of Fed rate hikes on the U.S. stock market, on the one hand, we can fully understand the role and impact of changes in U.S. monetary policy and grasp the channels and extent of the impact of U.S. monetary policy on the stock market. Prediction and risk warning for the stock market of different industry sectors. On the other hand, it provides reference and reference for investors to make asset allocation investment. Therefore, this paper is of great practical significance in terms of studying the impact of US monetary policy adjustment on the stock market.

2. Fed rate hike history and context

The Fed's adjustments to the federal interest rate are called rate hikes or rate cuts. Every rate hike and rate cut affects the economic development of countries around the world. The Fed said the latest round of rate hikes was due to factors including rising inflation and the coronavirus pandemic. In recent months, strong job growth in the U.S. has led to continued strength in economic activity and employment indicators and a sharp drop in the unemployment rate. The higher inflation rate reflects supply and demand imbalances caused by the pandemic, the international situation, higher energy prices and broader price pressures. The Fed believes that the impact of this rate hike on the United States is difficult to determine, and it will bring upward pressure on inflation in the short term. At the same time, when the U.S. shifts from loose monetary policy to tight monetary policy, interest rates will rise and the dollar index will strengthen.

With the cycle of interest rate hike cycles appearing, many scholars began to compare different interest rate hike cycles to find similarities and differences. According to the interest rate hike cycle in 2004, Zhong Wei summed up the Fed's interest rate hike formula with inflation rate and unemployment rate as important indicators [6]. At the same time, he observed the previous Fed rate hike cycles from the interest rate fluctuation cycle, and analyzed the global capital flow caused by the Fed. The interest rate hike cycle is an inevitable stage in the U.S. economic cycle. The Federal Reserve has launched 6 rounds of interest rate hike cycles. From 1983 to 2018, the duration of these 6 rounds of interest rate hike cycles varies greatly, from the shortest 11 months to the longest 36 months; there are many reasons for raising interest rates, such as 1987. The interest rate hike cycle to 1989 was to address the stagflation problem caused by the shock of crude oil supply [7]. However, the background of this round of interest rate hikes is different from usual: the choice to raise interest rates due to the economic downturn and the rapid rise in inflation. The backdrop is the same as the rate hike cycles of 1999 and 2004. Raising interest rates during economic expansion generally does not change the upward trend of US stocks; raising interest rates during economic downturns will have a negative impact on US stocks. If the pace of interest rate hikes is faster and corporate earnings expectations fall, the negative impact on US stocks will be more long-term.

3. Research content and research methods

This paper examines the impact of changes in U.S. monetary policy on stock market prices. A detailed analysis of the impact of the Fed rate hike cycle on U.S. stock industry yields. In order to better study the investor returns of different sectors of the US stock market are affected by the rate hike cycle. Here, according to the Fama-French website, the U.S. stock market constituents are divided into 12 industry sectors. The last round of the Fed's rate hike cycle (December 17, 2015 - December 20, 2018) and the current round of interest rate hikes (January 3, 2022 - May 31, 2022) are compared and analyzed.

Based on the US financial market, and by constructing the Fama-French three-factor model. According to 50% of the market value of listed companies, they are divided into small-cap scale stocks and large-cap scale groups; According to the company's book-to-market ratio (BM) at the end of the year, it is divided into low BM (L), medium BM (M) and high BM (H), which each account for 33% of BM. Cross the size factor with the value factor to obtain the following SL, SM, SH, BL, BM, BH combinations.

Through the multiple linear regression analysis method of market factor, size factor, value factor and stock return, the three-factor coefficients of two rounds of interest rate hike cycles are calculated, and the significance test is carried out. Validate the trend, factor significance and goodness of fit of the model.

