THE MARKET REACTION TO INTEREST RATE CHANGE: THE EFFECT OF FINANCIAL LEVERAGE

by

Luyao Yu
Bachelor of Science, Queen's University, 2012
Engineering Physics, Mechanical Option

and

Ai Zhang
Bachelor of Science, Capital Normal University, 2011
Mathematics

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Name: **Luyao Yu & Ai Zhang**

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Supervisory Committee:

_____

Amir Rubin
Senior Supervisor
Associate Professor of Finance

_____

Alexander Vedrashko
Second Reader
Associate Professor in Finance

Date Approved: _____

Abstract

This research project examines the relationship between the financial leverage of firms with total book assets above $50M and the Target Federal Fund Rate changes during 1990 to 2015. We do not find that the value-weighted index is affected by change in interest rates. We find that increases in interest rate tends to hurt firms with higher book leverage (debt divided by total assets) than firms with low leverage. Unfortunately, these results do not seem to be robust, and we believe that the major reasons for that is that we use the full interest rate change, rather than the unanticipated component of interest rate change, which is unobservable.

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1: Introduction

1.1 Federal Reserve Policy Rate

To promote a strong and stable U.S economy, the monetary policy implemented by the U.S Federal Reserve (the Fed) serves three main objectives: 1) maximize sustainable employment, 2) stabilize prices (control inflation), and 3) set up moderate long-term interest rates. Inside the Fed's monetary policy toolbox, the Fed influences the general financial conditions by setting the U.S. Federal Reserve Policy Rate, which is the interest rate that banks pay to one another for overnight loans.

The level of interest rate has direct impact on the U.S. economy. The consumer spending weighs over 70% of the whole economy. One of the main effects of interest rate on the U.S. economy is the borrowing costs between institutions or individuals. For consumers, the lower the interest rate, the cheaper it is for individuals to obtain a mortgage on a new home or borrow money to buy a new car. For businesses, a lower interest environment will reduce the funding cost which in return encourages to expand their productions capability and more business investments in general. On the other hand, the higher the interest rate, the more expensive for individuals and businesses to borrow because they can choose to save rather than to invest, which in turn, slows down the overall economic development. But the consequence of saving more and investing less can also preserve price stability by lowering inflation pressures.

Assuming higher corporate earnings have a positive impact on stock prices. Based on the above intuition, the change in Federal Reserve Policy Rate is expected to have effects on the pricing of stock market following the announcement of a change in the policy rate through the change of borrowing cost to individuals and businesses. A lower interest rate and borrowing cost should be more favourable to companies with higher financial leverage compared to companies with lower financial leverage. This article examines the effect of a change in interest rate on the stock return of companies with different financial leverage.

Numerous research has been done on the effect of interest rate on the stock market return, but most of the research examines the relationship at a macroeconomic level (Alam and Uddin, 2009, Bernanke and Kuttner, 2005, and Thorbecke, 1997, etc.) instead of at individual company

level. This article tries to fill the gap in the literature by analyzing the interest rate effect on the cross-section of companies.

1.2 Literature Review Literature Review

1.2.1 Relationship between Interest Rate Change and Equity Return

Bernanke and Kuttner (2005) found that stock market reacts immediately only to unanticipated Target Federal Fund Rate change, but not anticipated rate change. Specifically, they found that a hypothetical unanticipated 25 basis point change in Fed rate is associated with 1% increase in the broad stock index.

Bernanke and Kuttner (2005) used the prices of Federal funds futures contracts to measure the surprise element of the rate change and therefore differentiate unanticipated rate changes from anticipated ones. They looked at the Fed rate changes between June 1989 and December 2002. (In total, there are 131 observations of FOMC meetings, including ones with no change of Fed rate). To find the significant relationship between the rate change and stock market price, they run a regression of the daily CRSP value weight return of the announcement date on the raw change in Federal fund rate changes, which were divided into unanticipated and anticipated components. The regression result showed that the stock market responds to the unanticipated components significantly, whereas insignificantly responds to the anticipated components.

The explanation of the relationship between Fed rate change and the stock market is that monetary policy surprise would affect the expected future excess returns or expected future dividends, which affect the stock price. Monetary policy surprise affects expected future excess returns by raising the expected equity premium. This can be interpreted in two ways. Firstly, for example, increasing Fed rate will raise companies' interest cost and therefore weaken their balance sheet and increase the riskiness of the stocks, which would increase the shareholder required return and reduce the price. Secondly, when Fed rate increase, the bond market becomes more attractive to investors, which means equity investors would require a higher return as compensation for their opportunity cost if investing in the bond market. The increased opportunity cost leads to a reduction in price.

