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## **Macro Variables and Volatility of Asset Prices**

### **Abstract**

In this paper, I analyzed the effect of macroeconomic variables and systematic risk on volatility of asset prices in the equity market. I presented multifactor models of asset pricing and provided extensive empirical tests that indicate firms with different properties reacted differently to the systematic risk. My foci in this essay was mainly monetary factors and I described monetary theories before and after the financial crisis of 2008, as well as the empirical testing with respect to the effect of monetary factors on variations in asset prices. Moreover, I analyzed asset price mispricing or the existence of bubbles in the stock market and whether monetary policy should react to these bubbles?

Historically since the outset of industrial revolution, financial market has played an instrumental role in the progress of economic production. This role has become much stronger with the growing complexity in economic structure, specifically since the surprise of financial crisis in 2008. My goal in this paper is to touch upon the monetary economy in the past and how its perception and conception has changed after the advents of a few financial crises since the beginning of 21<sup>st</sup> century. Since studying financial market in general is very broad, my focus is on monetary factors, specifically Federal Reserve monetary policy and its effect on the movement of asset pricing in the equity market. The results of this research could benefit investors, business corporations, and government decision makers so that they become aware of the changes that has taken place in the economic structure in the last two decades. Although, since the emerge of internet and the revolutionary technological advancement of information

technology, the financial world has become united, the analysis in this paper is confined to the monetary policy in USA only; therefore, exchange rate fluctuations are excluded from the analysis.

### **Macroeconomic Variables and Asset Prices**

Stock prices and economic activities are in a mutual interaction and relationship all the times. It is typically presumed that asset prices are an indicator of future economic activities and therefore, a reflection of future profit for corporations and increase in dividend for investors. In this case there were some suggestions that stock prices can be used as leading indicators of future economic activities. Moreover, changes in macro variables change the investor's expectation about future cash flows of their investment and more importantly it changes the systematic risk that investors are facing and the discount rate that investors used to calculate the present value of future returns. From theoretical point of view the value of a specific asset that is traded in the capital market is decided by three factors: (a) The future amount of cash flows from the asset; (b) the expected rate of return to calculate the present value of the future cash flows; and (c) the time involved in the calculation of cash flow (Cochrane, 2001). In this scenario the investor is facing a risk and uncertainty about the future from two different grounds: The risk related to a specific industry and a specific firm, or specific risk and the risk related to the elements related to the circumstances in the economy, or systematic risk. Almost all research on asset pricing is dealing with identifying the appropriate elements that form the risk associated with an investment decision making.

On the assumption that investors are risk averse and would have a diversified portfolio of assets the Sharp-Markowitz theory of asset pricing cancel out the specific risk and describe that the only risk that investors consider in their investment decision making is the systematic risk.

Markowitz (1952) defined the optimal portfolio of assets for any investor as a portfolio that either yields the maximum rate of return with a certain risk tolerance for any investor, or a portfolio with the least amount of risk for a specific level of return. Then, according to this model, the equilibrium prices in the capital market would be established by way of investors' decision to buy or sell in the equity market. Thus, according to this model, the overall rate of return of all assets in the market is an indication of systematic risk that is related to the economic circumstances. However, empirical evidence indicates that systematic risk reflects in various degrees for different stocks in different industries. The analysis of this risk, the reason that it is different for different assets, its definition and measurement, and its correlation with expected rate of return is the core issue in all asset pricing theories.

There are number of research that indicated firm specific features such as size of the company, value effect, leverage, book equity to market equity, and price to earnings ratio affects the degree of sensitivity of specific equity towards changes in systematic risk (Banz (1981); Chan et al. (1991), Basu (1977); Bhandari (1988); Stattman (1980); and (Fama and French, 1992, 1993, 1996). However, all these studies were referred to the specific features of corporations such as size, leverage, so on and so forth. The goal in this paper is to explain the systematic risk from macro side of the economy and analyze how different firms react to the macro conditions depending on their specific features. In other words, macro variables determine the systematic risk and firm specific features measures the firm's reaction to the systematic risk.

### **Macroeconomic Models**

The empirical testing of the single-factor asset pricing model such as the Markowitz (1952) and Sharp (1964) model did not justify the whole movement of asset pricing in the equity market. Arbitrage pricing theory (APT) that was developed by Ross (1976) is a simpler model

compare with the capital asset pricing model (CAPM) with fewer assumptions and is often used in the models to test the relationship between macro variables and the stock market. According to this model, systematic risk is caused by several factors and a change in any given macroeconomic variable changes the systematic risk and the future returns of equities.

