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Monetary Policy and Stock Market

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INTRODUCTION

The aim of the following thesis is to study the effects of central banks' monetary policy on financial markets. Central banks, in fact, hold a prominent position in the global economy and their decisions extend far beyond the scope of traditional monetary policy.

The analysis specifically explores a key theme for understanding the functioning of contemporary financial markets: the relationship between central banks and financial markets.

The impact of monetary policy decisions, often perceived as an abstract mechanism, directly reflects on the dynamics of financial asset returns. In this regard, this study aims to provide a comprehensive overview of how central banks, through the adjustment of key macroeconomic variables, can influence not only overall economic stability but also the directions taken by financial markets, with the result that their choices can ultimately determine the potential success or failure of investment strategies for businesses and savers.

The first chapter outlines the theoretical foundations of monetary policy and its interaction with financial markets. It focuses on the objectives and instruments of monetary policy, highlighting how these can influence not only the real economy, but also stock markets. It is first highlighted that the instruments available to central banks, while designed to stabilize the economy, can generate significant secondary effects on equity markets and investor behavior, affecting asset valuations and impacting speculative dynamics.

Subsequently, it is explored how, through the study of monetary shocks and their interactions with markets, the latter not only react to central bank policies but also anticipate their decisions, demonstrating a continuous connection and dialogue between monetary policy and financial performance.

The second chapter analyzes the mechanisms through which monetary policies influence asset valuations and market expectations. It explores the transmission channels, demonstrating how central bank decisions interact with markets in often

invisible ways. Subsequently, it compares two intervention approaches: the “Fed put”, which tends to support markets during critical phases, and “leaning against the wind”, which aims to prevent excesses and imbalances before they occur, highlighting their different effects on market equilibrium and investor confidence. Finally, the chapter addresses the role of central banks in identifying financial vulnerabilities and managing periods of high uncertainty, carefully monitoring market stress signals, which is crucial for preserving economic stability.

In the third chapter, the theories analyzed in the previous chapters find practical application, testing the discussed hypotheses through empirical evidence. The examined processes are tested using a quantitative approach to understand how monetary policy decisions are directly reflected in returns.

Building on the analysis by Cieslak, Morse, and Vissing-Jorgensen (2019), which demonstrates how excess returns concentrate in the even weeks of the FOMC cycle, this study aims to verify whether this pattern persists in the current context. It also investigates how extraordinary events, such as the COVID-19 pandemic, have altered these dynamics, revealing whether market behavior has changed under recent economic pressures. The analysis is further extended to European markets, with inflation included as an additional explanatory variable, to understand stock return movements and assess to what extent it influences these results.

CHAPTER 1

THEORETICAL FOUNDATIONS OF MONETARY POLICY AND THE STOCK MARKET

1.1 Monetary policy objectives and tools

In the global economic environment, monetary policy plays a significant role in shaping the growth, stability, and development through nations. Monetary policy, under the governance of central banks and monetary authorities, refers to the actions targeted at regulating money supply and setting interest rates for keeping inflation under control, supporting job creation, and achieving stable and sustainable economic growth.

Apart from the direct effects that monetary policy exerts on the real economy, it also plays a central role on financial markets. This makes central bank decisions highly influential regarding investor expectations and behavior in an attempt to modulate liquidity conditions, interest rates, and therefore the price of financial assets. What this implies, therefore, is that monetary policy is perfectly related to stock, bond, and currency markets and underlines interdependencies between monetary policy decisions and the dynamics of financial markets. This interaction underlines the increasingly crucial role of central banks in firmly setting the course, through their policies, both of the global economic outlook and of the financial markets' trajectories, confirming the critical importance of monetary policy within the global economic and financial landscape.

Through the historical evolution of economic theories, monetary policy has grown in importance, proving to be a flexible and dynamic tool, capable of adapting to changing economic conditions and responding to financial crises of varying nature and magnitude.

Monetary policy theories are rooted in the intellectual debates of the classical school with the Keynesian School over the role of money in its implications for

production, prices, and employment. While the classical economists insisted on the long run neutrality of money by implying that a change in money supply would only alter the price level and nothing else in an economy, John Maynard Keynes brought about a revolutionary view. Keynes most emphatically believed in the regulatory role of the state in the economy, including monetary policy, so that interest rates and, therefore, investments and consumptions could be influenced. With his theory, putting aggregate demand at the forefront of economic activity, he gave monetary policy an active role in heating up or cooling down the economy through the manipulation of interest rates and their impact upon investment and spending.

John Maynard Keynes was a man of great sharpness of thought regarding economics and its mechanisms. He shaped the view of how financial markets should be perceived and what contribution by the state to their regulation is needed. His feeling is that the markets are inherently volatile and speculative, which he has often referred to with the use of such a metaphor as “animal spirits”. These “spirits” symbolize the irrational impetus in investors’ decisions, very often unrelated to the real economic fundamentals of the companies in which they invest. The Keynes comparison with a beauty contest, where the participants try to predict the preferences of the other judges rather than rely on their genuine tastes, provides a clear view of how speculation can dominate market behavior over the objective analysis. This tendency of capital markets to move based on perceptions and expectations rather than intrinsic value inevitably leads to volatility. The potential market swings can become wild, with rapid price fluctuations that reflect changes in expectations and sentiment rather than underlying economic realities. This volatility, although a natural characteristic of financial markets, represents a significant risk for both individual investors and the economy as a whole. It can create speculative bubbles and crashes, negatively impacting savings, investment, consumption, and ultimately, overall economic stability.