Thorbecke (1997) investigated the relationship between monetary policy andmarket index returns over the period of 11 August 1987 to 31 December 1994. The empirical analysis

found that there is a statistically significant negative relation between federal rate changes and return in the DJIA and DJCA, where the return is the percentage changes in the indexes over the 24 hours bracketing the news of federal fund rate change.

Bernanke and Kuttner (2005) and Thorbecke (1997) is similar to our paper in a way that they use short-term (one-day) stock market change. Bernanke and Kuttner (2005) used one day value-weighted return on the interest rate change date. Thorbecke (1997) used 24-hour price change following the time of the interest rate change. There are also papers examine the long-term effect of interest rate on stock market change (Alam and Uddin, 2009 and Moya-Martíneza et al, 2009), which will be discussed next.

Alam and Uddin (2009) calculate the month by month change of Bank Deposit Rate from January 1988 to March 2003, and calculate the month by month change of Stock Exchange Index in each country, and they run a regression of stock price changes on the interest rate changes. They did it for fifteen developed and developing countries- Australia, Bangladesh, Canada, Chile, Colombia, Germany, Italy, Jamaica, Japan, Malaysia, Mexico, Philippine, S. Africa, Spain, and Venezuela. They found that individual country results are mixed. For Malaysia, they found that change of interest rate has a negative relationship with changes of share price, whereas in eight of the countries: Australia, Canada, Chile, Germany, Jamaica, Mexico, Spain, and Venezuela, no relationship between changes in interest rate and changes of share price exists.

Moya-Martíneza, Ferrer-Lapeñab, and Escribano-Sotos (2009) examines the relation between changes in 10-year Spanish government bond yield and industry equity returns through wavelet analysis and found an inverse relationship between bond yield and equity return, but industries vary regarding the extent of interest exposure. For example, the Utilities, Real Estate, Banking, Food, and Beverages are the most vulnerable to interest rate risk, while other industries such as Chemicals and Paper, Industrials and Health Care are much less influenced by interest rate change.

1.2.2 Relationship between Leverage and Stock Return

There is much research relates to the long-term effect of leverage and equity return, but in our research, we do not examine the long-term effect. Bhandri(1998) found a positive correlation between leverage (non-common equity liabilities to market value of equity) and expected common stock return of companies traded on the New York Stock Exchange (NYSE). The expected return is the monthly real return (adjusting nominal return by inflation). Bhandri(1998) controlled for beta and firm size and included as well as excluded January effect. They rank

samples by BETA into three groups, then divide each BETA subgroups into three groups by firm size, then divide each sub-subgroup into three groups by leverage ratios, so a total of 27 groups. Because there is a high variability of the correlation between BETA and leverage ratios across time and industry due to the large leverage employed by many finance, real estate, and insurance companies, so Bhandri(1998) run another regression on manufacturing firms only (low BETA and leverage ratio variability).

The common three-factor model considers book-to-market equity value when explaining stock returns. Fama and French (1992&1995) shows that firms with high book-to-market equity value tend to be poor earners compared to low book-to-market equity value firms, which is consistent with Chen and Zhang (1998). Therefore, book-to-market equity value has effect on the stock return, so we need to consider both the book leverage (long-term debt to total book value of assets) and market leverage (total debt to market equity value). One interesting finding by Griffen and Lemmon (2002) is that firms with high distress risk tend to have larger return reversals around earnings announcement.

1.2.3 Other related literature

The most affected sector by interest rate is the finance and banking sector. Many articles examine the profitability of finance sector given the interest rate level (Elyasiani and Mansur, 1998 and Angbazo, 1997, etc.). Flannery and James (1984) develops a model that analyze the relationship of interest rate sensitivity of stock returns and the size of maturity/ duration difference of firm's assets and liabilities (i.e., the maturity composition of net nominal assets, assuming duration equals maturity for discussion simplicity), and finds the result to be positively correlated. Based on Fama(1975), Fama and Gibbons(1982), and Nelson and Schewert(1975) argument that unanticipated changes in interest rate result primarily from changes in inflationary expectations, a relationship between common stock returns and interest rate changes should exist because of the redistributive effects of unanticipated inflation and unanticipated changes in expected inflation (French et al.,1983 and Christie,1982).

