The Effects of Quantitative Easing on Stocks with Differing Equity Duration

An Honors Thesis (HONR 499)

by

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Abstract

This paper studies the effects of U.S. government quantitative easing programs on equities with differing equity durations. I use multiple linear regression to uncover the relationship between equity duration and quantitative easing. The findings indicate that firms with higher equity duration experience greater returns when Fed bond holdings increase and when the Fed announced the first quantitative easing program in 2008. I also find that high durations stocks outperform low duration stocks when interest rates fall. However, the analysis indicates that high duration stocks underperform in tapering periods. Robustness checks confirm these results and the economic significance of the findings.

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1. Process Analysis Statement

Like most young kids, I was always interested in the lives of adults around me. My natural curiosity led me to ask many questions, especially about their jobs. The person I peppered the most with my inquiries was my dad, who worked as a CFO. My interest led him to start teaching me about finance. In grade school, I would spend hours with him watching CNBC and other financial news networks, learning about the stock market, and slowly understanding why it went up and down. As I got older, my passion for finance grew, and as a freshman in college, I decided to turn that passion into my future career.

My idea for this thesis subject came from a conversation with my dad during the summer of 2020 while COVID was at its peak. Despite unemployment at an all-time high, lower consumer purchasing power, supply chain shortages protected out to 2022 or even 2023, and several other negative economic indicators, major stock market indexes were rebounding at an unprecedented rate from the historic losses they had taken. As a finance major and an investor myself, I was puzzled about how that could happen. The one factor that stood out to me was the U.S. government's monetary policy. The government had cut rates and set aside trillions for various programs designed to weather the economic storm. I wanted to quantify this impact on the stock market but did not know how to go about it.

I did some initial research with my advisor, Professor Houston, and we decided I could use a regression model to find the correlations between different variables related to government spending and equities. However, multiple academics have already researched the relationship between quantitative government easing and stock returns. Since I wanted to do research that had not been done before, I decided to add another element to the project, a variable known as equity duration. With the focus of our research finalized, the data gathering process started. Collecting the data for our variables was not tricky because several significant databases such as CRSP and Compustat store information like historical stock returns and other financial data. The most complicated variable to gather data on was government asset purchases. I was hoping to find a detailed schedule of the monthly dollar amounts of bonds purchased by the federal reserve, but I could not find any such information. Instead, I found a database that listed out total Fed assets each month and decided that I could approximate bond purchase amounts by calculating the change in Fed assets using those numbers.

Once data collection was done, the difficulty ramped up significantly. I developed a literature review and read prior research to gain a deep understanding of the financial concepts I would write about. This was by far the most challenging part of the process. Many of the concepts at play in these academic papers were foreign to me, so I had to teach myself the concepts I was reading about gradually. Additionally, the prior research was heavily based on models, so I also had to go through and understand the calculations and models that supported the concepts I was learning. Learning math was slightly more manageable for me since I am naturally analytical, so that I could follow some of the outlined formulas.

Doing all this while also taking classes was quite the challenge, but I overcame it by setting aside time specifically for learning that research. While teaching myself that material, Professor Houston cleaned and sorted the data and then coded a program that calculated the financial variables we required. He also walked me through his coding and explained how the raw data turned into a finished product. This gave me an appreciation for the scale of the project we had undertaken. Our datasets were massive, and even though I had been learning to code, my skills were rudimentary compared to what was needed to process that much data. Running the regressions was relatively straightforward once the data was processed into the variables I needed. After the regressions were run, I interpreted the results with Professor Houston and determined that they supported my hypotheses.

2. Introduction

The United States government first implemented quantitative easing in 2008 to respond to the economic devastation caused by the financial crisis. It quickly became a staple of government monetary policy and has recently been used in response to the COVID-19 pandemic. As the financial markets change, investors constantly look for new ways to understand and potentially predict market activity to generate positive returns. The age of laissez-faire economics is essentially over, and government intervention, even in capitalist economies, has become commonplace during financial hardship. This intervention targets fixed-income assets through large-scale asset purchases (LSAPs), which lower interest rates. These lower rates indirectly make borrowing more manageable, impacting other financial instruments like equities. These widespread effects in the financial markets make this subject very relevant for investors, especially since it is likely that governments will engage in quantitative easing in the future.
It is essential to quantify the impact of quantitative easing for two reasons. First, it helps investors understand how government intervention impacts the financial markets. This, in turn, gives government bodies like Congress and the Fed a way to measure their response to specific economic events to ensure the policy changes they enact are adequate. Second, quantifying the impact of quantitative easing also gives investors an additional model to determine firms' intrinsic value. Of course, this measurement is uniquely nuanced to the period when government intervention occurs. However, it provides value, nonetheless.