Therefore, risk becomes a constant concern not only for individual market participants but also for regulatory and policy authorities. For Keynes, the risk associated with market volatility was not to be merely learned to live with by investors

but rather one in which state intervention could and should play a stabilizing role. Emphasizing the crucial role of aggregate demand as an economic activity engine logically brought him to the conclusion that active policies, in times of financial turbulence, should be implemented to support the economy.

That is where the important concept of the necessity for monetary policy measures that would stabilize financial markets arises. Keynes, though recognizing limitations of such interventions, advocated the use of monetary policy as a tool in an attempt to power overall economic conditions. In this view, central banks assume a very crucial role. Although they use monetary policy to manipulate the money supply and interest rates, under extreme conditions, they even intervene directly in financial markets to avoid dysfunction or stabilize panicked markets. The theoretical debate thus laid the ground for developing tools to achieve desired macroeconomic objectives.

Monetary policy is one of the key transmission mechanisms, with traditional and unconventional tools, through which central banks affect not only economic activity and financial conditions but also stock market behavior.

According to Galì, traditional monetary policy instruments include setting benchmark interest rates, open market operations, and the use of reserve requirements. These instruments are directed at the regulation of aggregate demand, thus keeping inflation under control.

Interest rates

Within the framework of conventional monetary policy, interest rates represent the main lever through which central banks exert their influence on the economy. As illustrated in Galí's "Monetary Policy, Inflation, and the Business Cycle" (2008), by varying the cost of money, central banks can adjust consumer spending and investments, thus influencing economic output and price levels. The change in interest rates is pinpointed on changing the cost of borrowing and, therefore, incentivizing or disincentivizing the activities of lending and borrowing. Lower interest rates reduce the cost of borrowing for banks, businesses, and consumers, further encouraging investments and consumption, hence promoting economic activities and, accordingly,

growth. Increasing the interest rate can be used to slow down an overheating economy and contain the inflationary pressures.

The impact of these policies on financial markets and stock markets is complex and varied. On one hand, extremely low interest rates can drive investors to flock into the equity market in search of higher returns, thereby supporting stock prices and, in some cases, leading to excessive valuations. Expansive monetary policies may, on the other hand, improve liquidity conditions and investor confidence, so fostering corporate growth and economic expansion. However, keeping the interest rates low for a long period is risky because it can distort asset prices, increase indebtedness, and create speculative bubbles.

Central banks are accordingly confronted with the delicate task of balancing economic stimulus goals while sustaining financial stability. The financial crisis of 2007-2008 and the subsequent Great Recession highlighted the limitations of this traditional approach, especially when, in an attempt to counter early signs of recession and stabilize financial markets, central banks, led by the United States Federal Reserve, began to aggressively lower interest rates. However, with the rapid deterioration of the global economy, rates were soon lowered to the zero lower bound (ZLB), an almost uncharted territory for modern monetary policy. This strategy was a sign of the belief that high liquidity and decreased financing costs may be all that economic activity needs to revive the cycle and dampen the crisis's effects.

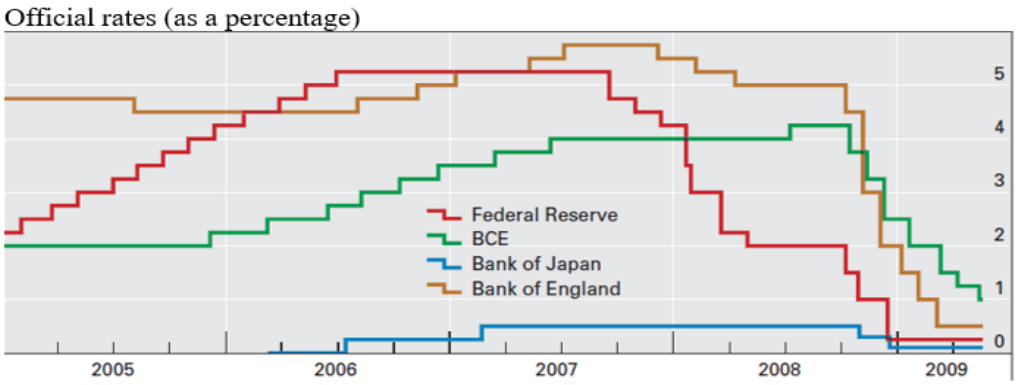

Figure 1.1: Official rates of the main central banks from 2005 to 2009, demonstrating significant drops in the aftermath of the financial crisis in 2007-2009. In reaction to the crisis, central banks including the Bank of England, the Bank of Japan, the Federal Reserve, and the European Central Bank lowered interest rates to almost zero.

Nominal interest rates were approaching zero, drastically reducing the effectiveness of traditional monetary policy in stimulating the economy. In that framework, the concept of "liquidity trap" should be mentioned. Indeed, a liquidity trap occurs when interest rates approach zero. As a result, the stimulating effect of traditional monetary policy on the economy significantly decreases. Under such conditions, consumers and businesses would prefer to hold cash instead of investing due to hopes of low or negative return in the future and, therefore, result in decreasing the incentive for taking risks. This type of attitude may lead to a vicious circle of low demand, low inflation or deflation, and stagnating growth of the economy.

Moreover, "the dysfunctional state of the financial system has severely undermined the effect of rate cuts".

Open Market Operations

One of the basic conventional tools central banks are using to implement monetary policy consists of open market operations. Through these operations, central banks buy or sell government securities on the open market to directly influence the monetary base and, indirectly, short term interest rates. This practice has significant implications both on the general economy and, more specifically, on stock markets.