Other things equal, unanticipated inflation affect the real value of net nominal asset but not the net real asset because nominal assets are assets generate fixed cash flow in nominal terms, and real assets generate return with the price level. Therefore, shareholders of banks with higher net nominal assets should suffer from unexpected inflation, and shareholders of banks with lower net nominal assets are better off. Because the cash flows of nominal assets and liabilities are discounted using nominal interest rate, unexpected change in expected inflation will change the

nominal and real value of net nominal assets. In conclusion, the cross-sectional variation in the effect of unanticipated interest rate change on stock return should be influenced by net nominal assets since unanticipated changes in the level of interest rates result from changes in inflation expectations (Fama, 1975, Fama and Gibbons,1982, and Nelson and Schewert, 1975). Flannery (1981) finds that market interest rate fluctuations have a negative impact on the profitability of commercial banks since large banks have effectively hedged themselves against interest rate risk by matching maturities of assets and liabilities.

Many studies find a negative relationship between stock prices and interest rate changes. However, our paper doesn't find a negative correlation. The distinction between what we do and past studies are in two ways.

First, this paper doesn't differentiate the anticipated interest rate changes from unanticipated changes. Bernanke and Kuttner (2005) found that US stock market only reacts to the unanticipated Fed rate change, but not anticipated ones. That means if this paper classifies all interest rate changes into two groups (unanticipated and anticipated Fed rate changes) and does regression separately, we might see a negative correlation between unanticipated Fed rate change and stock price changes. But in this paper, we make an assumption that all interest rate changes are unanticipated, so no reclassification of interest rate change is made.

Second, this paper analyses what is the immediate (one-day) effect of an interest rate change on equity index return, and many other studies do monthly return analysis on the effect of interest rate changes. For example, Alam and Uddin (2009) found that, in Malaysia, the change of interest rate has a negative relationship with stock return, but the calculation of stock return is different from this paper. Instead of immediate (one-day) return of equity index on the days of rate change, they used monthly average stock price to calculate returns.

2: Data and Methodology

2.1 Data

All data are collected between the period Jan 1st, 1990 to Dec 31st, 2015 because we want to study the past 25 year's historical behavior of the U.S. stock market and covering the lowest historical interest rate period, which is following the 2008 Financial Crisis until 2015.

2.1.1 Interest Rate Change Data

We find the exact dates of the interest rate announcements between Jan 1990 and Dec 2015 from http://www.fedprimerate.com/fedfundsrate/federal_funds_rate_history.htm. The interest rate we use in our regression model estimation is the Target Federal Funds Rate. We only include dates where there is a change in Fed fund rate (if no change in target rate, we do not include it in our regression). In the regression model, we define interest rate change, as Rate Change, such that 25 basis point decrease will be negative 0.0025 (no unit) in our regression model value and 25 basis point increase will be positive 0.0025 (no unit) in our regression model.

Table 2-1: Descriptive statistics of Target Fed Fund Rate and Target Fed Rate Change

In total, there are 79 changes between Jan 1990 to Dec 2015. In total, there is 47 decreases in interest rates and 32 increases in interest rates.

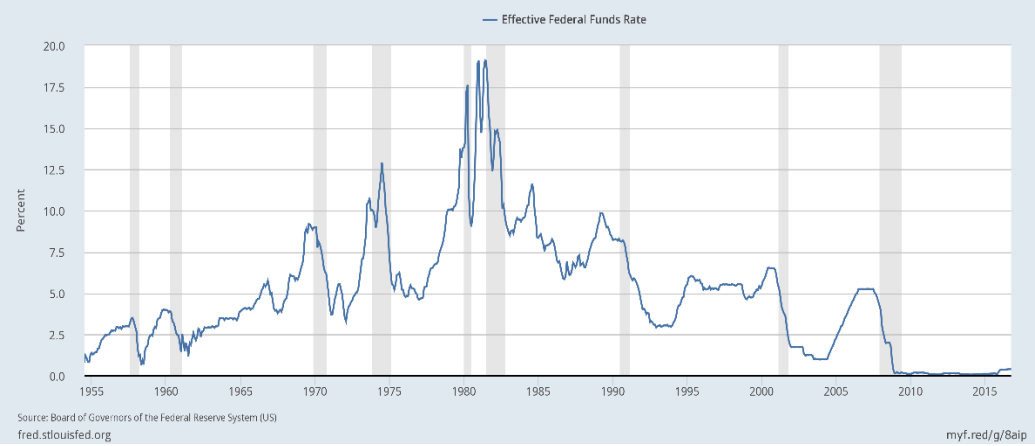
p5, p25, p50, p75 and p95 means the percentile; SD means standard deviation. Min is the minimum and max is the maximum. N is the number of observations. Mean is the average. Those apply to all tables in this article.

