

The Effect of Federal Open Market Committee on Major Stock Market Indexes

Jason Lin and Justin Junkel

Abstract

This project examined the impact of changes in the federal funds rate target on equity prices. The project used ordinary least squares regression to consider the effects of those changes along with corporate profits on stock market value. The goal of the project was to confirm the results of other more narrowly defined studies and in doing so show that the causal relationship is even stronger. The data sets were taken from 1990 through 2006, using the adjusted level of corporate profits and federal funds rate targets as explanatory variables and NYSE and NASDAQ composite indices as dependant variables. The results of this project showed that corporate profits were the largest driver of equity prices, as suggested by current research. It also showed that federal funds rate changes have no impact on equity prices in a direct fashion, because federal funds rate is not the rate directly faced by firms in the market. Overall results did confirm the findings of previous research.

I. Introduction

This paper examines the period from 1990 to 2006, during which time the overall equity markets had a brief period of falling value after the 1990 recession followed by long sustained increases in value until 2000. The federal funds rate target also trended upward after falling post recession. At the beginning of the 21st century the markets crashed, losing a large portion of the value gained. The federal funds rate target was taken to near historic lows following the crash.

The major goal of this project is to determine how the Federal Open Market Committee's (FOMC) changes of its federal funds rate target affect equity markets. Most current studies look at how unanticipated changes affect the market using very sophisticated methods. This study aims to confirm the results of other studies while looking at both anticipated and unanticipated changes. It is the hope of the study that if it can be shown that the same relationships can be seen using a simpler approach it will demonstrate how strong and pervasive those relationships are. In order to add some additional insight and as a basis for comparison, the project also tracked corporate profits as a driver for equity markets. The methodology used was regression analysis. This report will briefly review the literature on this topic to explain the underlying principles, data, and methodology, and will present the final empirical result of the selected models and analysis.

II. Review of Literature

Existing research in this field is relatively extensive and when compared to this project considerably more complex and involved. The general consensus of existing research and theory is that as interest rates rise the prices of underlying equity assets will fall (Bernanke and Kuttner). The mechanism that causes the price to change can be seen in two key areas of business operations: changes in corporate capitalization rates and changes in expected cash

Jason Lin is Professor of Finance at School of Business, Truman State University, Kirksville, MO 63501. jlin@truman.edu. Justin Junkel is Account Receivable Manager at Pinnacle Technical Resources, 1230 River Bend Dr. Dallas, TX 75247.

flows. Changes in interest rates alter the amount of profitable long-term capital investments, which greatly influence expected cash flows. The amount of profitable future investments and the cost of capital a firm faces affect stock prices by changing dividend forecasts and yields and free cash flows, which affect firms' valuation and affect real output in the economy (Bernanke and Kuttner 1223; Gatti and Gallegati 112). Thorbecke also points out that changing interest rates will change the discount factors firms use in project evaluation; this in turn will affect the profitability of the project (635).

The other critical piece of information that is found in existing research is that stock prices will only change when changing conditions represent new information even though those changes will affect the real economy (Gatti and Gallegati 102). So, if a given change in the Federal Funds Rate (FFR) target is fully anticipated, then the stock prices should not move with the announcement. That is to say that stock prices reflect all currently available information about the underlying company and economy. That is not to say that the change in the FFR had no effect on equity valuations, merely that this effect was priced in over time. This makes the effects extremely difficult to capture.

Interestingly, most current research indicates that the transmission mechanisms discussed above are due mostly to changes in the expected future excess returns of a stock and very little on any actual changes in real interest rates (Bernanke and Kuttner 1223; Lobo 139; Ehrmann and Fratzscher 719-20). Changes in real interest rates caused by changes in federal funds rate targets do affect real economic activity by changing borrowing costs and default risks. The effects on stock values appear to be more attributable to these changes in real economic activity than to interest rates. Bernanke and Kuttner also find evidence that equity markets do respond more strongly to changes viewed as permanent (1253). This further shows that changes in real interest rates themselves do not cause stock prices to move because only permanent changes in federal funds rate targets reflect the Fed's expectations of future economic conditions. Lobo also notes that there is some evidence that the markets react stronger to rate hikes than cuts (139). Ehrmann and Fratzscher find some evidence that the causality between rate changes and stock prices may go both ways (722). Just as federal funds rate target changes may indicate the Fed's expectations for future economic conditions, so may changes in stock prices reflect expected changes in economic conditions that may require changes in federal funds rate targets. This has interesting implications for monetary policy, which attempts to influence the real economy by changing the real interest rates prevalent in the economy.