The main task of open market operations is to control banking system liquidity and, therefore, money supply and interest rates. A purchase of government securities by the central bank injects added liquidity into the system, which acts to increase the availability of money for loan and investment activities. This process tends to lower interest rates, with the ease of borrowing encouraging investment and spending. Conversely, the central bank can increase interest rates by selling government securities and absorbing liquidity from the system, thus depressing an overheating economy.

These operations have both a direct and multifaceted impact on stock markets. First, open market operations may reduce the relative attractiveness of fixed income investments against equities and thus are likely to lead capital flows into the stock markets. This can support the demand for stocks, contributing to rising stock prices

and positively influencing overall market valuation. Investor expectations about the future course of monetary policy and economic performance are formed by open market operations. This could mean that an extended securities purchase program by the central bank might signal commitment to address recession or low inflation, which builds up investor confidence and, hence, serves as support for asset prices, stock market prices included.

However, the critical issue to note here is that while open market operations may work in stimulating economic activities and, hence, having a positive effect on their respective stock markets, if it is not well balanced, it also carries a risk leading to overheating of the economy and the creation of speculative bubbles. As would be expected, excessive injection of liquidity into the system overvalues stock markets and builds unsustainable debt accumulations, creating vulnerability in the entire financial system.

Reserve Requirements

Finally, reserve requirements are a powerful tool available to central banks for influencing the liquidity available in the banking system, the cost of credit, and indirectly, economic activity and stock markets. These requirements determine the percentage of deposits collected by banks that must be held as reserves, either in liquid form at the central bank or as cash on hand. By changing the reserve requirements, central banks directly impact the bank's ability to create credit via the money multiplication process.

When a central bank cuts its reserve requirements, the commercial banks have more money to lend to businesses and consumers. The expanded lending capacity can stimulate economic activity by making it easier and cheaper for borrowers to get credit for investment and consumption. It facilitates access to credit, eases access to credit (interest rates on loans), and boosts expenditure on investments and consumptions.

A low interest rate, high credit availability environment usually is favorable for stock markets. Firms can, in particular, make use of better credit conditions to expand their scale of activities or finance new projects, thereby allowing them to grow in

profitability and, by consequence, higher stock valuations. Increased investment and consumption spending feeds into aggregate demand and can accelerate economic growth. This dynamic tends to be reflected positively in stock markets, where improved economic prospects enhance investor sentiment and the valuation of companies' future earnings opportunities.

Unconventional monetary policy tools

However, such a dramatic decline in economic activity within only two years, from 2008 to 2009, really showed the constraints of traditional monetary tools and clearly called for the introduction of extraordinary intervention programs, leading to the implementation of large scale unconventional techniques. This experience enriched the toolkit available to central banks and had a profound impact on the theory and practice of modern monetary policy, underlining the importance of flexibility and innovation throughout responses to financial and economic crises. Central banks, finding themselves at the epicenter of the storm, had to navigate uncharted waters, adopting a series of unconventional measures to stabilize markets and support the real economy.

Quantitative Easing

One of the most significant strategies is "Quantitative Easing" (QE), which involved central banks purchasing financial assets, primarily government bonds, directly from the markets. These purchases are financed by creating bank reserves, effectively "printing" new money. The idea goes that this addition to capital available in the financial system would provide an incentive for banks to increase the dispensation of credit and thus encourage investment and spending.

On the side of the financial markets, QE simply pushes the prices of financial assets higher as investors move to riskier assets, such as stocks, in search of higher returns. This supports consumer spending through the wealth effect, the psychological and economic process wherein people stay in an attitude of spending more when the

value of their assets rises, even though their income may remain constant. These large scale purchases of government bonds by the Fed tend to drive down the yields on those bonds because price and yield are inversely related. Lower yields on government bonds mean lower long term interest rates and, hence, stimulate investment.

In November 2008, during the peak of the financial crisis, the Fed launched its first QE program (QE1) which involved the purchase of an amount close to $1.75 trillion in government securities. This maneuver expanded its balance sheet. The Fed was not alone in using asset purchases as a monetary policy tool. In March 2001, the Bank of Japan introduced its own financial asset purchase program, aimed mainly at expanding the monetary base rather than lowering long term interest rates. The Bank of England also implemented QE around the same time as the Fed, announcing its first major program in March 2009, just days before the Fed's QE1. The European Central Bank, however, faced political and legal opposition and only launched its first large scale QE program in January 2015. A key point of discussion among economists and policymakers today is the significance of the structure of central bank liabilities for the effectiveness of balance sheet operations.

According to the "79th Annual Report" (2009) by Bank for International Settlements says that there is considerable debate about how quantitatively significant changes in the composition of C.B.s' liabilities, bank reserves in particular, are affecting the economy and financial markets. Others again stress that, even if the bank reserves have expanded considerably under QE, full effects may not reach the real economy if the credit channels are blocked or banks are unwilling to lend. It is for this reason that QE is being supplemented by "credit easing" operations, which directly impact the composition of the asset holdings of central bank balance sheets. These operations are intended to spur the flow of credit toward those sectors of the economy where conventional monetary policy, and even QE itself, were unable to ensure the attainment of goals related to recovery.

By purchasing private debt securities, such as corporate bonds, and implementing targeted financing programs that offer funds to commercial banks on favorable terms, with the condition that these funds are loaned to critical sectors,

central banks aim to directly support credit markets vital to the economy. Such unconventional monetary intervention is designed to be more direct and sector specific impact compared to other stimulus measures. It directs funds into those parts of the economy that most urgently require funding support and enables them to overcome short-term credit squeezes or financial fragility.