	N	Mean	SD	p5	p25	p50	p75	p95	Min	Max	Skewness
Rate Change	79	-0.000981	0.003568	-0.005	-0.0025	-0.0025	0.0025	0.005	-0.0075	0.0075	0.18
Fed Target Rate	79	0.041741	0.017797	0.01	0.03	0.045	0.055	0.0725	0.0025	0.08	-0.16

The reason that we choose Target Federal Funds Rate is that it is very influential to the economy. The Target Fed Fund Rate affect the EFFR (Effective Federal Funds Rate). The EFFR is calculated as a volume weighted median of rates that depository institutions, such as banks, charge each other for short-term (overnight) loans. The EFFR is a central interest rate in the U.S. market that has a strong influence on other interest rates such as prime rate (set by individual banks for the use of many types of business loans or consumer loans). Additionally, the federal fund rate also affects the Discount Window Primary Credit Rate (a rate that financial institutions

lend from the Federal Reserve, commercial paper rate issued by U.S. corporations, and U.S. government securities rate.

Figure 2-1: Effective Federal Funds Rate from July 1954 to October 2016



2.1.2 Balance Sheet Data

To determine leverage, we use balance sheet data from COMPUSTAT ANNUAL file. We collect the total liabilities, total long-term debt, total common equity, and total asset of companies in the entire data base.

2.1.3 Daily Stock Data

We collect securities daily holding period return, ticker, the number of shares outstanding, and price from CRSP in the entire data base. We calculate 3-day gross return as follows: We find the holding period return on the announcement date, before the announcement date, and after the announcement date of the Federal Reserve target rate change. Then we set the announcement date as t, then find three-day gross return centered on the announcement day by multiplying holding period returns. The equation is as below.

$$3-day\ gross\ return = \left(1 + return_{daybefore}\right) \times \left(1 + return_{after}\right) \times \left(1 + return_{day}\right) - 1$$

We then calculate market equity or market capitalization as the product of the shares outstanding and price. Because we want to make sure our securities to have less noise as possible, we excluded entries with market equity below USD 50 million (negative price is automatic excluded). We also collect daily Value Weighted Return including and excluding distributions from CRSP.

By collecting last prices on the trading day before the interest rate announcement and last prices on the trading day after the interest rate, we assume that investors are rationale and react immediately to the effect of the change in interest rate on companies' cash flow and discount rates. We note that sometimes the Federal Reserve announce their interest rate change on a Friday afternoon, when the stock exchange stopped, or announce it right before a statutory holiday so that investors have to wait more than a day to Trade on the information.

Table 2-2: Descriptive statistics on corporate balance sheet data and stock return

Numbers shaded in the grey area have units in millions of dollars.

	Total Long Term Debt	Total Liabilities	Common Equity	Total Debt	Market Equity	3-day Gross Return
N	193009	193009	193009	193009	193009	193009
Mean	1393.70	7932.15	1706.13	9737.45	3547.74	0.01
SD	9432.99	72996.02	6899.87	77421.97	16247.45	0.07
p5	0.00	7.21	23.53	40.42	64.49	-0.09
p25	0.90	56.22	85.28	182.94	158.20	-0.02
p50	70.38	343.76	236.93	671.16	452.87	0.00
p75	471.47	1663.82	849.07	2646.61	1615.22	0.03
p95	4925.69	16930.00	6976.42	25175.00	13473.55	0.11
Min	0.00	0.00	0.00	0.00	50.00	-0.82
Max	393265.60	3589783.00	233932.00	3771200.00	620757.31	2.13
Skewness	20.70	23.64	12.26	22.54	1.63	13.8

2.2 Methodology

2.2.1 Leverage Ratio Variables

We have six leverage ratios in total. The first set is total long-term debt over total assets and total liabilities over total assets. The second set is total long-term debt over market equity and total liabilities over market equity, where market equity equals shares outstanding times the price of the stock on that day, collected from CRSP. The third set is total long-term debt over total common equity and total liabilities over total common equity. In addition to book value of equity, we do also market value of equity and check market leverage – it is the more important leverage one wants to have.