I begin quantifying the impact of quantitative easing by looking at the research done by DeChow, Sloan, and Soliman (2004), who developed a measure for implied equity duration. This measure is adapted from the traditional duration measurement used for bonds and is reached by examining the time to maturity of cash flows for a chosen equity. However, this alone gives no insight into my research question: What are the impacts of quantitative easing on stocks with differing equity durations? The existing implied equity duration model requires eight variables, four financial variables, and four forecasting parameters. I build off the implied equity duration model from (DeChow et al., 2004) by using financial data from Q1 2008 through Q4 2020 to calculate all eight variables. I then run through calculations to estimate a firm's implied equity duration. Additionally, I accumulate other variables relating to stock returns and government asset purchases from the Center for Research in Security Prices (CRSP) and the Federal Reserve Economic Database (FRED).

I include all of these variables in several multiple linear regression models. Equity duration is the primary independent variable in each model. The results of these models demonstrate the significance of my findings. I find a negative relationship between equity duration and monthly returns and a positive and significant interaction term between duration and bond holdings. I also find a negative relationship between the percentage change in Fed bond holdings and abnormal returns. Furthermore, since financial markets react to expectations and news, I examine the relationship between equity duration and the Fed announcements of quantitative easing programs and later announcements of tapering. My findings show a significant positive relationship between equity duration and cumulative abnormal returns during the periods prior to and after the quantitative easing program announcements. In addition, when examining quantitative easing tapering announcements, the findings demonstrate a significant positive relationship between equity duration and CAR in the post-announcement window.

3. Hypothesis Development

Quantitative easing programs are enacted to support the United States economy by effectively lowering interest rates through large-scale asset purchases (LSAPs). While these LSAPs focus on fixed income securities, the effects could reverberate throughout the economy and impact equities (Guo, 2015). As the central bank increases asset purchases, bond prices rise, and interest rates fall. However, for publicly traded equities, the impact of these purchases is likely not to be even since different firms have different expected cash flow structures and discount rates.

The intrinsic value should approximate the discounted value of its expected future free cash flows. As free cash flow estimates change, the intrinsic value should change. As interest rates increase, investors should discount the firm's cash flows by a greater amount, thus decreasing the asset's value. While investors have relative certainty when bonds offer cash flows, equities are different. Firms are not obligated to pay dividends or repurchase shares. Different firms are in different stages of their life cycle. Some firms are closer to default, while others' value entirely depends on their growth prospects. This means the timing of expected cash flows differs widely across firms.

$$Intrinsic\ value = \frac{FCF_1}{(1+r)^1} + \frac{FCF_2}{(1+r)^2} + \frac{FCF_3}{(1+r)^3} + \cdots \qquad (1)$$

To measure interest-rate sensitivity, investors often use duration, which is a weighted average time until the mean cash flow. (DeChow et al., 2004) designed a similar measure of interest rate sensitivity for equities, called implied equity duration. Implied equity duration measures the time to maturity of cash flows for a chosen equity. Equity investors expect to take many years to realize that their cash flows are likely to have a high duration of equity. More of the equity's value is based on long-term cash flows instead of short-term cash flows. Companies with higher equity durations tend to be growth stocks and have low returns on equity (DeChow et al., 2004). This makes sense considering companies in the growth stage tend to reinvest their profits rather than pay them out as cash distributions to investors.

It is essential to understand the impact changes in interest rates have on expected cash flows during a finite time horizon. When determining the present value of future cash flows, I use interest rates to discount these cash flows to account for the time value of money. When interest rates increase, cash flows are discounted more heavily and have a lower present value. The same concept applies when interest rates decrease. Cash flows would then be discounted less, and the present value would be higher. When the Federal Reserve implements quantitative easing programs, their LSAPs drive interest rates down (Gagnon, Raskin, Remache, Sack, 2011). In doing so, the government could impact the valuations of high equity duration companies.

The relationship between growth prospects and returns has been hotly debated. Fama and French (1992, 1993) include the book/market ratio in their models and note that value stocks outperform growth stocks. Zhang (2005) argues that value stocks outperform growth stocks because value stocks have more assets in place. It is more challenging to scale back operations during downturns, thus making these assets riskier and justifying the value premium. Similarly, stocks with a short equity duration are expected to receive cash flows sooner than long-duration equities. To achieve this, the firm must expend resources. Capital budgeting projects that the firm has undertaken are likely difficult to unwind, thus making firms that undertake such projects riskier than other firms that have yet to use their growth prospects. Because of this, I expect that stocks with short equity duration should command greater returns than stocks with high equity duration:

Hypothesis 1: Equity duration is negatively related to future returns.