Forward Guidance

Among the unconventional monetary policy tools, a special focus is placed on the so-called Forward Guidance (FG) for its importance in analyzing its impact on financial markets. This emphasis is based on the in-depth review carried out by Eric T. Swanson in his study "Measuring the effects of federal reserve forward guidance and asset purchases on financial markets" (2021), published in the Journal of Monetary Economics.

According to Swanson, FG, together with LSAPs, sharply shifts financial conditions and equity markets, and its effect is similar to conventional changes in interest rates during normal economic times. Of these, FG is especially conspicuous as an unusual tool employed by central banks to steer market perceptions regarding the probable path of future monetary policy. The effectiveness of FG is rooted in proper and effective communication by each central bank, consequently affecting today's economic decisions through changes in economic agents' expectation about the direction that monetary policy would take in the imminent future.

Forward Guidance becomes particularly important in situations when the interest rates are near zero because traditional rate adjustments become less effective. In such a scenario, FG has been an essential tool to shape market expectations and financial conditions. Clarity, credibility, and expectations then are strong levers of monetary policy that come to have a huge bearing on financial conditions and investor behavior.

Swanson's research builds upon the methods of Gürkaynak et al. (2005a) to separately identify surprise changes in forward guidance and LSAPs for each FOMC announcement from July 1991 to June 2019. His analysis finds that "Forward guidance and LSAPs had substantial and highly statistically significant effects on Treasury

yields, corporate bond yields, stock prices, and exchange rates, comparable in magnitude to the effects of the federal funds rate in normal times".

Swanson's study revealed that both FG and LSAPs generated lasting effects on financial markets, with impacts comparable in persistence to traditional interest rate adjustments. These effects did not dissipate quickly but instead showed longevity.

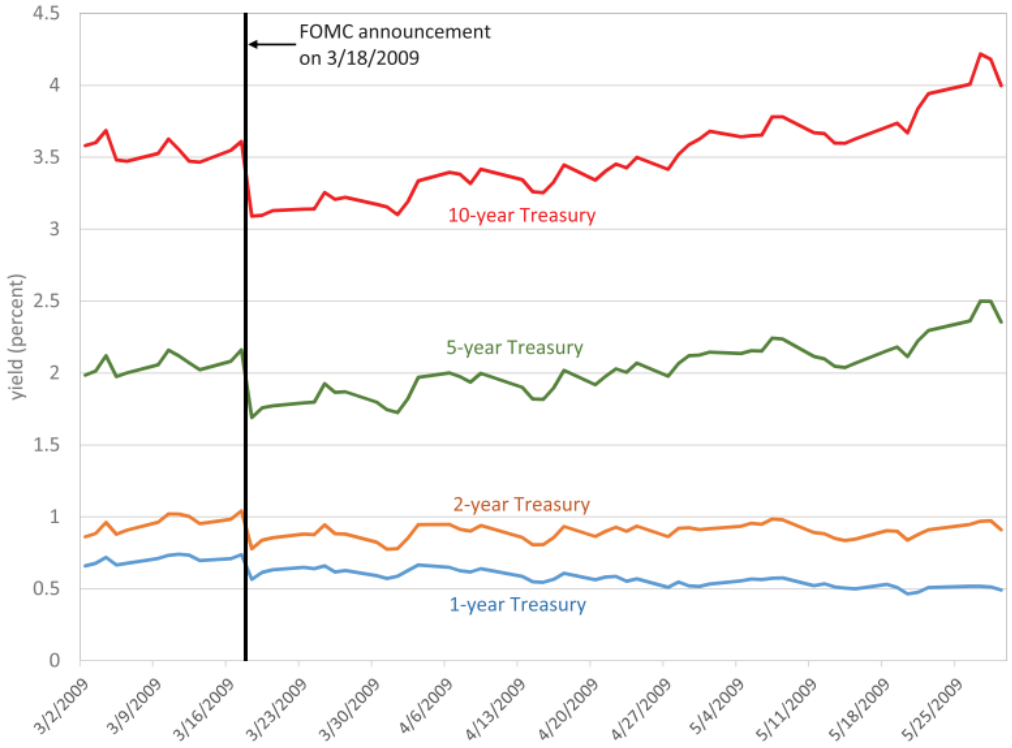

Fig. 4. 1-, 2-, 5-, and 10-year zero-coupon Treasury yields from March to May 31, 2009. See text for details.

Figure 1.2: The yields of 1, 2, 5, and 10 years zero coupon Treasury bonds from March to May 31, 2009, are shown in the chart to show the effect of the FOMC announcement on March 18, 2009.

The graph summarizes the combined effect of Forward Guidance and large scale asset purchases on both short run and long run government bond yields. Estimates of coefficients of the effects of changes in FG and LSAPs on government bond maturities from 6 months to 30 years are shown across three periods: the whole sample period starting from July 1991 to June 2019, the pre-zero lower bound period, the ZLB period, and the post-ZLB period. Specific evidence cited by the paper includes the announcement of FOMC on the March 18th, 2009 when yields on all maturities fell

sharply. However, starting from a few weeks afterwards, yields gradually rose and by the 30th business day, the long term yields fell earlier had reversed. This period, however, was unique in U.S. financial history. The stock market bottomed in March 2009, surging by 30% shortly after, and the Fed's bank stress tests, released on May 7, 2009, were better than expected, boosting both stock prices and bond yields. As a result, the market behavior during this period may not fully represent the long term effects of LSAPs in general.