Table 2-3: Descriptive statistics on calculated leverage ratios

DEratio = Total Liabilities/Book-Value of Equity

LDEratio = Long-term Debt/Book-Value of Equity

DAratio = Total Liabilities/Total Asset

LDAratio = Long-term Debt/Total Asset

DMEratio = Total Liabilities/Market-Value of Equity

LDMEratio = Long-term Debt/Market-Value of Equity

	N	Mean	SD	p5	p25	p50	p75	p95	Min	Max	Skewness
DAratio	193009	0.52	0.26	0.11	0.31	0.52	0.71	0.92	0.00	1.02	0.01
LDAratio	193009	0.16	0.17	0.00	0.00	0.10	0.26	0.51	0.00	0.96	1.18
DEratio	193009	3.75	200.59	0.12	0.45	1.11	2.61	12.41	0.00	87701.50	433.10
LDEratio	193009	1.39	171.77	0.00	0.01	0.28	0.84	2.74	0.00	75264.25	435.88
DMEratio	193009	7.58	132.38	0.03	0.17	0.55	1.75	10.04	0.00	17413.46	48.15
LDMEratio	193009	1.29	17.06	0.00	0.00	0.14	0.51	2.22	0.00	1757.50	45.75

We do not adjust the long-term debt since all types of long-term debt contribute to the capital structure of a firm. For equity, we use the total common equity of each firm from COMPUSTAT that includes common stock, capital surplus, retained earnings, and treasury stock adjustments for both common and nonredeemable preferred stock.

The company balance sheet data is annual data on the year of the interest rate announcement. The assumption here is that the debt structure of firms does not exhibit significant change that would alter our result.

2.2.2 T-test on Overall Market Return

Before performing regression on the firm-specific level, we run a t-test on interest rate change and market return. We define interest rate into two groups by whether there is an increase in rate or decrease in rate (up=1 means increase, up=0 means decrease).

The table below demonstrates the result. As we can see from the table, based on our classification of interest rate change, there is no relationship between the decrease or increase of interest rate and the market return. To make sure we are not making mistakes in our t-test model, we run a regression (included in Appendix) of one day return on to interest rate change (no units). The result shows that there is no significant relationship between market index return and change in interest rate.

Table 2-4: T-test on market index returns and interest rate change

Mean is the average 3-day gross return on the Value Weighted Return Index including distributions

T-test on other market indices returns (S&P500, DOW JONES, NASDAQ, and Russell 3000) and interest rate change are also used and attached in the appendix, but no significance discovered as well.

	Obs.	Mean	SD	95% Conf. Interval	
Interest Rate Decrease (down)	47	0.006174	0.035508	-0.00425	0.0166
Interest Rate Increase (up)	32	0.007324	0.014923	0.001944	0.012704
Difference between up and down		-0.00115		-0.0144	0.0121
t-stats		-0.1728			

* p<0.05, ** p<0.01, *** p<0.001

2.2.3 T-test on Three-day Gross Return with High/Low Leverage Ratios and Market Cap

We want to examine the relationship between leverage ratios and stock return of companies during the interest rate change. To do so, we classify leverage ratios into high leverage and low leverage by separating high leverage and low leverage each year from the year 1990 to the year 2015. We define interest rate into two groups by whether there is an increase in rate or decrease in rate (up=1 means increase, up=0 means decrease). Then we run a t-test of interest rate change and three-day gross return by the high/low leverage specified each year.

Table 2-5: T-test on stock returns and interest rate change based on leverage and market cap

Mean is the average 3-day gross return. Mean difference between up and down is the mean difference between average 3-day gross return during interest rate decrease (up=0) and average 3-day gross return during interest rate decrease (up=0). Down represents interest rate decrease and up represents interest rate increases

Significant differences are in bold text.

Panel A: T-test Based on High and Low Leverage Ratios.

For each year from 1990 to 2015, leverage ratios are classified into two groups: low leverage and high leverage, and we assign low leverage as 1 and high leverage as 2.

		Mean difference between up and down	t-statistics of mean difference	Interest Rate change	Obs.	Mean
Total liabilities Over Total assets	Low leverage	-0.00031	-0.63	Down	51661	0.00870
				Up	47317	0.00901
	High leverage	0.00074	1.77	Down	50137	0.00683
				Up	43894	0.00608
Long-term debt Over Total assets	Low leverage	0.00002	0.04	Down	50472	0.00830
				Up	47721	0.00828
	High leverage	0.00041	0.95	Down	51326	0.00726
				Up	43490	0.00685
Total liability Over Book common equity	Low leverage	-0.00034	-0.68	Down	49014	0.00875
				Up	44871	0.00909
	High leverage	0.00072	1.74	Down	52784	0.00688
				Up	46340	0.00616
Long term debt Over book Common equity	Low leverage	-0.00019	-0.37	Down	48726	0.00861
				Up	45157	0.00880
	High leverage	0.00058	1.41	Down	53072	0.00702
				Up	46054	0.00643
Total liability Over Market equity	Low leverage	-0.00029	-0.58	Down	50975	0.00878
				Up	43722	0.00907
	High leverage	**0.00152*** **	3.57	Down	50823	0.00677
				Up	43863	0.00525
Long term debt Over Market equity	Low leverage	-0.00047	-0.97	Down	49830	0.00866
				Up	47781	0.00913
	High leverage	**0.00101***	2.36	Down	51968	0.00693
				Up	43430	0.00592