III. Data and Methodology

Most of the existing studies focus on examining the effects of unanticipated changes in monetary policy and the FFR target. This project attempts to focus on the overall effect of a change in the FFR target, anticipated or not. This project used the following explanatory variables: federal funds rate target, corporate profits adjusted for inventory valuation and depreciation, and a dummy variable to test for a recession effect. The dummy variable is defined as having a value of one during a recession and a value of zero otherwise. The biggest decision was which equity indexes to track; in order to cover the most complete picture of the equity markets it was decided that the project should cover both the NASDAQ and the NYSE. This provides a very complete picture of the market because the NASDAQ is very heavily concentrated in technology and telecommunications and the NYSE covers virtually all other

sectors of the economy. A review of recent literature and simple observation of the markets reveals that various index measures are so highly correlated that the choice was likely to have nearly no impact on the outcome, provided that the indexes chosen were U.S. domestic indexes and that they covered all major economic sectors.

The indexes tracked were the NYSE composite index and the NASDAQ composite index. This choice was based on market coverage and also on availability of data; each could be downloaded in Excel format from the same site. The S&P 500 was not tracked as its high correlation with the NYSE composite index would likely not have yielded significantly different results. During the study period the economy was coming out of the 1990 recession and entered what became the longest expansion in history. The indexes rose consistently throughout the 90s, with decreasing volatility. At the turn of the millennium the markets crashed, particularly the NASDAQ. This caused an increase in volatility that, following a short recession, gave way to another bull market. The FFR was rising following the recession in 1990 and continued until the markets crashed when it fell to record lows. The recession dummy variable was selected to determine if the market reacted differently to FFR changes when the economy was in a recession, as defined by National Bureau of Business Research (NBER) business cycle data.

As mentioned earlier, this project attempted to capture both the anticipated and unanticipated effects of an FFR target change. This represents a different methodology from most previous research. The most generally accepted methodology for capturing unanticipated effects is to use FFR futures market data to construct an event study. This methodology works well, but is highly sophisticated and doesn't capture the anticipated effects that are priced in over time. The distinction between unanticipated and anticipated effects is not important to this project. With this goal in mind, the best method for capturing both effects is to expand the time interval of the data to be sufficiently long to capture both effects. A one month interval seemed most appropriate as a longer interval increases the risk of distortion in the data from other events. A shorter time interval may not capture the gradual pricing of the anticipated portion of any rate announcement. This was also the smallest data interval available for corporate profits.

Originally the model was envisioned to use changes in the values of the indexes, corporate profits, and FFR on a month to month basis to capture the effects; this was a log-log functional form. The first problem with this was that FFR changes are in regular intervals and are typically in small stepwise increments. This introduced considerable statistical anomalies into the data and seemed inappropriate given the project's goal of looking at the bigger picture. The data turned out to support simply looking at the values of the variables, a linear-linear form. This produced the least amount of distortion in the results. The data points, when plotted against the dependent variable, showed a significantly linear relationship and other forms did not fit sufficiently better to justify the added complexity.

Initially the study hoped to use a much larger time period to improve the accuracy of the results. The major problem with this was the Fed did not announce changes in its FFR target until the late 80s, and until the mid-90s these announcements were less than regular. This automatically limited the data set to no earlier than approximately 1990, the time at which very accurate estimates of the FFR targets are available if they were not announced. The other major issue was that corporate profit measures are adjusted for inventory valuation and depreciation.

Each data source has a slightly different method for making these adjustments, and the exact methodology used to make these adjustments was unknown. Without this information it was unclear if the data from different sources was comparable, nor could the data sources be normalized. Thus it was determined that using a single source would be most appropriate for the corporate profits data.

Accurate measures of corporate profits were not available for 2007 or beyond. At the time this study was conducted it was still the 2nd quarter of 2007 and very few companies had released results. Estimated data was available for approximately four months, but this data is often subject to considerable revision. Given the limited number of observations this would have added it did not seem to justify the possible distortions inaccurate data could have caused. In the interest of not distorting the data, the time period that captured the largest date range given these restrictions was July 1990 through December 2006. This was a long enough period to have a relatively large sample size and thus decent results. Given the data, variables, and manner in which the model was constructed the final step was to outline a detailed hypothesis.

Theory and empirical research indicate that it is reasonable to expect that corporate profits will be shown to have a strong, positive, and statistically significant relationship with equity values in both the NYSE and NASDAQ models. The federal funds rate target variable is somewhat more difficult to predict. Generally interest rates have negative impacts on equity market values; this should be expected in this model. Current research has shown that the relationship between the federal funds rate target and equity market valuations is indirect. Thus, it may be more difficult for a model as general as the one constructed here to detect this relationship. It is hypothesized that the federal funds rate target will be negatively related to equity valuation with a moderate level of statistical significance (perhaps only at the 10% level). Finally, it is hypothesized that the recession dummy variable will have a negative relationship to equity market value and will be statistically significant.