It is well known that the effects of the Federal Reserve's bond purchases are felt through the announcements and expectations in the market and the actual LSAPs themselves (Swanson, 2021). However, as the Federal Reserve purchases bonds and drives down interest rates, the effects of such asset purchases are likely to be felt unevenly by equity investors. Moreover, since there is variability in equity duration, some stocks would be more sensitive to interest rate changes than others. Therefore, I hypothesize that the Fed bond purchases (that decrease interest rates) have a more positive impact on firms with high equity duration:

Hypothesis 2: Stocks with high equity duration outperform stocks with low equity duration in periods when the Federal Reserve purchases bonds.

This hypothesis is a natural transition from our first hypothesis, given that the relationship between cash flows and interest rates has already been discussed. As the government continues to push interest rates down over time by using fiscal tools like LSAPs and direct Federal Funds rate decreases, I would expect that these longer-term changes would more impact cash flows pushed out further into the future.

These long-term fiscal tools were not the only ones the Fed utilized to attempt to aid recovery during and after the financial crisis of 2008. The expectations channel was one of the primary channels through which Q.E. impacted the financial markets (Apergis, 2019). This should not be surprising considering one of the central concepts in finance is the efficient market hypothesis, which proposes that financial markets factor in all available information at any given time (Fama, 1970). As a result, equity prices tend to reflect investor sentiment and expectations, not just company performance, which leads to information being reflected through changes in equity values prior to actual news being released. This same concept applies to quantitative easing programs. The Fed followed a similar series of steps for each Q.E. program, with the first step being forward guidance or an announcement of a possible Q.E. program (Swanson, 2021). Even though no action had been taken, these announcements impacted investor expectations and equity prices. Therefore, when considering the impact of news on equity prices, it is essential to consider the impact of information leakage prior to the actual new release or announcement.

Mamaysky (2018) discusses the importance of Q.E. announcements' time horizons and how different asset classes react to news in different windows.

Prior research has shown that announcement returns negatively correlate with market-to-book ratios (Henseler, Rapp, 2018). This connects back to the original equity duration research performed by DeChow et al. (2004), which demonstrated the book-market ratio to be a proxy for equity duration in firms with low equity growth. Therefore, I can reasonably conclude that announcement returns would positively correlate with the book-to-market ratio since it is the inverse of the market-book ratio. Furthermore, since the book-to-market ratio has been shown to negatively correlate to equity duration (DeChow et al., 2004), I can also conclude that there should be a positive relationship between announcement returns and firms with low equity duration.

Firms with low equity duration should recognize most of their intrinsic value within several years. These companies are usually mature dividend-paying companies with low growth and high return on equity (DeChow et al., 2004). Since these companies are cash cows, they are not as focused on reinvesting for growth and instead pay out their profits to investors. Given that their cash flows are short-term, it would be expected that long-term policies like LSAPs would not as positively impact these companies.

When quantitative easing measures are announced, the beneficiaries should be those whose cash flows are further in the future. Since these future cash flows will be less heavily discounted as interest rates fall, firms with high equity duration should outperform firms with low equity duration:

Hypothesis 3: There exists a positive relationship between equity duration and cumulative abnormal returns around the announcement of quantitative easing.

The Federal Reserve can also signal its intention to sell bonds or slow down asset purchases. When it slows down asset purchases, this is referred to as tapering. If the Federal Reserve announces it will taper bond purchases in the future, investors often expect interest rates to rise since there will be a greater supply of bonds. The expectation of rising interest rates could harm high duration stocks more than stocks with low duration since high duration stocks discount cash flows over longer periods and are thus more sensitive to interest rate risk. I therefore hypothesize:

Hypothesis 4: There exists a negative relationship between equity duration and cumulative abnormal returns around tapering announcements.

4. Data and Methods

I analyze the period from Q1 of 2008 through Q4 of 2020. I collect return data from the Center for Research in Security Prices (CRSP). This dataset includes daily returns, volume information, and exchange information. I collect all accounting data from Compustat. I construct financial ratios using this information. I winsorize all accounting variables at the 1% and 99% levels.

I construct several return measures from the CRSP data. The most basic is the monthly return measure (ret). I also construct an abnormal return measure (abret). The abnormal monthly return is the difference between the security's monthly return and the return on the value-weighted S&P 500 index during the same month. I also construct rolling 3-month and 6-month returns and abnormal returns. The rolling 3-month return is the total return on the security in the next three months. The rolling 6-month return is the total return on the security in the next six months. I follow Model (1) when constructing rolling abnormal returns.

$$abret = ret - vwretd \qquad (1)$$

I collect Federal Reserve balance sheet data from the Federal Reserve Economic Database (FRED) database.[1] FRED provides downloadable datasets on changes and levels of bonds held by the Federal Reserve. I use the percentage change in the value of bonds held by the Federal Reserve during the month as a proxy for quantitative easing (treastpch). Increases in this variable indicate that the Federal Reserve is purchasing bonds. Conversely, decreases in this variable indicate that the Federal Reserve is selling bonds.