The figure highlights the fact that the impact of the FG and LSAPs on government bond yields has been heterogeneous and important across bond maturities and time period under consideration. In particular, during the zero lower bound period, FG impacts short-term securities significantly more than long ones, since it shapes expectations about near-term monetary policy. In contrast, LSAPs exert a more pronounced influence on long term yields, reflecting their role in affecting longer duration assets.

The relevance and effectiveness of QE and Forward Guidance are not only central themes of academic and policy debate but were also the subject of a thorough analysis by Ben S. Bernanke, former Federal Reserve Chairman, in his paper "The New Tools of Monetary Policy" (2020). He says that these new monetary policy tools have proved quite powerful, and have provided considerable extra capacity for monetary policy. According to Bernanke, even though there are some divergent views, most studies conclude that the asset purchases of central banks significantly ease financial condition even when the financial market does not face unusual stress.

In his paper, Bernanke provides a simulation based on the Fed's FRB/US model, indicating that a combination of asset purchases and Forward Guidance can effectively add about 3 percentage points of policy space. He suggests that when these new tools are employed, monetary policy can achieve outcomes similar to what traditional policies could attain if the neutral interest rate were 3 percentage points higher. This conclusion aligns with Swanson's analysis, which also underscores the effectiveness of these unconventional tools.

The debate on the effectiveness of Quantitative Easing in the immediate aftermath of the financial crisis was marked by considerable uncertainty, largely due to the lack of experience in how financial conditions would actually respond to such measures. While some models, such as those by Eggertsson and Woodford (2003), predicted that the impact of asset purchases on financial conditions, particularly on stock prices, would be either negligible or temporary, two key arguments emerged to support the validity of QE.

The first argument in favor of QE was the portfolio balance effect. This theory suggests that if investors have preferences for certain assets or asset classes due to factors such as specialized skills, transaction costs, regulations, or liquidity preferences, altering the supply of these securities in the market will affect their relative prices. In other words, when a central bank purchases large quantities of a specific asset, reducing its availability in the market, the price of that asset tends to rise. This happens because investors, with fewer options in their "preferred habitats", are willing to pay more for the remaining assets.

The second argument supporting QE is its signaling effect, which acts as a commitment mechanism. Announcing asset purchases can be interpreted as a commitment to keep short term interest rates low for an extended period, thereby influencing market expectations and driving down long term rates. This occurs because investors form their expectations about future monetary policy based on the actions and communications of central banks. Policymakers encourage the belief that the central bank will maintain low short term interest rates as long as the QE program continues, as ending it prematurely could harm their credibility. With the expectation of prolonged low short term rates, investors shift towards long term securities, making short term investments less attractive. This shift in demand reduces the yields (or interest rates) on long term securities as well.

When QE effectively lowers interest rates for longer periods through portfolio balance or through signaling channels, the effect on the economy will be like that achieved with classic monetary stimulus policies, such as interest rate cuts.

Ben Bernanke concludes by discussing the innovative application of Forward Guidance, also referred to as “open mouth operations”, as a key tool for monetary policy that evolved following the financial crisis. He emphasizes how the core of central banks’ strategies for regulating economic expectations and leading future monetary policy, particularly with regard to policy rates and asset purchases, is Forward Guidance.

In his analysis, Bernanke points out the distinction between “Delphic” and “Odyssean” forward guidance that Campbell (2003) made, outlining the important but different roles that each form has played in the context of zero-interest rate policies.

Delphic guidance focuses on information clarity to enhance the understanding of the public and market participants with respect to the economic outlook and policy-makers’ monetary policy intentions. By contrast with the Delphic guidance, Odyssean guidance includes commitment or a promise from the policymakers to follow a certain course of action in the future based on the state of the economy. This will also help central banks to move out of market challenges without falling prey to short term deviations. The difference between these two kinds of Forward Guidance underlines the evolution in the use of this tool by the Federal Reserve and brings out the inherent complexity. It also follows that clear and credible communication is required for shaping market expectations and behavior effectively.

In his paper, Bernanke highlights the fact that, in the wake of the financial crisis, the Federal Reserve dramatically enhanced the transparency and efficacy of monetary communication by implementing mechanisms like post-meeting press conferences, formal inflation targets, and detailed economic projections. By strategically using forward guidance, the Fed has tried to shape future expectations of interest rates and asset purchases, relying on long-term promises to keep interest rates low and stimulate the economy. Numerous evidences suggest that Federal Open Market Committee pronouncements have had a significant impact on market expectations of interest rates, thus influencing asset values and yields in general.

A key example of this phenomenon was provided in the study by Gürkaynak, Sack and Swanson (2005). The research used high frequency analysis to show that

there are two main channels through which monetary policy announcements affect asset prices. The first are the unexpected news in setting the effective federal funds rate and the second is through news of future changes to the funds rate, conveyed with prior guidance given in the monetary policy statements. While both factors were important, forward guidance played an especially decisive role for long-term yields.

Over time, the practice of Forward Guidance has continued to evolve, hence it has been considered a key pillar of modern monetary policy. From the earlier reliance on qualitative statements, they shifted to more explicit and conditional commitments where central banks can more effectively shape market expectations and guide economic outcomes with better precision.