IV. Empirical Results

The final empirical result has two different regression models: one for the NYSE and one for the NASDAQ. The final model for the NYSE is, where FFRT is federal funds rate target, CP is corporate profits, and R is recession dummy:

$$\text{NSYE} = 3829.7 - 6.2360(\text{FFRT}) + 1.6568(\text{CP}) - 204.52(\text{R})$$

P-Values	(.002)	(.914)	(.005)	(.037)
----------	--------	--------	--------	--------

The p-values show that only the intercept and corporate profit variables were statistically significant to a high degree. The recession dummy variable is also significant and is negative, which would imply that during a recession the relationship between the markets and the FFR and profits is somewhat different. More specifically, during a recession all variables seem to have dampened effects and the function is lower for all values of FFRT and CP. The model did have significant positive first order autocorrelation, which is not uncommon with time series data. The above values are corrected for the autocorrelation. The model had an r-square of .7347, an adjusted r-square of .7306, and an F-statistic of 179.121 (p-value 0.00). The F-statistic does show that the model has significant overall explanatory power.

The model was tested for multicollinearity using auxiliary regressions and detected no multicollinearity, with the highest r-square of .1052. The model was tested for heteroskedasticity using diagnose/het command in Shazam and none was found. There was no evidence to support the existence of a heteroskedastic partition or proportional heteroskedasticity. A reset test was performed to check for misspecification and there was significant misspecification. This is probably because the model does not capture anywhere near the entire list of explanatory variables that influence the markets and the time interval of the explanatory variables is relatively long. This problem afflicts the NASDAQ model as well. Clearly, corporate profits have a large amount of influence on the market. This is logical, and confirms the findings of other studies, because profits determine future ability to finance investments using retained earnings and thus reduce borrowing costs. The FFRT does not appear to have any affect on the markets; at first this seems contradictory, but current research suggests that the effect of interest rates on future cash flows and returns affects stock prices. These effects are more closely captured in this model by the corporate profit variable than by the FFRT variable.

The results of the NASDAQ model are as follows:

$$\text{NASDAQ} = 10422 + 1861.4(\text{FFRT}) + 15.836(\text{CP}) - 1911(\text{R})$$

P-Values	(.521)	(.255)	(.243)	(.525)
----------	--------	--------	--------	--------

This model is also corrected for significant positive first order autocorrelation. The model does not show that any of the explanatory variables are significant and also has a low r-square of .3397 (adjusted r-square of .3295) and a low F-statistic of 33.270, though the F-statistic has a p-value of 0.00. This suggests that the overall model has some explanatory power beyond what each individual variable contributes. This model has no multicollinearity like the first, with the highest r-square in auxiliary regressions being .1052. It has very minor heteroskedasticity in a very small number of the tests, performed using the same command as above, which indicates that it is not severe enough to require correction, indeed it may not even exist. Heteroskedasticity was detected in only three of the eight tests without any real significance. A reset test did find the same misspecification problem as the NYSE model.

Overall, these models seem to show that corporate profits have the largest impact on equity market prices and that recessions or FFR targets seem to matter little, if at all. In fact, nothing seems to explain the NASDAQ, which will be addressed later. The idea that corporate profits have a larger impact should not be surprising, because higher profits mean more cash on hand for capital expenditures, paying dividends, and paying creditors, which reduces the firm's risk and lowers financing costs. Therefore, high profits dampen the impact of high interest rates. Also, the FFR is not the rate firms face in the market; that rate is determined by a plethora of sources and information. Federal funds rate changes may not track all that well with changes in a firm's cost of capital.

The separation of the federal funds rate from the market rate that firms face means that the federal funds rate itself has little direct impact on the value of stocks. Other studies have found very strong correlations between the federal funds rate and stock prices. Most of those studies used unanticipated changes in federal funds rate targets, but it is possible that the reaction of stock prices to target changes was more a function of what unanticipated changes say about

the Fed's expectations of economic conditions than a result of the change in interest rates. It is also likely that a general model, like the one constructed here, would not be able to detect the indirect effects, leading to low p-values for the FFRT variable. This finding is consistent with current works that show FFR changes affect stock values mostly through excess returns and not real interest rate changes. These conditions in turn affect corporate profits and thus stock prices. The recession variable's weak significance is probably due to the very small number of recessions found within the data set, and those very mild, but recessions do seem to depress market values across the board.