The multifactor approach has been used in quite a few research (King; Cohen and Progue, as cited in Rao and Ramachandran, 2009). Some research are based on the short run relationship between macroeconomic variables and the stock prices (Schwert, 1990; Fama-French, 1989). In some other studies, the discounted cash flow or present value model (PVM) has been used. In this model, the stock price is related to the future expected cash flows and the future discount rate that investors use to calculate the present value of future cash flows. According to this model, all macroeconomic factors that influence the future expected cash flows or the discount rate by which these cash flows are discounted should have an influence on the stock prices. The advantage of the PVM model is that it can be used to focus on the long run relationship (Rao & Ramachandran, 2009). Rao & Ramachandran, (2009) model that was based on the model proposed by Chen, Roll and Ross is as follows:

Stock prices are a function of future pay-offs or dividend stream and an expected discount rate:

$$P = E(c)/k \quad (1)$$

Where,

c is the dividend stream and k is the discount rate. Therefore, the actual returns in any period are:

$$r = dp/p + c/p = d [E(c)]/E(c) - dk/k + c/p \quad (2)$$

Where,

$k$  is the change in discount factor, and  $E(c)$  is the expected cash flows. Thus, what changes asset prices is whatever affects the discount rate and the expected cash flows. On the other hand, macroeconomic variables are typically an indication of bust and boom in the economy and this indicator is usually used by investors as a key player in asset pricing decisions. Moreover, macroeconomic variables can capture business cycle fluctuations and help investors to forecast stock market volatility, to have a more effective optimal portfolio selection, and to efficiently monitor their financial risks. Furthermore, the policy makers can benefit from finding the relevant macro variables that could be included in the calculation of systematic risk involved in their investment. A number of research were conducted on the effect of macro variables on asset pricing in the equity market (Errunza and Hogan, 1998; Hamilton and Lin, 1996; Andersen et al. 2003; Clark and Kozicki 2004).

There are a few common problems in all models that attempt to test the the effect of macro variables on asset pricing. First, macro data such as total output or investment are not calculated in real time and the testing results are different when researchers use revised data. Secondly, there is a lag between macro data changes and their effects on asset pricing. Döpke, Hartman& Pierdzioch (2006) conducted a research for Germany in the period from 1994 to 2005 to find out whether macroeconomic variables that capture business cycle fluctuations help to forecast stock market volatility. They concluded that the results of volatility forecasts that was based on real-time macroeconomic data was roughly comparable with the results based on revised macroeconomic data. He concluded that using the real time data instead of reliable revised macroeconomic data did not reduce the validity of research findings.

## **Monetary policy and Stock Market**

### **Pre-Crisis Monetary Policy**

The global financial crisis of 2007–2008 and the subsequent great economic recession that had not been seen after the great depression of 1929-1934 came as a surprise to many economists and financial authorities (Kolozsi, 2013). This lack of foreseeing was considered as the deficiency of classical and neo-classical approaches to financial problems in the economy. Howlett and Ramesh reaffirmed this conclusion that if theories cannot forecast the appearance of disasters, they are outdated and should be replaced by new paradigms (as cited in Kolozsi, 2013). Thus, economists suggested that a revolutionary theoretical change is necessary in order to avoid an economic collapse like the great recession. After the financial crisis of 2008, it became obvious that the single target-single instrument of monetary policy, inflation and interest rate targeting, was not adequate and the implication of multi target and multi instrument policies became inevitable.

Traditionally, the conventional macroeconomic view was on the basis of the new consensus model (NCM). NCM's pivot policies of central bankers were: inflation targeting, financial deregulation, and the fine-tuned use of central banks' policy rate that would ensure global financial and economic stability and prosperity (Argitis, 2013). NCM was formed on the basis of neo-classical and neo-Keynesian economic perspectives. It was part of a macro vision that rested upon: (a) The self-regulated capitalist economy that would function coherently and would obtain a natural rate of unemployment; (b) a decentralized laissez-faire exchange economy in which individuals get motivated by self-interest and are guided by goods prices as signals in a perfectly competitive market. This was based on the Walrasian general equilibrium system in which supply meets demand instantaneously at a market-clearing price, money is neutral,

monetary policy is neutral in the long run (Gali and Gertler ; Woodford; Goodhart; Boianovsky and Trautwein; Romer's, as cited in Argitis, 2013).