1.2 Role and objectives of CBs through stock markets

The interaction between central banks and financial markets defines one of the most relevant and complex aspects of the modern global economy. The basic elements of this relation are essentially a few, comprising the central banks' basic objectives: price stability, sustainable economic growth, and financial stability. These goals are primarily oriented toward the real economy, but their attainment is deeply related to the influence that central banks have on the financial markets.

The fact that central bank actions affect not only short term economic expectations but also establish long term growth and stability is due to the relationship between market movements and monetary policies. In this balancing act of sensitive macroeconomic goals with the governance of financial markets, what is needed is a well measured approach that takes into account the global implications of the policies enacted. Thus, central banks cannot take a single step without being under the close scrutiny of investors, analysts, and policymakers.

In his study "Central Banks, Stock Market and the Real Economy" (2024), Ricardo J. Caballero explains that the primary goal of monetary policy is to ensure equilibrium in the goods market by aligning aggregate spending with potential output. However, monetary policy tools operate through financial markets, impacting the

goods market with long and variable delays. Even though decisions about the overnight policy rate are frequently used to sum up the role of monetary policy, modern central banks have far more influence over the financial system. Actually, monetary policy works to influence financial conditions, which reflect the prices of all assets. This in turn affect the real economy, albeit with a number of obstacles and delays.

Caballero asserts that monetary policy, primarily aimed at maintaining equilibrium in the goods market by aligning aggregate spending with the economy's productive capacity, relies heavily on financial markets as its main transmission channel. This approach acknowledges that while the ultimate objective is to affect the real economy, the tools at a central bank's disposal first operate by influencing asset prices and financial conditions.

The central bank's focus on "financial conditions" is a recognition of the wide range of channels through which monetary policy can influence economic activity. Monetary policy, therefore, operates in a balance between the intention to directly influence the real economy and the need to act through the more abstract and complex financial markets.

Financial Stability

One of the main goals of central banks is to safeguard financial stability, which is essential for preserving economic growth and avoiding financial crises. The latter can have catastrophic impacts on the economy as a whole. This implies that central banks control the stock market and use it as a mean to direct the economy toward sustainability and stability.

Financial stability, defined as the absence of systemic disruptions that could hinder the economy's functioning, is deeply connected to the health of stock markets. Extreme fluctuations, speculative bubbles, and stock market crashes can both signal and contribute to financial instability, negatively impacting consumption, investment, and the confidence of economic agents. As a result, central banks closely monitor stock market trends, stepping in when necessary to curb excessive volatility and correct market distortions that could harm the broader economy.

In his text “Inflation Targeting and Financial Stability” (2012), Michael Woodford critiques the pre global financial crisis mindset that financial stability should not be a factor in monetary policy decisions. He challenges the prevailing belief among many central bankers that financial crises, due to their unpredictability, make any effort to address emerging financial risks ineffective. Woodford’s perspective gained significant attention, especially in debates about the role of monetary policy in counteracting or even “bursting” asset bubbles, situations where the market price of an asset greatly exceeds its fundamental value.

The global financial crisis of 2007-2008 has forced economists and policymakers to revise pre crisis confidence in the ability of central banks to deal with asset bubbles and financial imbalances. This view of confidence reflected the fact that central banks could successfully “clean up” once asset market speculative bubbles burst, even if they allowed such bubbles to form in the first place, without taking strong pre-emptive measures to try to prevent their formation. The term “clean up” referred to the notion that central banks could intervene post crisis with expansive monetary policies or emergency measures to stabilize markets, provide liquidity, and support the overall economy, thus mitigating the adverse effects of collapsing asset prices.

That criticism by Woodford stems from the fact that, while financial crises may retain some element of surprise, nothing prevents central banks from acting preemptively in order to lean against emerging financial risks. He highlights that passively waiting for a crisis to unfold and then intervening may lead to less effective responses. As a consequence, there would be much higher economic and social costs.

The objective of pursuing financial stability has been extensively addressed by Claudio Borio in work published by the Bank for International Settlements, in particular in the paper entitled “Monetary policy and financial stability: what role in prevention and recovery?” (BIS Working Papers No 440, January 2014). Borio’s study delves into the intersections of monetary policy and financial stability, offering critical insights for central banks in managing financial cycles.

According to Borio, in the context of the current global financial system, financial stability is a critically important objective for central banks and regulators.

The increasing interconnectivity of markets, as well as the complexity of financial products, have increased the potential repercussions that volatility of stock markets and asset prices may have on systemic stability. In this scenario, the job of central banks has become more intricate because monetary authorities must now trade traditional monetary policy goals such as inflation control against maintaining financial stability.

In the investigation of the relationship between monetary policy and financial stability, Claudio Borio emphasizes that misalignments in the financial market cyclically occur together with their effects. Borio insists that each step forward needs "greater ambition" and "greater humility". It requires more ambition to recognize the view that monetary policy can and should play a more proactive role in preventing systemic financial crises that disrupt the macroeconomy. At the same time more humility is required in acknowledging the limits of what monetary policy can hope to achieve on its own, in particular in securing recovery after a financial crisis has burst into the open. He emphasizes the importance of a balanced approach that considers both the strengths and limitations of monetary policy in preventing and managing financial crises.

Borio underlines the fact that the key problem for central banks in terms of securing financial stability is the recognition and management of the boom and bust phases of financial cycles. According to him, the step of integrating these long and possibly destabilizing financial cycles into policymakers' frameworks is necessary for monetary and financial stability. This approach requires a shift in monetary and financial policy thinking.