My primary independent variable is equity duration. Equity duration represents interest rate risk, like bond duration. The problem is that not all firms pay dividends each quarter. This is different from long-term bonds, which often make semi-annual coupon payments.

I follow DeChow et al. (2004), who build a well-established measure to measure equity duration. The model requires four financial variables and four forecasting parameters. The four financial variables are book value, sales, earnings, and market cap. I require the book value and sales figures to be both current and lagged one year, while earnings and market cap only need to be the current values. The four forecasting parameters are the autocorrelation coefficient for return on equity (ROE), the autocorrelation coefficient for sales growth, expected return on equity, and the long-run GDP rate. The autocorrelation coefficients are based on pooled autoregressions for ROE and sales growth from COMPUSTAT data. The expected return on equity is derived by reverting past ROE to its long-run mean using an autocorrelation coefficient of 0.57. This is a value determined by DeChow et al. (2004) in their initial equity duration estimations and can be considered a mathematical constant. I follow a similar process to find the long-run GDP rate derived by reverting past sales growth to the long-run mean using an

[1] https://fred.stlouisfed.org/

autocorrelation coefficient of 0.24. This value was also determined by DeChow et al. (2004) and can also be considered a mathematical constant for our calculations.

Once all eight variables have been determined, we move through calculations that lead us to a firm's implied equity duration estimation. First, implied equity duration is estimated using a weighted average time to receive cash flows. Next, model (1) details the cash flow calculation (C.F.) in each period. Finally, I calculate cash flow in each period as the firm's earnings minus the change in book value over the period.

$$CF_t = E_t - (BV_t - BV_{t-1}) \tag{2}$$

Each of these values can be forecasted using the parameters we specified above. We estimate current earnings as:

$$E_t = B_{t-1} * ROE_t \tag{3}$$

My calculation for equity duration (D) reflects the average time to receive each cash flow. I discount each cash flow to the present at a set discount rate (0.12). I provide the full model in Model (3). In this equation, t represents the year of the cash flow, r is the discount rate, P is the equity price, and T is the maximum number of periods used in the model (10). For every firm, the terminal value duration will be (T+(1+r)/r) = 19.33.

$$D = \frac{\sum_{t=1}^{T} t * \frac{CF_t}{(1+r)^t}}{P} + \left(T + \frac{1+r}{r}\right) * \frac{P - \sum_{t=1}^{T} \frac{CF_t}{(1+r)^t}}{P} \tag{4}$$

The calculation of finite equity duration for a firm is significantly more involved. I follow DeChow et al. (2004) and use a 10-year time horizon for the forecasting period. Once I estimate each cash flow, discounted to the present at the discount rate, I multiply it by t, which indicates the number of years in the future. Larger values of D indicate greater equity duration and greater interest rate sensitivity. Therefore, firms with high equity duration should be more sensitive to changes in interest rates.

I report the summary statistics of the equity duration and percentage change in bond holdings in Table 1. The average equity duration in our sample is 16.72. The lowest average equity duration occurs in 2013 (15.95 years), while the highest occurs in 2007 (17.14 years). 2007 corresponds to the peak of the expansionary period prior to the 2008 Financial Crisis. My percentage change in Fed bond holdings exhibits more variability. I report the year-over-year percentage change in column 3. The Federal Reserve slimmed down its balance sheet by approximately 31% in 2007. In the following years, the Federal Reserve purchased a significant value of bonds. It was only in 2018 when the Federal Reserve's balance sheet slimmed down again. Bond purchases increased significantly in 2020 due to the emergence of the Covid-19 pandemic and the choice to stimulate the U.S. economy by reducing interest rates.

In Table 2, I report my descriptive statistics. My primary sample contains 824,454 monthly firm observations. First, I report the monthly returns (ret). The average firm in my sample has a monthly return of 1.09%. The average firm has an abnormal return of 0.21%. The Federal Reserve balance sheet is increasing by 0.96% each month, although it increases by as much as 40.12% in one of our sample months. Firms in my sample have a range of equity duration between 5.63 and 29.47 years. They also have an ROA and a cash ratio of 0.42% and 17.8%. The average firm has a market/book ratio of about 2.97, although there is a large degree of dispersion.

In Table 3, I examine the correlations between variables. I find a negative relationship between equity duration and the percentage change in Treasury holdings (-1.9%). Firms with high equity duration are more likely to be small, less profitable, and liquid. They are also likely to be considered growth stocks and have relatively low efficiency (total asset turnover).