The NASDAQ model's unusual results, that none of the explanatory variables individually were significant but that overall the F-statistic showed the model had some explanatory power, were quite vexing. This project did not determine a definite explanation for this, but may suggest a possible explanation that could be the topic of future research. During the mid-to-late 90s, the stock market was in a bubble which eventually crashed around the turn of the century. It is possible that a bubble, which is self-sustaining for a time, could break down the ordinary relationships that affect equity market prices. This could have resulted in the relatively low significance of the FFR and corporate profits for both models. The psychology of the markets changed with the introduction of new technologies. Investors were convinced that these technologies would pay off and so hope and expectations were no longer based on rational considerations.

The result was that corporate profits and other drivers no longer had as large of an impact on stock prices. Many investors, particularly non-institutional, may have believed that others in the market knew something they did not and thus they continued to buy and later sell with the crowd. The most interesting piece of evidence is that the NASDAQ fell much further than the NYSE when the bubble burst, so it is logical to assume that the NASDAQ was being influenced even less by the normal drivers. That would seem to be exactly what this project's results suggest: the NASDAQ showed no significant relationship to the expected drivers while the NYSE did show a relationship. Attempts to restrict the data range to exclude the bubble failed. The remaining data set was not large enough, and did not exhibit sufficient change in the FFR variable to have any statistical relevance. A more sophisticated methodology is needed to disentangle the effects of the bubble. Also, in the future, longer data ranges will give greater insight.

In summary of the empirical results it is useful to outline exactly how these results compared to the working hypotheses. For the NYSE model the corporate profits and recession dummy variables matched predictions. The corporate profits variable was positively related to market value and the relationship was highly significant. The recession dummy variable was negatively related to market value and the relationship was significant at the five percent level. The federal funds rate target variable did not generate the hypothesized results. The variable was negative as predicted, but the relationship was extremely insignificant having a p-value of .914.

The NASDAQ model did not generate the anticipated results. None of the explanatory variables were statistically significant and the federal funds rate target variable did not even have the expected sign. Overall this model did not conform to expectations; possible explanations for this were discussed above.

V. Conclusion

In conclusion, this project seems to suggest that the relationships supported by more sophisticated models hold even using a much more generalized model. This supports the claims of those studies by showing that a more pervasive and strong relationship exists. Clearly the major driver of equity value is expected future cash flows and opportunities that were captured by the corporate profit variable. The federal funds rate does affect stock prices, but only indicates changes in excess rates and expected cash flows. This study also uncovers an explanation for the strong correlation between federal funds rate changes and stock prices that has been observed in other studies. Specifically, the FOMC's decision to change the FFR target affects stock valuations mostly by altering the FOMC's perceived economic outlook. The stock market bubble of the 90s does distort the results somewhat and makes any definitive conclusion impossible. A more targeted and sophisticated study could possibly disentangle the effects and would be an interesting future research topic. Overall, this project achieved its goal of verifying the results of more sophisticated studies and opened the door for future studies.

Reference

- Bernanke, Ben and Kenneth Kuttner. “What Explains the Stock Market’s Reaction to Federal Reserve Policy?” The Journal of Finance. 60.3 (Jun 2005): 1221-1254.
- Broadus, Alfred. “Reflections on Monetary Policy.” Federal Reserve Bank of Richmond Economic Quarterly. 81.2 (Spring 1995): 1-11.
- Ehrmann, Michael and Marcel Fratzscher. “Taking Stock: Monetary Policy Transmission to Equity Markets.” Journal of Money, Credit, and Banking. 36.4 (Aug 2004): 719-737.
- Gatti, Domenico Delli and Mauro Gallegati. “Financial Constraints, Aggregate Supply, and The Monetary Transmission Mechanism.” The Manchester School. 65.2 (Mar 1997): 101-126.
- Goodfriend, Marvin. “The Phases of U.S. Monetary Policy: 1987 to 2001.” Federal Reserve Bank of Richmond Economic Quarterly. 88.4 (Fall 2002): 1-16.
- Hafer, R.W. The Federal Reserve System: An Encyclopedia. Westport, CT: Greenwood Press, 2005.
- Kliesen, Kevin and Frank Schmid. “Monetary Policy Actions, Macroeconomic Data Releases, and Inflation Expectations.” Federal Reserve Bank of St. Louis Review. 86.3 (May/Jun 2004): 9-20.
- Lobo, Bento. “Asymmetric Effects of Interest Rate Changes on Stock Prices.” The Financial Review. 35 (2000): 125-144.
- Thorbecke, Willem. “On Stock Market Returns and Monetary Policy.” The Journal of Finance. 52.2 (Jun 1997): 635-653.