Incorporating financial cycles into policy frameworks also implies accepting the trade-off that maintaining financial stability may necessitate short term sacrifices in economic growth. This occurs because efforts to curb a credit or market boom might initially slow down economic activity. However, Borio argues that such sacrifices are in any case necessary for preventing financial crises, which may be far more disruptive and costly to the economy in the longer term. This view is founded on the observation that the wide fluctuations around the financial cycle tend to drive real economy

developments that, on the whole, traditional monetary policies may fail to predict or manage. For example, a prolonged period of low interest rates can fuel a credit and asset boom that, if left unmanaged, can lead to a speculative bubble destined to burst, causing serious economic consequences.

In summary, Claudio Borio's in depth analysis underlines the need for a radical overhaul of the role and instruments of central banks, moving towards an approach characterized by greater proactivity and prevention. This allows to ensure resilient and sustainable economic and financial stability, better equipped to address the challenges of the future.

Inflation

Having set out financial stability as one of the principal objectives pursued by central banks through the prudent management of equity markets, it becomes evident how this priority fits with the other key pillar of central banks' regulatory activity: inflation control.

Traditionally, one of the primary concerns of various central bank policies in different parts of the world has been the controlling of inflation within targeted limits. In this overall context, through their monetary policies, the pursue-inflation approach aims at interest rate regulation and other traditional ways to protect the currency's purchasing power for economic stability and fostering long-term growth. However, modern economies have become so complex that controlling inflation may best be done in a more holistic and innovative way than has been traditionally practiced, due to the global connectivity of financial markets. In this context, the significant role that equity markets can play in managing inflation emerges, an aspect that opens up new frontiers for the regulatory activity of central banks.

Daisuke Ikeda, in his paper "Monetary Policy, Inflation and Rational Asset Price Bubbles", (2021) explores this innovative dimension, offering a refined perspective on how stock market dynamics influence inflation. Ikeda constructs a dynamic model that incorporates rational bubbles and nominal rigidities to demonstrate how stock market booms can serve as effective tools for managing inflation.

According to Daisuke Ikeda, periods of bubble expansion in stock markets should not automatically be interpreted as warning signals for economic stability, but can be seen as opportunities to positively influence the economy and control inflation.

Ikeda argues that "a bubble-led boom mitigates firm's borrowing constraints and keeps inflation from rising by decreasing the shadow cost". Such a counterintuitive mechanism relies on a deeper understanding of the way in which stock market valuation affects investment decisions by firms. During stock market bubbles, it is the increasing value of companies that allows them to obtain finance on better terms. The easing of borrowing constraints has a twofold effect: it stimulates economic activity by increasing investment and production, while also reducing firms' marginal costs by lowering the "shadow cost of borrowing". The shadow cost of borrowing refers to the internal or implicit cost a company incurs when attempting to secure financing through borrowing. The concept of the cost of credit goes beyond a bank or credit agency's nominal interest rate, as it involves additional factors, like credit restrictions, liquidity constraints, and other obstacles that a business may face while attempting to access financing.

In the framing of this model, the shadow cost of borrowing takes on particular significance, as it is in direct interaction with both stock market bubbles and inflation dynamics. If a stock market bubble increases the value of firms, then it increases their collateral to borrow against. This, in fact, reduces the shadow cost of borrowing, as banks or lenders perceive lesser risk while lending money to those firms because of the higher valuation of their assets.

Ikeda makes it crystal clear that "the decrease in the shadow cost of borrowing...adds downward pressure on marginal costs and thereby inflation". Following this, it is easily seen that bubbles can exert a deflationary impact on the economy through cheaper production. His work on how monetary policy interacts with inflation, and with asset price bubbles, appraisal of this intricate relationship. According to Ikeda, stock markets, which are influenced by monetary policies by central banks, have provided both direct and indirect deflationary pressures. The fact that bubbles ease corporate borrowing constraints shows that a phenomenon often

considered hostile to economic stability can facilitate, in specific circumstances, other goals of general monetary policy such as inflation fighting.

Finally, Ikeda proposes a monetary policy framework that includes an enhanced involvement in the presence of bubbles. Leaving inflation targeting to one side, he argues that "optimal monetary policy...calls for tightening to curb the excessive economic expansion fueled by bubbles." Ikeda redefines the role of monetary policy in the age of speculative fluctuations. He proposes a more innovative approach that contrasts with conventional strategies focused solely on inflation. Rather than eliminating bubbles, he argues that central banks should implement targeted interventions to wisely modulate their effects on the economy, balancing growth and stability. This perspective assigns bubbles a dual role: on one side they can threaten economic stability, and on the other side, if managed carefully, they can act as catalysts for sustainable growth. Ikeda's concept of optimal monetary policy includes controlled tightening to restrain excessive economic expansion without stifling growth.

Guillaume Plantin, in his article "Asset bubbles and inflation as competing monetary phenomena", (2023) offers an innovative and multifaceted perspective on the relationship between asset bubbles and inflation. He presents a model that integrates "menu costs", a concept in economic theory referring to the expenses firms face when adjusting prices in response to market or economic changes, and the standard Taylor rule.

Menu costs, in particular, act as a barrier to firms' ability to adjust prices immediately in response to market changes or shifts in the broader economic environment. These costs introduce rigidity into consumer prices, meaning that prices are resistant to rapid and frequent adjustments. This rigidity creates inertia within the price system, leading to delayed economic reactions to fluctuations in demand or other economic shocks.