### **Post-Crisis Monetary Policy**

The monetary policy in the post-crisis era is a shift from the “one objective – one instrument” model of central banking. The new models are more comprehensive and complex. Kolozsi (2013) proposed an institutional matrix of the state and society that should include the behavior of economic actors (investors), as well as the economic policies of the state. This model described that monetary policy should not only be concerned about the general cost of living, but also should focus on the financial stability as a whole. Furthermore, Minsky incorporated the “institutional principle” in economic analysis and deemphasized the Walrasian/Hicksian general equilibrium model as the focal theory to study macroeconomics. Minsky's macro vision arises from his institution-specific conceptualization of the “Wall Street” model of a capitalist economy (Minsky, as cited in Argitis, 2013).

Minsky suggested that there is no inherent equilibrating tendency in the Wall Street economy and natural instability and unemployment are the fundamental characteristics of financial capitalism, especially after the rise of securitization as a norm of banking practice (Minsky, as cited in Argitis, 2013). In Minsky's Wall Street economy, banks are fundamental institutions in creating capital and financial assets. Banks increase money supply whenever they expect borrowers are able to generate sufficient cash flows to repay their loan.

The incorporation of money in the profit expectations of entrepreneurs and banks is the essence of the non-neutrality of money. In this sense, the financial structure of the economic units and their commitment to payments are not neutral and the value of capital, financial assets, investment, and the realization of profits all depend upon financial arrangements and

interactions that involve monetary variables. Minsky also argued that the demand price of capital assets should exceed the supply prices, so that capital assets to be produced in a way that expected profits to be realized and the accumulation of capital to be ensured (Minsky, as cited in Argitis, 2013).

Furthermore, Minsky allowed firms to use their market power and set the markup in order to increase their control over nominal cash flows and empower their financial positions. In a way, at the micro level, the markup distributes profits among firms and the firms' share of profits and expected nominal cash flows depends on firms' market power. At the macro level, prices influence the distribution of income and outline the aggregate amount of profit for firms. It is crucial for the stability and functioning of financial capitalist economies that nominal cash inflow of the economic units be greater than their nominal cash outflow (Papadimitriou and Wray, as cited in Argitis, 2013).

Thus, the coherence of the economic system depends on the ability of deficit spending units to meet their financial commitments. Otherwise, fragility and instability dominate the relations of production and distribution in determining the macroeconomic performance of financial capitalist economies. Thus, investment and accumulation of capital are finance-led and are determined by the expectations of future asset and goods prices. Moreover, all capital asset positions are finance positions and liability structures. The thrust of Minsky's perspective is that the purchase of capital assets today depends on the expectation of future income flows, which validate past investment decisions, and on future income flows that validate future payment commitments (Minsky, as cited in Argitis, 2013).

According to this view, if future income flows are less than what the expected income flows were at the time that the investment decisions were made, then these decisions that were

based on incorrect expectations about the future and current income would fail to be validated. Therefore, investment is more volatile than the other components of aggregate demand, not due to interest rate changes and credit spreads, as the NCM hypothesizes, but due to the investor's subjective evaluations of the future innovations, revisions of rules of thumb, liquidity and variations in the perceived lender's and borrower's risk and margins of safety.

A key insight behind Minsky's two-price system is the uncertainty that agents build their decisions in margins of safety. This uncertainty is associated with the mental models that individuals hold to guide their behavior and decisions. This is why liquidity matters. Individuals impute this uncertainty to others in the economy. Further, if rational agents doubt the validity of their mental model, then they might abandon it as the evolution of the economy generates an environment that weakens their degree of belief in this mental model. With the adoption of a new model when this happens, significant changes in the behavior of individuals and the economy are possible. In contrast to the rational expectations of the NCM, Minsky argued that economic agents extract the models of the economy that guide their actions out of their experience and observations of the world in which they live. Minsky's argument is that economic agents have their own place in the economy, their history, and their analytical capacity (Minsky, as cited in Argitis, 2013).

However, it must be noted that, for Minsky, institutions and interventionist policies cannot bring the economy to stable full-employment equilibrium, but can only set ceilings and floors in the "natural" instability of financial capital. Consequently, for Minsky, central banks must act as stabilizers in the financial markets, where prices of financial assets, cash flows and balance sheets are determined. Central banks should target financial stability through stabilizing

the price of existing financial assets and providing liquidity of financial positions (Kregel; Tymoigne as cited in Argitis, 2013)

### **Monetary Shocks**

Historically, there has always been a mutual relationship between asset prices and monetary policy. However, the neutrality of money in the long run and the focus on the destabilizing effect of inflation on the economy in the short run shifted the purpose of monetary policy towards inflation curtailment and ignored the movement of asset price. James Tobin (1969) was one of the first scholars who asserted that financial policies can play a role in altering the market value of a firm's assets relative to their replacement costs. Tobin's view described the formulation and understanding of channeling of monetary policy transmission into the stock market (Tobin 1978). Therefore, according to Tobin, a contractionary monetary policy reduces asset prices and an expansionary monetary policy increases asset prices.