Fama and French argue that single factors do not explain portfolio excess returns well. For a more comprehensive analysis and interpretation, Fama and French proposed a three-factor model in 1992. On the basis of the traditional capital pricing model, the market value ME (risk premium caused by the different scales of listed companies) and the book-to-market value ratio BE/ME (the risk premium caused by the different book market value of listed companies) are added. At the same time, it shows that the ratio of market capitalization to book market capitalization has a significant explanatory power for excess returns. In addition, the scale factor is also known as the small-cap stock anomaly; The value factor is also known as the high book-to-market equity anomaly [8-10]. The basic form of the model is,

$$R_i - R_f = \alpha + \beta_i^{mkt}(R_m - R_f) + \beta_i^{size}(SMB) + \beta_i^{value}HML \quad (1)$$

where R_i indicates the return on asset i at time t , R_f indicates the risk-free rate, α is the intercept term, R_m indicates the market rate of return, $R_m - R_f$ is the risk premium of the market, SMB is the market capitalization scale indicator, HML is the difference between the return on a portfolio of stocks with a high book-to-market ratio and a low book-to-market ratio. α in the model should tend to 0. If α does not tend to 0, the constructed three-factor model is defective.

4. Empirical Analysis

According to the selected industry indicators and three-factor data from the Fama-french website, and based on the data from 2015 to 2022, this paper analyzes the investor's industry return on changes in the Federal Reserve's monetary policy.

4.1 Market Level

Table 1. Excess returns of 6 stock portfolios in the context of Fed rate hikes in 2022

Explained variable: excess return of 6 stock portfolios							
BE/BM							
Size	Low	M	High		Low	M	High
MKT					t(MKT)		
Small	1.019485	0.922552	0.998997		36.36390	55.13507	132.0357
Big	1.027473	0.865970	1.047662		100.9620	39.29894	44.23046
SMB					t(SMB)		
Small	1.159480	0.904270	0.888782		20.09497	26.25847	57.07639
Big	-0.172677	0.025864	0.097539		-8.244333	0.570307	2.000850
HML					t(HML)		
Small	-0.223019	0.313496	0.775027		-6.132481	14.44351	78.96749
Big	-0.231809	0.328300	0.769170		17.55992	11.48559	25.03174
α					t(α)		
Small	0.025357	-0.013182	0.013021		0.699706	-0.609489	1.331366
Big	0.004538	0.003903	0.016980		0.344953	0.137040	0.554588
<i>Adjusted R²</i>					s(e)*100		
Small	0.977026	0.981276	0.995251		36.0702	21.5279	9.7344
Big	0.995032	0.945602	0.950433		12.0934	28.3505	30.4746

Table 2. Excess returns of 6 stock portfolios in the context of Fed rate hikes in 2015

Explained variable: excess return of 6 stock portfolios							
BE/BM							
Size	Low	M	High		Low	M	High
MKT					t(MKT)		
Small	1.099620	0.987865	0.977790		111.1194	172.5194	252.3240
Big	1.002815	0.937646	1.124374		234.3688	130.6649	111.8756
SMB					t(SMB)		
Small	1.020379	0.930844	0.903358		64.40068	101.5311	145.5977
Big	-0.110797	-0.040142	0.005991		-16.17295	-3.493827	0.372303
HML					t(HML)		
Small	-0.257651	0.267095	0.615303		-17.80094	31.89114	108.5593
Big	-0.310784	0.119561	0.816098		-49.65952	11.39132	55.51774
α					t(α)		
Small	-0.004298	0.001349	0.008105		-0.540288	0.292090	2.601997
Big	0.010563	-0.002781	-0.001951		3.071064	-0.482051	-0.241496
<i>Adjusted R²</i>					s(e)*100		
Small	0.965019	0.984572	0.993027		21.8826	12.6621	8.5691
Big	0.987520	0.958587	0.952779		9.4616	15.8681	22.2240