* p<0.05, ** p<0.01, *** p<0.001

Panel B: T-test Based on Market Cap. M represents unit in millions of dollars

		Obs.	Mean	SD	95% Conf.	Interval
50M< Market cap <100M	Interest rate down	15806	0.0080962	0.092615	0.006652	0.00954
	Interest rate up	12287	0.0055056	0.066704	0.004326	0.006685
	Difference		**0.0025906****		0.000651	0.004531
	t-statistics		2.6174			
100M≤ Market cap <200M	Interest rate down	16487	0.0047446	0.087932	0.003402	0.006087
	Interest rate up	14467	0.0058805	0.060598	0.004893	0.006868
	Difference		-0.0011359		-0.00284	0.00057
	t-statistics		-1.3054			
200M≤ Market cap <500M	Interest rate down	22306	0.0074761	0.086015	0.006347	0.008605
	Interest rate up	19279	0.0071015	0.057925	0.006284	0.007919
	Difference		0.0003746		-0.00106	0.001807
	t-statistics		0.5126			
500M≤ Market cap <2000M	Interest rate down	25802	0.0096931	0.080966	0.008705	0.010681
	Interest rate up	24577	0.008793	0.04982	0.00817	0.009416
	Difference		0.0009002			
	t-statistics		1.4942			
2000M≤ Market cap	Interest rate down	21397	0.0078885	0.071603	0.006929	0.008848
	Interest rate up	20601	0.0091073	0.039572	0.008567	0.009648
	Difference		**-0.0012189***			
	t-statistics		-2.1478			
Total		193009				

* p<0.05, ** p<0.01, *** p<0.001

Based on the above table, high leverage ratios using market equity show a significant reaction to interest rate change announcement, and companies with market cap of 50M to 100M or over 2000M show significant stock return reactions. It is possible that large cap firms have an advantage with higher interest rates because they have a competitive advantage because they may have favourable borrowing terms.

2.2.4 Regression using Leverage Ratios

The regression model we are using is a simple linear regression. The following equation forms the basis of our tests:

$$Three\ Day\ Return_i = \alpha + \beta_1 RateChange + \beta_2 Leverage\ Ratio_i + \beta_3 InterRatios_i$$

Where Leverage Ratio is defined as in previous section 2.2.1, subscript i represents the company in the North American market, InterRatios is the product of interest rate change and Leverage Ratio. RateChange is interest rate change, such that 25 basis point decrease will be negative 0.0025 (no unit) in our regression model value and 25 basis point increase will be positive 0.0025 (no unit) in our regression model.

Table 2-6: Regressions of stock return with interest rate change, leverage ratios and product of interest rate change and leverage ratios

Panel A: Regression with robust errors, clustering permno

	DEratio interDE	LDEratio interLDE	DAratio interDA	LDAratio interLDA	DMEratio interDME	LDMEratio interLDME
Rate Change	-0.205***	-0.225***	0.206*	-0.102*	-0.229***	-0.232***
	(0.0451)	(0.0439)	(0.106)	(0.0618)	(0.0438)	(0.0439)
Leverage Ratio	-3.31e-05**	-5.70e-06	-0.00571***	-0.00397***	-5.49e-07	8.73e-06
	(1.58e-05)	(1.75e-05)	(0.000590)	(0.000847)	(6.14e-07)	(8.54e-06)
InterRatio	-0.00662**	-0.00112	-0.838***	-0.803***	0.000434***	0.00502
	(0.00315)	(0.00350)	(0.174)	(0.269)	(0.000168)	(0.00372)
Observations	193,009	193,009	193,009	193,009	193,009	193,009
R-squared	0.000	0.000	0.001	0.000	0.000	0.000

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Regression with Year Fixed Effects and Firm Fixed Effects

	DEratio interDE	LDEratio interLDE	DAratio interDA	LDAratio interLDA	DMEratio interDME	LDMEratio interLDME
Rate Change	-1.586***	-1.586***	-1.208***	-1.448***	-1.585***	-1.589***
	(0.124)	(0.123)	(0.160)	(0.132)	(0.124)	(0.124)
Leverage Ratio	1.21e-05	0.00303	-0.00374**	-0.00448**	5.84e-07	-8.27e-06
	(1.13e-05)	(0.00350)	(0.00184)	(0.00203)	(1.94e-06)	(1.59e-05)
interRatio	0.00280	1.52e-05	-0.723***	-0.844***	0.000272	0.00430
	(0.00264)	(1.75e-05)	(0.186)	(0.288)	(0.000176)	(0.00480)
Observations	193,009	193,009	193,009	193,009	193,009	193,009
R-squared	0.059	0.059	0.059	0.059	0.059	0.059
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel C: Regression with Month Fixed Effects and Firm Fixed Effects