Increase or decrease in money supply as a measure for monetary policy has been tested repeatedly and the tests indicate that stock returns lag behind changes in money supply (Keran; Homa and Jaffee; Hamburner and Kochin, as cited in Chen, 2007). The lag is because increase in money supply affects the stock market after hypothetically increase in money supply increases the aggregate demand. In other words, an increase in M2 adds to the liquidity that is available to purchase securities and that results in higher prices for stocks. In other empirical testing, there were opposing views; some found strong relationship between the two variables (Hamburner and Kochin, 1972) and some found no relationship between the two variables (Cooper, 1974 ).

Monetary shocks can produce movements in stock market that are exacerbated and are larger than the change in profits, dividends, and aggregate output in the economy. This is because of the effect of monetary shocks on inflation rate and market expectations. On the empirical side, it was found that monetary policy shocks have a significant effect on the stock market (Shanken; Thorbecke; Hinkelman, as cited in Chen, 2007). Monetary shocks have a far greater impact on financial markets than the real economy. Thus, a tightening monetary policy depresses stock returns because, it lowers the returns on stocks and it shift the market into the bear market. Thus, as a result of the financial decisions of firms, monetary shocks have a persistent impact on output and they lead to considerable volatility in stock market returns.

Monetary shocks affect large and small firms differently (Perez- Quiros and Timmermann, 2000; Chen, 2007). They stated that there is an asymmetry in the variation of a small firm's and large firm's risk's stock over the economic cycle. The heterogeneous response of firms to monetary policy shocks is due to their capacity for internal finance. This asymmetric response occurs because the increase in the interest rate decreases firms' profit, reduces their next period equity value and decreases their capacity to borrow (Carlstrom and Fuerst, 1997).

### **Interest Rate Changes and Asset Prices**

However, the main instruments of monetary policy that Federal Reserve has used for years is different short term interest rates, such as Federal Fund Rate (FFR), Discount Rate (DR). Bernanke and Blinder (1992), used the FFR in their studies and since then, using FFR as an indicator for monetary policy has become the most widely used measure of monetary policy (Hamburner and Kochin, 1972; Cooper, 1974). There are some research that are conducted on the basis of market interest rate (Perez-Quiros and Timmer-mann, 2000; Rigobon and Sack,

2002, 2003). Currently, market expectations that are captured from federal funds futures contracts has become popular (Kuttner, 2001; Bernanke and Kuttner, 2003).

However, when Federal Reserve and Open Market Committee announce the (FFR), it is a surprise and therefore, investors try to forecast FFR before it is announced. The rate that is typically used by investors as a proxy for FFR expectations is the Federal Funds Future (FFF) (Krueger and Kuttner, 1996; Rudebusch, 1998; Brunner, 2000). There are more short-term interest rates that potentially measure federal funds rate expectations. The most used ones are current-month federal funds futures contract (Kuttner, 2001), the month-ahead federal funds futures contract (Cochrane and Piazzesi, 2002), the three-month Treasury bill rate (Rigobon and Sack, 2002; Gurkaynak, Sack, &Swanson, 2007).

Despite all the effort that investors have made to anticipate monetary policy, Bernanke and Kuttner (2003) stated that monetary policy surprises appear to have a significant effect on equity prices by changes in the equity premium. Bernanke and Kuttner (2003) emphasized that the response of stock prices to the monetary policy is due to the impact of the monetary policy on investors' expectation towards the future phase of economic activity. Kuttner (2001) indicated that on the day that FFR is announced by Federal Reserve, markets react mostly to the unexpected component of FFR that has not already been incorporated into the market evaluation of equities.