Due to insufficient data on this round of interest rate hikes, the 2015 interest rate hike cycle was selected as the change in U.S. stocks for auxiliary analysis. In the context of the two rate hikes, the chart shows that there is a clear corporate difference in excess returns. The excess returns of small companies are significantly greater than those of large companies, while the difference in excess returns of various stock portfolios with different book-to-market ratios is less obvious. Judging from this round of interest rate hikes and the 15-year interest rate hike, the market excess yield coefficient fluctuates around 1 and is very significant. This indicates that market risk has a strong explanatory power for cross-sectional changes in stock returns. Except for a few large-cap portfolios, the scale

factor SMB is generally significantly positive, indicating that the return rate is significantly positively correlated with the scale factor. After the 15-year interest rate hike, the SMB coefficient of large-cap companies in the medium term was significantly negative. This is also in line with the law of Fama-French. Both analyses show that the size factor of the market value of small companies is generally larger than that of large-cap companies. It shows that the scale factor has a greater impact on the stock returns of small-cap companies. The HML coefficients of the two interest rate hike cycles have a significant impact, and the HLM coefficients of portfolios with a relatively small book-to-market value are significantly less than 0, and the HLM coefficients of portfolios with a relatively large book-to-market value are significantly greater than 0.

It shows that compared with the portfolio with low book value, the portfolio with high book value is more likely to obtain excess returns, that is, value stocks are more likely to obtain excess returns than growth stocks. Finally compare the model's alpha with the adjusted R^2 after two hikes. On the whole, the α of the two models is approximately equal to 0, and they are not significant, and the adjusted R^2 of the fitting value is greater than 0.94, and the fitting effect is good. This shows that in the context of interest rate hikes, the Fama-French three-factor model is still significantly effective.

4.2 Industry Level

Then discuss the impact of interest rate hikes on the industry. According to the changes in the returns of the stock industry sectors after the recent 3 interest rate hikes, the Fama-French three-factor regression was performed on 12 industries, and the change in the investor returns of different stock industry sectors were calculated as shown in the following figure:

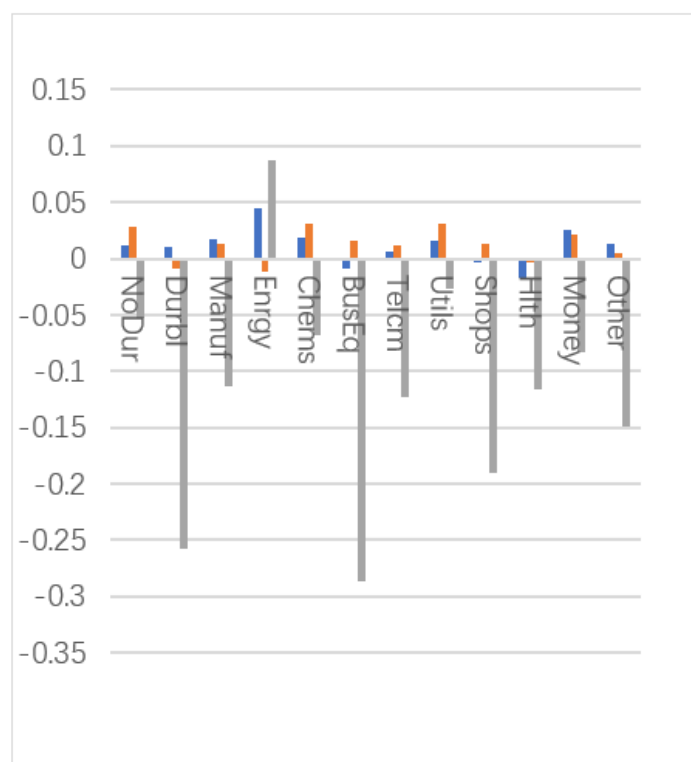


Figure 1 Changes in U.S. monetary policy changes to industry investor returns

The short-term impact of monetary policy on most stocks in the previous interest rate hikes was positively correlated, but this cycle of interest rate hikes was clearly negatively correlated. Among them, the expected return of investors in durable consumer goods and business equipment fell significantly, followed by retail and information technology, and financial industry and public utilities fell less.