5. Results

In Table 4, I regress my return measures on equity duration, the percentage change in Fed bond holdings, the interaction between the two, firm-level controls (γ_i), and industry fixed effects (θ_i). Again, I use 2-digit SIC codes as our industry fixed effect measures. In addition, I cluster standard errors at the firm level.

$$ret = \beta_0 + \beta_1 D_i + \beta_2 treastpch_i + \beta_3 (D_i * treastpch_i) + \beta\gamma_i + \beta\theta_i + \varepsilon_i \quad (5)$$

In Model (1) of Table 4, I find a negative relationship between equity duration and monthly returns. This finding implies that equities with a longer time to generate cash have lower monthly returns. I do not find a significant relationship between the percentage change in Fed bond holdings and returns. However, the interaction term between duration and bond holdings is positive and significant. This finding indicates that when there is an increase in the Fed's bond holdings, consistent with attempts to lower interest rates, firms with higher equity duration experience greater returns than firms with lower equity duration.

In Model (2), our dependent variable is the abnormal return during the month. I find a negative and significant relationship between equity duration and abnormal returns. I also find a negative relationship between the percentage change in Fed bond holdings and abnormal returns, indicating that firms underperform when the Federal Reserve reduces its bond holdings. This is consistent with our expectations since sales of bond holdings would likely increase interest rates and decrease equity valuations. Finally, I also find a positive relationship between the interaction term and abnormal returns.

In Models (3), (4), (5), and (6), I provide robustness tests of my main models. In Model (4), our dependent variable is the rolling 3-month return. In Model (5), our dependent variable is the rolling 3-month abnormal return. Finally, in Models (5) and (6), our dependent variables are the rolling 6-month and rolling 6-month abnormal returns, respectively. I find results quantitatively consistent with those in Model (2) in each model.

My results in Table 4 support Hypotheses 1 and 2. I find a negative relationship between equity duration and returns. I also demonstrate a negative relationship between the interaction term and returns, indicating that high duration stocks outperform low duration stocks when interest rates fall. The economic significance of our findings is quite large. In Model (5), my results indicate that a one-year increase in equity duration for a firm in a year when the Federal Reserve increased bond purchases by 7% would lead to a -0.34% decline in 6-month returns. Next, I examine the effects of the announcement of QE1 (11/25/2008), the first quantitative easing program of the Federal Reserve. I regress my cumulative abnormal returns (CARs) measures on equity duration, firm-level controls, and industry fixed effects. I cluster standard errors at the firm level.

In Model (1), my dependent variable is the cumulative abnormal return from 30 days prior to the announcement until the day. I find a positive and significant relationship between equity duration and the (-30, 0) CAR. This finding indicates that firms with greater equity duration experienced more positive CARs. This is consistent with Hypothesis 3, which indicates the investor response to QE1 would be positive. The announcement likely altered investors' expectations of future interest rates downward.

In Models (2), (3), and (4), my dependent variables are the (-1, 0), (-1, 1), and (-2, 2) CARs. I find no statistically significant relationship between CARs and equity duration. This finding indicates that investors did not respond in the five days around the announcement. However, my findings in Models (5) and (7) indicate a significant relationship between duration and the investor response. The dependent variables in these two models are the (-3, 3) and (-7, 7) CARs. It would be reasonable to ask why these regressions and Model (1) exhibit significance, but those of Models (2), (3), and (4) do not.

The most rational explanation is that the Federal Reserve strives to be as transparent as possible. The Fed often announces future actions well in advance of the action to avoid market shocks. This is likely the case here. There appears to be a significant amount of information leakage. Notably, only the regressions involving dependent variables with abnormal returns earlier than two days before the announcement are significant. Models (8), (9), and (10) do not yield significant relationships between equity duration and CARs. These models involve post-announcement CARs in the (0, 30), (1, 60), and (1, 75) days around the QE1 announcement.

I next examine the investor response to the Federal Reserve's tapering announcements. If the Federal Reserve begins to taper its bond-buying, interest rates rise, as there is less demand for bonds. As interest rates rise, the performance of equities that exhibit more interest rate risk should underperform. I, therefore, hypothesize (Hypothesis 4) that equities with high duration are likely to underperform around tapering announcements by the Fed.

In Model (1) of Table 6, we regress the (-30, 0) CAR around the Federal Reserve's tapering announcement on June 14, 2017) on equity duration, firm controls, and industry fixed effects. I find no statistically significant relationship between duration and CARs. This finding is corroborated by Models (2)-(7). In each case, there is a lack of statistical significance between equity duration and CARs.

In Models (8), (9), and (10), my dependent variables are post-announcement windows. They are (0, 30), (1, 60), and (1, 75) days after the announcement, respectively. In each of these, I find a statistically significant negative relationship between equity duration and CARs. This finding indicates that in the post-announcement period, the securities underperform, but investors did not immediately respond to the tapering announcement.