Moreover, some studies indicated the causality between interest rates and stock prices runs in both directions and monetary policy responses to the stock market changes significantly (Rigobon and Sack, 2003). They stated that the impact of stock market on monetary policy is through the channel of aggregate demand. The final conclusion of Rigobon and Sack's was that relationship between interest rates and asset prices are mutual and this endogeneity might cause a

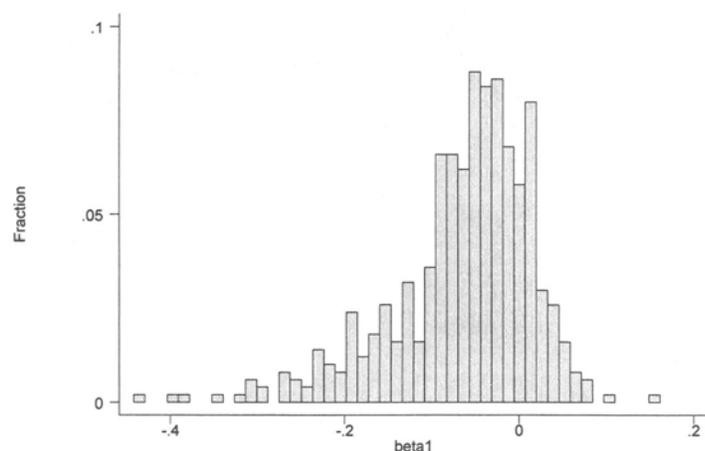
bias in the empirical testing that attempt to test the association between equity returns and monetary policy.

### **Monetary Policy and Firm Specific**

The empirical evidence indicate that the firm and industry specific of corporations affect their sensitivity towards changes in monetary policy. Thus, the effect of monetary policy changes on future earnings of different stocks is in a heterogeneous fashion across industry and companies. It has been tested often that size, level of leverage, type of product and the type of the technology that companies use affect their sensitivity towards a change in monetary policy. Bernanke and Blinder (1992) showed a significant relationship between monetary policy changes and bank-dependency of firms.

Thorbecke (1997) in a research conducted for the period of 1953-90 concluded that the effect of monetary policy on stock returns in the USA is different for different industries and small firms reacted more strongly than large firms. It is proposed that informational asymmetries is responsible for different degree of impact of monetary policy on value of different stocks, because, firms that are more equipped can have access to fund easier in case of monetary constraint (Ehrman & Fratzscher, 2004). Ehrman & Fratzscher, with a methodology similar to Bernanke and Kuttner (2003) conducted a research on the individual firms included in the S&P500 index and examined their reaction in regard with U.S. monetary policy shocks. They found that the sectors such as technology, communications, and consumer goods that are cyclical react much stronger to monetary policy than less cyclical sectors. Also, they found strong empirical support for the hypothesis that the financially constraint firms react more towards monetary policy changes. For instance, they indicated that corporations with poor cash flows or

low debt have been affected by monetary shocks almost twice as much as firms with high cash flows or high debt.



*Figure 6.* Distribution of monetary policy effects across S&P500 stocks (Eherman & Fratzscher, 2004, p.724)

One factor that repeatedly has been tested positive in a relationship between monetary policy and stock prices is the financially constrained firms; that is, the firms that have less liquid assets and are more dependent on external financing. The research shows that the financially constrained firms are more affected by changes in interest rates than firms that are less constrained. Using the size of firms as a proxy for the degree of credit constraints, the empirical tests show that smaller firms are more vulnerable in financial cycles and more affected by monetary shocks (Fama and French's, 1995; Perez-Quiros and Timmermann, 2000).

In respect with the effect of monetary policy on stock returns in the bear and bull markets, studies show that monetary policy has different impacts on stock prices in the bull and bear market. For example, monetary policy might have greater effects in the bear markets (Bernanke and Gertler; Kiyotaki and Moore, as cited in Chen, 2007). In regard with the asymmetric effects of monetary policy, Chen conducted a research and tested different measures

of monetary policy, money aggregates (M2), discount rates (DR), Federal funds rates (FF) and their relationship with stock prices in the bear and bull market. He concluded that a contractionary monetary shock lowers stock prices in both bull and bear markets, but more in the bear market.