Table 3. Descriptive statistics of interest rate hike cycle from 220220103 to 20220531

	α	β_{MKT}	β_{SMB}	β_{HML}	R^2	$E(R)$
NoDur	0.0096 (0.1286)	0.6544 (11.3389)	-0.1995 (-1.6797)	0.2633 (3.5179)	0.5860	-0.0521
Durbl	0.1299 (0.5775)	1.4352 (8.2504)	0.5826 (1.6275)	-0.4441 (-1.9681)	0.6468	-0.2582
Manuf	-0.0482 (-1.0605)	1.0010 (28.4492)	0.3366 (4.6486)	0.3774 (8.2687)	0.9116	-0.1136
Enrgy	0.3465 (2.0239)	0.9642 (7.2785)	0.2659 (0.9752)	1.0476 (6.0968)	0.3744	0.0877
Chems	-0.0614 (-0.9350)	0.7798 (15.3374)	-0.2215 (-2.1174)	0.2195 (3.3277)	0.7369	-0.0674
BusEq	0.0245 (0.6257)	1.1352 (37.4245)	-0.1594 (-2.5538)	-0.3799 (-9.6550)	0.9699	-0.2858
Telcm	0.0004 (0.0049)	0.6844 (10.7505)	0.0930 (0.7102)	0.1575 (1.9072)	0.6115	-0.1231
Utils	0.0553 (0.6415)	0.4553 (6.8330)	-0.2620 (-1.9106)	0.2213 (2.5599)	0.3395	-0.0267
Shops	-0.0429 (-0.5310)	1.0610 (16.9837)	-0.0158 (-0.1229)	-0.0280 (-0.3461)	0.8305	-0.1908
Hlth	0.0030 (0.0428)	0.6435 (11.8445)	-0.0461 (-0.4119)	-0.0592 (-0.8397)	0.7158	-0.1157
Money	-0.0451 (-0.8477)	1.1212 (27.2713)	-0.0029 (-0.0340)	0.4753 (8.9124)	0.8927	-0.0832
Other	-0.0533 (-1.2849)	0.9626 (30.0199)	0.1678 (2.5422)	0.1520 (3.6551)	0.9304	-0.1490

Energy sector stock yields have been on the upswing amid this hike. The α obtained by the OLS regression of the Fama-French three-factor with the daily rate of return of the energy industry sector is significantly greater than 0. The fitted value of the model as a whole is only 0.37 on the basis that the scale factor is not significant. This shows that the Fama-French three factors cannot fully explain the positive effects of the energy industry. The positive effects of its energy industry sector stocks can also be influenced by other international situations, such as the intensified situation in Russia and Ukraine, and the global energy shortage. The exact reason remains to be verified.

The increase in interest rates of the Federal Reserve increases the cost of capital in the stock market and reduces capital investment in the real economy. The same increases the burden on the real economy, prompting international capital to flow into the US capital market, resulting in the appreciation of the dollar. Therefore, as the US dollar strengthens, this rate hike will have a negative impact on the entire stock market in the short-term, and the long-term impact should not be large.

5. Conclusion

Based on the research results of the Fama-French three-factor model, the following conclusions are drawn: in the context of the Fed raising interest rates, the Fama-French three-factor model is still significantly effective in the US stock market. In the short term, investors expect yields across sectors of the U.S. stock market to generally decline. From the perspective of capital market development, the tightening monetary policy in the United States has a negative impact on all sectors of the stock market except energy. Among them, the durable goods sector and the business equipment sector have the most serious impact, while the public sector and non-durable goods sector have the most serious impact. The negative impact is relatively small. Expected yields for energy sector stocks have

developed relatively well. The short-term development of the yields of the energy industry may be better due to changes in the global situation and energy shortages. At the same time, this study also has many shortcomings. This round of interest rate hike cycle has not ended, and the required data interception is less, which lacks data support for long-term research. However, this study plays a role in predicting and risk warning for constituent stocks in different industries, and also provides reference and reference for investors to invest in asset allocation.

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