Why do I find this result? The efficient markets hypothesis indicates investors should revalue shares as soon as the tapering announcement is made. However, it appears that there is a lag in the investor response. One explanation is that investors do not expect the Federal Reserve to taper their bond buying. They could also expect the Fed to taper its bond-buying over a long period.

6. Conclusion

Quantitative easing, although directed at fixed assets, has effects that reverberate throughout the economy and impact equities. These effects result from the changes in interest rates, which impact the expected cash flow structures of equities and their intrinsic valuations. The impact of changes to expected cash flow structures is more easily measured in bonds. However, measuring these inequities is more complicated. For example, firms go through several stages in their life and choose when to issue dividends or repurchase shares. This uncertainty means that the timing of cash flows can vary widely. To account for interest rate sensitivity when analyzing the market, the implied equity duration measure was developed. When regressed with cumulative abnormal returns and Fed asset purchases, this implied equity duration measure gives the relationship between duration and returns during periods of quantitative easing.

I collect data from Q1 2008 through Q4 2020, with all return data coming from CRSP and all accounting data from Compustat. In addition, Fed balance sheet data was collected from the FRED database. Financial ratios were constructed and then winsorized at the 1% and 99%

levels using the data. Several return measures were constructed using the CRISP data, a proxy for Fed asset purchases, and a variable for equity duration. These variables, along with four other financial variables and four forecasting parameters, are used in a series of calculations that comprise the model.

The return measures are regressed against the equity duration results from the model, the percentage change in Fed bond holdings, the interaction between the two, firm-level controls (γ_i), and industry fixed effects (θ_i). In Model (1) of Table 4, I find a negative relationship between equity duration and monthly returns, implying that equities that take longer to generate cash have lower monthly returns. I also find that the interaction term between duration and bonds holdings is positive and significant. This indicates that when the Fed purchases more bonds, firms with higher equity duration experience greater returns than firms with lower equity duration. In Model(2), I find a negative and significant relationship between equity duration and abnormal returns and a negative relationship between the percentage change in Fed bond holdings and abnormal returns. This is consistent with our expectations, indicating that firms underperform when the Fed reduces bond holdings. Finally, I provide robustness tests for our main models in Models (3) through (6), all of which return similar results to our findings in Model (2).

I also examined the effects of quantitative easing announcements on cumulative abnormal returns, with our results indicating a positive and significant relationship between equity duration and the (-30, 0) CAR, which is consistent with our hypotheses. I also find a significant relationship between duration and investor response in the (-3, 3) and (-7, 7) CARs. Finally, I examined the effects of Fed tapering announcements. My results show a statistically significant relationship between equity duration and CAR in the (0, 30), (1, 60), and (1, 75) day post-announcement windows. Overall, I conclude that there are significant economic implications in the findings of this research.

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Table 1: Summary Statistics

In this table, we report the percentage change in bond purchases by the Federal Reserve and the average equity duration of sample firms by year.

Year	Avg. Dur.	treastpch
2003	16.64	-
2004	17.19	6.0%
2005	17.11	5.6%
2006	17.14	4.9%
2007	17.11	2.6%
2008	16.70	-30.5%
2009	16.19	17.9%
2010	16.19	26.0%
2011	16.31	85.3%
2012	15.95	10.6%
2013	16.20	16.7%
2014	16.74	22.9%
2015	16.83	3.5%
2016	16.80	0.1%
2017	17.06	0.0%
2018	17.08	-4.3%
2019	16.69	-8.5%
2020	17.04	78.5%
Average	16.72	14.0%

Table 2: Descriptive Statistics

In this table, we report the descriptive statistics of the sample observations. We Winsorize accounting variables at the 1% and 99% levels.

Variable	Obs	Mean	Std. dev.	Min	Max
ret	825,454	1.09%	14.72%	-98.39%	879.82%
abret	825,454	0.21%	13.80%	-100.77%	874.27%
rolling3mo	825,454	3.45%	27.07%	-99.87%	2300.00%
rolling6mo	825,454	7.26%	42.41%	-100.00%	3596.15%
rolling3mo~t	825,454	0.61%	24.59%	-100.77%	2274.65%
rolling6mo~t	825,454	1.42%	37.11%	-100.81%	3305.52%
treastpch	825,454	0.96	3.90	-17.09	40.12
dur	825,454	16.72	3.26	5.63	29.47
lnat	825,454	6.83	2.17	2.24	12.34
roa	825,454	-0.42%	16.22%	-89.71%	26.04%
che_at	825,454	0.178	0.205	0.000	0.882
debt_at	825,454	0.209	0.194	0.000	0.769
sale_at	825,454	0.798	0.730	0.022	3.695
mb	825,454	2.970	3.573	0.281	25.550
capx_at	825,454	0.040	0.052	0.000	0.288