	DEratio interDE	LDEratio interLDE	DAratio interDA	LDAratio interLDA	DMEratio interDME	LDMEratio interLDME
Rate Change	-0.576***	-0.576***	-0.190*	-0.463***	-0.576***	-0.580***
	(0.0497)	(0.0497)	(0.115)	(0.0681)	(0.0497)	(0.0498)
Leverage Ratio	9.52e-06	0.00255	-0.00225	-0.00181	1.01e-06	-5.09e-06
	(1.12e-05)	(0.00330)	(0.00188)	(0.00206)	(1.93e-06)	(1.80e-05)
InterRatio	0.00226	1.25e-05	-0.740***	-0.695**	0.000235	0.00431
	(0.00260)	(1.65e-05)	(0.187)	(0.291)	(0.000170)	(0.00450)
Observations	193,009	193,009	193,009	193,009	193,009	193,009
R-squared	0.067	0.067	0.067	0.067	0.067	0.067
Month FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3: Result Analysis

3.1 Long-Term Debt to Common Equity and Total Liabilities to Common Equity

Based on the result presented in panel A Table 2.2.4, we can see that the coefficient on the change in interest is significantly different from zero. It means that for every point increase in interest rate, there is a significant decrease in the stock return, holding all other variables constant.

The coefficient on the interest rate change (Rate Change) is negative, so it means that a decrease in the interest rate change will cause stock return increase. This is to some extent expected as a decrease in interest rate sends a positive signal to the stock market. With lower interest rate, it means expansionary monetary policy is going forward. With expansionary monetary policy, the overall demand in the U.S. economy will go up. It will be cheaper for businesses and individuals to borrow, which will encourage businesses to expand and individual consumers to spend more. The lowering of interest rate also help to decrease mortgage interest repayments which increase the households' disposable income; lowering interest rate will lower the market's willingness to save; lowering interest rate also decreases the exchange rate of the U.S. dollar against other curricles, which will lower the cost exports.

However, when we look at the leverage ratios, which represent by the total liability to equity ratio, its coefficient is negative and so is the interRatios. For total liability to common equity ratios, these numbers are significantly different from zero. This finding does not relate to our research goal because it means regardless the interest rate movement, the lower the leverage, the higher the return.

Our initial belief is that the higher the total liability to common equity ratio, the more profitable a firm should be perceived as by the general market following an interest rate decrease. The significant negative coefficient on interRatios confirms our belief.

3.2 Long-Term Debt to Total Asset and Total Debt to Total Asset

Based on the regression table, the coefficients on interaction term of total liability/total assets and long-term debt/total assets with interest rate change (interDA and interLDA) are significant using different regression techniques (robust errors, year fixed effect or month fixed effect). The significant negative coefficient on interRatios confirms our belief that the higher the leverage ratio, the more profitable a firm should be perceived as by the general market following

an interest rate decrease. Now, this result reinforces our previous finding of a positive correlation between total liability/common equity and stock return during interest rate change.

3.3 Long-Term Debt to Market Equity and Total Debt to Market Equity

All the coefficients on leverage ratios in this set do not show significance. The interDME shows significance when we use robust errors, but not in month fixed effects and year fixed effects. The interLDME ratio shows no significance regardless the regression techniques. The inconsistency in this set does not provide many strong results for our research.

4: Conclusion

This paper focuses on the effect of interest rate change on companies with different financial leverage. We found a positive relationship between a company's financial leverage and its stock price when interest rate decreases and a negative relationship between a company's financial leverage and its stock price when interest rate increases.

However, when we put all the individual companies with different financial leverage together, we did not discover a significant impact of the change in interest rate on the overall stock market returns. The main reason could be that we did not separate the unanticipated effect of interest rate change and anticipated effect of interest rate change. We assume all the results of the interest effect is unanticipated meaning that, all announcements are surprises to the market. If the result of the interest rate change announcement is fully anticipated by the market, there should be no change in the overall stock market returns. On the other hand, if the result of the interest rate change announcement is unanticipated, the market should theoretically adjust to the new expectations of interest rate effect on the overall economy or stock market as shown in some of the research papers (Bernanke and Kuttner, 2005 and Flannery and James, 1984)

It is also possible that our overall stock return profile or individual stock return profile is inaccurate. As demonstrated by Thorbecke (1997), the change in Fed Fund Rate does have an effect on the price of DOW JONES INDUSTRIAL AVE. 24 hours following the announcement time. For future research, we could collect more accurate stock prices data relating to the announcement if it is possible, such that price immediately before the announcement and 24 hours following the announcement.