## **Monetary policy and Asset Mispricing**

### **Asset Price Bubbles**

In the early 2000s and during the recent credit crunch, it was evident that asset-price bubbles exist, but the literature on this subject is sparse. Bernanke, Gertler, and Gilchrist (1999) included an exogenous element as a symbol for bubbles in their financial accelerator model and promoted and promoted the subject of asset-price bubbles and monetary policy for the first time. Their reasoning was that asset prices would grow into a bubble, but bubble decays over time and when it bursts, the asset prices go back to the fundamental value. The important dialogue among researchers is whether monetary policy should react to asset mispricing or asset price bubbles. There are two opposing views: On the one hand, Bernanke and Gilchrist stated that monetary policy should focus on inflation curbing and forget about asset mispricing. On the other hand, Cecchetti et al. (2000) suggested that the monetary policy should react to the asset mispricing, or what is known in the literature as “leaning against the wind” theory. Bernanke and Gertler (2001) criticized Cecchetti et al by stating that the optimal policy response is based on the nature of the bubble process and it is not feasible whether asset-price movement happens because of change in economic activity or a change in noise trading. This lack of feasibility has been enough for many economists not to target asset prices in conducting monetary policy (Greenspan, 2002).

The problem that might be caused by monetary policy reaction to mispricing assets is that the timing of monetary policy poses significant difficulties (Gruen et al., 2005). The existence of a lag between asset price changes and monetary policy decisions might be harmful to the economy specifically, in case of a monetary tightening and may be counterproductive. In this case, the economy will be hit simultaneously by two deflationary forces, burst of the bubble and contractionary monetary policy. The other question is how much should be the magnitude of the monetary policy response to correct for a bubble?

As a whole due to lack of information and feasibility the overwhelming view is in favor of monetary policy not responding to asset mispricing (Greenspan, 2002; Assenmacher-Wesche and Gerlach, 2008). They concluded that using monetary policy as a tool to counter asset mispricing and to provide a guard against financial instability would have large effects on economic activity. Gwilym (2013) conducted a research in 2011 and used an endogenous bubble and a specific behavioral framework and concluded that the monetary policy that target the mispricing of the asset has a destabilizing effect in the economy. On the other hand, some suggested that central bank should responds to deviations of asset prices from their trend rather than to mispricing (Trichet, as cited in Gwilym, 2013). However, recent financial upheavals and frequent appearance of bubbles proved that it is almost impossible to detect bubbles and financial crisis. Thus, it is suggested that monetary policy to be used to clean after the crisis by interest rate cut and safeguard the economy after bubble bursts (Bernanke and Gertler 2000). Nevertheless, the existence of asset price booms and busts in the market, as well as the greater effect of systematic risk than firm specific on price of equities, the pendulum of opinions has now has turned in favor of “leaning against the wind” theory.

An intermediary position in the lean versus clean spectrum has been offered by Blinder (2010), who argued that “a distinction should be drawn between credit-fueled bubbles (such as the house price bubble) and equity-type bubbles in which credit plays only a minor role (such as the tech stock bubble).” In this view, the mop-up-afterward approach would still be appropriate for equity bubbles, but the central bank should combine regulatory instruments and interest rates and limit credit-based bubbles. It is now suggested that macro prudential regulation should be adopted by monetary authorities to stabilize the financial system (Canuto & Cavallari, 2013). The proposed macro prudential regulation should reduce pro-cyclicality and control the externalities that amplify fluctuations. Therefore, the financial system can operate with less systemic risk and can enhance the resilience of the system in downturns. One of the ideas that were promoted is to improve the liquidity accessibility regulations, a more robust banking system, and tighter regulatory standards. Moreover, in the presence of random shocks, endogenous bubbles arise as a result of waves in optimism and pessimism in the economy. This idea is the base for the newly developed behavioral finance theory that focuses on the cognitive limitations of individuals’ behavior (Kahneman and Thaler, 2006).

### **Conclusion**

In this essay, I explained the effect of macroeconomic variables on stock market, specifically the effect of monetary policy from both the credit and the interest rate channel of monetary policy transmission. The focus is both on the exogenous and the endogenous measure of monetary policy shocks. Both empirical and theoretical findings of research indicate that monetary policy affects individual stocks in a strongly heterogeneous way. The heterogeneity is due to the capital structure of industry and firm specific features. For example cyclical and

capital-intensive industries react stronger to U.S. monetary policy than non-cyclical industries. Moreover, the level of leverage and financial constraint is an important element in heterogeneity.

Other finding in the empirical testing is a strong relationship between monetary policy and stock returns. However, the channel through which monetary policy affects stock prices is different. Some economists explain that the effect of monetary policy on asset prices is via changes in prices, other group of economists focus on the effect of monetary policy on investors' expectations about the future economic activity and its effect on asset prices. These two views somewhat represent the old view or pre-crisis and the new outlook that was formed after the financial crisis of 2008. In a research that I conducted in 2015, this result was affirmed that monetary policy affects equity prices by changing the investors' expectations (Hojat, 2015).

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