Table 3: Correlation Matrix

In this table, we report the correlation matrix containing our independent variables of interest.

	treastpch	dur	lnat	roa	che_at	debt_at	sale_at	mb	capx_at
treastpch	1.000								
dur	-0.019	1.000							
lnat	0.018	-0.223	1.000						
roa	-0.010	-0.506	0.321	1.000					
che_at	-0.002	0.285	-0.379	-0.302	1.000				
debt_at	0.012	-0.001	0.304	0.028	-0.388	1.000			
sale_at	-0.008	0.018	-0.238	0.140	-0.038	-0.123	1.000		
mb	-0.015	0.304	-0.086	-0.092	0.238	0.091	0.087	1.000	
capx_at	-0.014	0.041	-0.004	0.062	-0.109	0.088	0.131	0.053	1.000

Table 4: The Relationship between quantitative Easing and Equity Duration

In this table, we regress monthly returns on equity duration, the change in the Federal Reserve's bond holdings, the interaction between these variables, firm-level controls, and industry and year fixed effects. We cluster observations at the firm level. We winsorize data at the 1% and 99% levels. We report p-values in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Returns	abret	rolling3mo	rolling3mo_abret	rolling6mo	rolling6mo_abret
Duration	-0.000469***	-0.000558***	-0.00187***	-0.00183***	-0.00347***	-0.00275***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
% change in Fed Bond holdings (treastpch)	0.0000598	-0.00239***	-0.00753***	-0.00967***	-0.0195***	-0.0186***
	(0.883)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Duration * % change in Fed Bond holdings	0.000174***	0.000201***	0.000677***	0.000625***	0.00119***	0.00101***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Natural log of total assets	-0.000296***	-0.000296***	-0.000525*	-0.000384	-0.000807	-0.000379
	(0.001)	(0.001)	(0.055)	(0.154)	(0.156)	(0.480)
ROA	-0.00735***	-0.00798***	-0.0336***	-0.0311***	-0.0901***	-0.0685***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash / total assets	0.00308***	0.00272**	0.00644*	0.00622*	-0.000396	0.00159
	(0.008)	(0.019)	(0.079)	(0.082)	(0.958)	(0.822)
Total debt / total assets	0.00210*	0.00202*	0.00776**	0.00751**	0.0201***	0.0169**
	(0.070)	(0.080)	(0.034)	(0.037)	(0.008)	(0.017)
CAPEX / total assets	-0.0249***	-0.0234***	-0.0427***	-0.0517***	-0.0616**	-0.0747***
	(0.000)	(0.000)	(0.002)	(0.000)	(0.023)	(0.003)
Total sales / total assets	0.00327***	0.00331***	0.0118***	0.0114***	0.0251***	0.0228***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.0271***	0.00349	0.0429***	0.0269***	-0.198***	-0.0230
	(0.000)	(0.195)	(0.000)	(0.001)	(0.000)	(0.146)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level clustering	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.0239	0.00544	0.0668	0.0161	0.0994	0.0276
Num. of Obs.	860152	860152	844986	848042	828425	828425