The insignificant relationship of interest rate change and overall stock market return in our finding can also be partly explained by the existence of the long-term effect. It is possible the market wait for some time before investing according to the interest rate change. Or there could be a ripple effect for interest rate change to be significant in the market since it takes time for businesses and individuals to take new loans or decrease borrowings.

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6: Appendix

Table 6-1: T-test of interest rate change and market index returns

	One Day Return					
Index	VWRET Including Distribution	VWRET Excluding Distribution	S&P500	NASD	RUSSELL	DJ
Mean Difference (mean down-mean up)	0.00127	0.00125	0.000574	0.00191	0.000731	0.00162
t-statistics	0.35	0.35	0.17	0.47	0.22	0.49
	Three-day gross					
Index	VWRET Including Distribution	VWRET Excluding Distribution	S&P500			
Mean Difference (mean down-mean up)	0.001025	0.000948	0.0007351			
t-statistics	0.17	0.16	0.12			

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 6-2: Target Fed Fund Rate change information

Date of Announcement	Federal Fund Rate	Change in Federal Fund Rate	Date of Announcement	Federal Fund Rate	Change in Federal Fund Rate	Date of Announcement	Federal Fund Rate	Change in Federal Fund Rate
1990-01-01	8.25		1995-12-19	5.5	-0.25	2004-09-21	1.75	0.25
1990-07-13	8	-0.25	1996-01-31	5.25	-0.25	2004-11-10	2	0.25
1990-10-29	7.75	-0.25	1997-03-25	5.5	0.25	2004-12-14	2.25	0.25
1990-11-14	7.5	-0.25	1998-09-29	5.25	-0.25	2005-02-02	2.5	0.25
1990-12-07	7.25	-0.25	1998-10-15	5	-0.25	2005-03-22	2.75	0.25
1990-12-19	7	-0.25	1998-11-17	4.75	-0.25	2005-05-03	3	0.25
1991-01-08	6.75	-0.25	1999-06-30	5	0.25	2005-06-30	3.25	0.25
1991-02-01	6.25	-0.5	1999-08-24	5.25	0.25	2005-08-09	3.5	0.25
1991-03-08	6	-0.25	1999-11-16	5.5	0.25	2005-09-20	3.75	0.25
1991-04-30	5.75	-0.25	2000-02-02	5.75	0.25	2005-11-01	4	0.25
1991-08-06	5.5	-0.25	2000-03-21	6	0.25	2005-12-13	4.25	0.25
1991-09-13	5.25	-0.25	2000-05-16	6.5	0.5	2006-01-31	4.5	0.25
1991-10-10	5	-0.25	2001-01-03	6	-0.5	2006-03-28	4.75	0.25
1991-11-06	4.75	-0.25	2001-01-31	5.5	-0.5	2006-05-10	5	0.25
1991-12-11	4.5	-0.25	2001-03-20	5	-0.5	2006-06-29	5.25	0.25
1991-12-20	4	-0.5	2001-04-18	4.5	-0.5	2007-09-18	4.75	-0.5
1992-04-09	3.75	-0.25	2001-05-15	4	-0.5	2007-10-31	4.5	-0.25
1992-07-02	3.25	-0.5	2001-06-27	3.75	-0.25	2007-12-11	4.25	-0.25
1992-09-04	3	-0.25	2001-08-21	3.5	-0.25	2008-01-22	3.5	-0.75
1994-02-04	3.25	0.25	2001-09-17	3	-0.5	2008-01-30	3	-0.5
1994-03-22	3.5	0.25	2001-10-02	2.5	-0.5	2008-03-18	2.25	-0.75
1994-04-18	3.75	0.25	2001-11-06	2	-0.5	2008-04-30	2	-0.25
1994-05-17	4.25	0.5	2001-12-11	1.75	-0.25	2008-10-08	1.5	-0.5
1994-08-16	4.75	0.5	2002-11-06	1.25	-0.5	2008-10-29	1	-0.5
1994-11-15	5.5	0.75	2003-06-25	1	-0.25	2008-12-16	0.25	-0.75
1995-02-01	6	0.5	2004-06-30	1.25	0.25	2016-12-16	0.5	0.25
1995-07-06	5.75	-0.25	2004-08-10	1.5	0.25			