Table 5: Cumulative Abnormal Returns around the Announcement of QE 1

In this table, we regress the cumulative abnormal returns around QE 1 announcement on equity duration, firm-level controls, and industry fixed effects. We cluster observations at the firm level. We winsorize data at the 1% and 99% levels. We report p-values in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	(-30, 0)	(-1, 0)	(-1, 1)	(-2, 2)	(-3, 3)	(-5, 5)	(-7, 7)	(0, 30)	(1, 60)	(1, 75)
Duration	0.00626**	0.00136	0.000940	0.000957	0.00319**	0.00212	0.00368**	-0.00183	0.00544	0.00514
	(0.022)	(0.162)	(0.400)	(0.492)	(0.043)	(0.219)	(0.047)	(0.508)	(0.107)	(0.154)
	0.00890***	0.00151	-0.00130	-0.00192	0.00297*	0.00414**	0.00683***	-0.0199***	-0.0173***	-0.0148***
Natural log of total assets	(0.002)	(0.212)	(0.350)	(0.268)	(0.078)	(0.025)	(0.001)	(0.000)	(0.000)	(0.000)
ROA	0.0239	-0.0373	-0.0550*	-0.0802**	-0.0617*	-0.0130	0.00134	-0.508***	-0.384***	-0.414***
	(0.708)	(0.209)	(0.085)	(0.030)	(0.087)	(0.750)	(0.975)	(0.000)	(0.000)	(0.000)
Cash / total assets	0.0869**	-0.00510	-0.00276	-0.0307	0.0298	0.0465*	0.0700***	0.0269	0.191***	0.260***
	(0.030)	(0.760)	(0.882)	(0.147)	(0.172)	(0.067)	(0.009)	(0.541)	(0.000)	(0.000)
Total debt / total assets	-0.0960**	0.0435***	0.0760***	0.0569*	0.0306	0.00639	0.0124	0.182***	0.106**	0.113**
	(0.020)	(0.009)	(0.000)	(0.070)	(0.292)	(0.833)	(0.708)	(0.000)	(0.028)	(0.033)
CAPEX / total assets	-0.296**	-0.0249	0.0199	-0.0693	-0.0506	-0.0997	-0.188**	0.311**	0.319**	0.422**
	(0.017)	(0.603)	(0.731)	(0.440)	(0.562)	(0.271)	(0.050)	(0.011)	(0.041)	(0.017)
Total sales / total assets	0.0151	-0.00194	-0.00301	-0.00255	0.00219	0.00172	0.00325	0.0152	0.00714	0.0182
	(0.198)	(0.645)	(0.513)	(0.687)	(0.722)	(0.807)	(0.671)	(0.164)	(0.617)	(0.243)
Constant	-0.109	-0.0224	-0.000503	-0.0133	-0.111***	-0.0216	-0.0325	0.142**	-0.133	-0.233**
	(0.305)	(0.730)	(0.992)	(0.756)	(0.001)	(0.707)	(0.602)	(0.033)	(0.230)	(0.016)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.0688	0.0411	0.0666	0.0818	0.0575	0.0526	0.0734	0.135	0.144	0.124
Num. of Obs.	4155	4154	4154	4154	4154	4154	4154	4154	4152	4152

Table 6: Cumulative Abnormal Returns around the Announcement of Tapering

In this table, we regress the cumulative abnormal returns around tapering announcement (6/14/2017) on equity duration, firm-level controls, and industry fixed effects. We cluster observations at the firm level. We winsorize data at the 1% and 99% levels. I report p-values in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	(-30, 0)	(-1, 0)	(-1, 1)	(-2, 2)	(-3, 3)	(-5, 5)	(-7, 7)	(0, 30)	(1, 60)	(1, 75)
Duration	-0.00189	0.0000627	0.0000304	0.000200	0.0000198	-0.0000443	-0.00124	-0.00384**	-0.00536*	-0.00602*
	(0.205)	(0.831)	(0.932)	(0.665)	(0.972)	(0.955)	(0.217)	(0.034)	(0.084)	(0.088)
Natural log of total assets	0.00413***	0.000652**	0.000767**	0.00214***	0.00235***	0.00268***	0.00234**	0.00612***	0.0139***	0.00960***
	(0.008)	(0.018)	(0.026)	(0.000)	(0.000)	(0.001)	(0.019)	(0.000)	(0.000)	(0.000)
ROA	-0.0315	-0.00899	-0.0110	-0.00294	-0.0132	-0.0250	-0.0637**	0.0116	-0.0534	-0.101*
	(0.379)	(0.221)	(0.233)	(0.787)	(0.331)	(0.218)	(0.013)	(0.744)	(0.231)	(0.067)
Cash / total assets	-0.00551	0.00552	0.00192	0.0136*	0.0104	0.0352***	0.0406***	0.0659***	0.148***	0.107***
	(0.790)	(0.184)	(0.710)	(0.054)	(0.221)	(0.005)	(0.004)	(0.000)	(0.000)	(0.003)
Total debt / total assets	-0.0201	0.00622*	0.00204	0.00488	0.00556	0.00617	0.0110	0.0363*	0.00625	-0.0212
	(0.257)	(0.068)	(0.639)	(0.404)	(0.473)	(0.532)	(0.384)	(0.069)	(0.809)	(0.482)
CAPEX / total assets	0.0405	0.0196	0.00226	-0.00623	0.0362	0.0450	0.0454	0.216**	0.326*	0.343*
	(0.720)	(0.207)	(0.912)	(0.823)	(0.343)	(0.400)	(0.526)	(0.034)	(0.089)	(0.098)
Total sales / total assets	-0.000611	-0.00127	-0.00165	-0.00575**	-0.00562**	-0.00350	-0.00469	-0.00326	0.00119	0.0108
	(0.922)	(0.386)	(0.381)	(0.010)	(0.041)	(0.310)	(0.236)	(0.552)	(0.900)	(0.319)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.0719	0.0691	0.110	0.0803	0.0804	0.123	0.0806	0.0672	0.0856	0.0657
Num. of Obs.	3763	3763	3763	3763	3763	3763	3763	3763	3763	3763