In the context of Guillaume Plantin's work, a nuanced connection between asset bubbles and inflation is explored, challenging the conventional view that bubbles are purely negative for the economy. Speculative bubbles, following the vision of Plantin, rather than being mere market anomalies that should be avoided, could be a key

instrument to contain inflation. The mechanism leading to this result lies in the interaction between rigid prices and inflationary expectations.

In an economy characterized by menu costs, there is a certain inertia in consumer prices. When combined with a monetary policy following the standard Taylor rule, which may involve keeping real interest rates artificially low to stimulate economic activity, conditions become ripe for the formation of asset bubbles. In this environment of rigid prices and low interest rates, speculative bubbles can easily form because cheap money encourages investment in assets that may not accurately reflect their intrinsic value. As a result, the mismatch between asset prices and underlying economic fundamentals grows, creating fertile ground for bubbles to develop.

Plantin's argument is that speculative bubbles may work like a shock absorber of excess liquidity that would otherwise feed demand for goods and services, potentially increasing inflation. Indeed, such absorption, while only temporary, reduces the money available for consumption and productive investments, thereby tempering inflation. The result implies that speculative bubble can serve as a valve for excess liquidity, postponing the onset of inflationary pressures.

In other words, the key point that Plantin makes is that speculative bubbles, seen by many as so injurious to economic stability, under certain conditions can function to temporarily dampen inflation in economies that have rigid prices. This balance, however, is precarious and subject to reversal when inflation begins to accelerate and real interest rates start moving upward. It would then become clear that such a speculative bubble could not be sustained, and would burst, revealing it as a temporary fix rather than a lasting solution to the problem of inflation. Central banks should recognize the fleeting nature of this procedure and be prepared to manage the fallout from the inevitable collapse of the bubble.

The debate on the interaction between monetary policy, asset bubbles and inflation is thus enriched by Platin's contribution. The latter emphasizes the need for a proactive but cautious approach to monetary policy. His work emphasizes the importance of continuously monitoring financial market dynamics and adjusting policies to strike a balance between promoting economic growth and preventing

financial instability. In this regard, Plantin's research not only deepens the theoretical understanding of asset bubbles but also provides valuable insights for the practical application of monetary policy in today's increasingly complex and interconnected economic landscape.

Economic Growth

Finally, financial markets are an important force aimed at fostering economic development and growth. The latter objective, while presenting itself as a longer term goal than the prevention of financial crises or the maintenance of stable and predictable inflation levels, is of crucial importance to a nation's overall economic well-being. Central banks ensure that all regulations and monitoring are done with great care and attention, in order to favor an environment where financial innovation, capital allocation, and production investment can take place. These efforts are mastered or undertaken for the sole purpose of facilitating better access to credit, enabling firms to expand their activities and stimulating entrepreneurship as well. It is also important to note that a well performing financial system attracts foreign direct investment, which, in turn, brings knowledge competencies, and technology that accelerates economic growth. With openness and stability in the financial setting, central banks reduce the probability of volatility and uncertainty in the economy while creating an environment that allows long-term growth to continue unabated, to the benefit of all in society.

The paper "From Institutions to Financial Development and Growth: What Are the Links?" (2015) by Andrés Fernández and César E. Tamayo offers an in depth analysis of the role institutions play in shaping financial development and, consequently, economic growth.

Institutions, understood as the legal and social frameworks that govern economic systems, have a significant impact on the development of financial markets by addressing information frictions and transaction costs. Central banks are at the center of monetary policy and surveillance of the financial system in establishing conditions most conducive to viable financial development that will lead to long term economic growth. Interventions by central banks aim to establish a stable and predictable

financial environment, which is an essential precondition for minimizing information frictions and reducing transaction costs that generally hinder economic exchange and resource allocation.

In this context, central banks emerge as key institutions, with their ability to enforce high standards of transparency and information disclosure being critical to reducing information asymmetry, one of the main barriers to effective financial development. Central banks may guarantee that financial institutions operate in the most transparent manner possible, providing investors with accurate and timely information. This not only enhances the quality of investment decisions, but also leads to a more equitable and dynamic market environment.

Furthermore, central banks' efforts to promote transparency and information disclosure is based on the idea that institutions generating an effective and reliable legal system help reduce the transaction costs linked to executing and complying with financial contracts. This concept suggests that prudential regulation and supervision are key tools for mitigating market frictions and enhancing financial development. The application of this principle to their actions underlines how prudential regulation and supervision can be powerful tools to mitigate market frictions and support financial development. Reflecting on the functions and actions of central banks in the context of Fernández and Tamayo's insights allows for a better understanding of how these institutions contribute to a more stable and transparent financial system, ultimately supporting sustainable and inclusive economic growth.

In conclusion, financial markets are major units of the policies undertaken by central banks. They represent powerful channels through which a central bank may monitor and guide the economy. Central banks, through financial markets, conduct transmissions of economic policies aimed at stipulating growth, controlling inflation, and stabilizing financial systems. While accomplishing these tasks, they influence investment and consumption decisions of both the public and private sectors and contribute to the stabilization of market expectations, which is very helpful for the creation of a more predictable and resilient economic environment.

1.3 Identification of the interdependence between monetary policy and financial condition

The following section of my thesis outlined above describes how monetary policy, paired with stock market performance, can coexist in a relationship of action and reaction. monetary policy sets up the fundamental grounds for economic growth, while the stock market reacts to such measures, readjusting and very often even anticipating further changes. Their interaction is significant in order to understand how developments along one side usually have an impact on the other, with effects spilling beyond the realm of immediate influence. We seek to understand in some detail the particularities of this relationship and try to ascertain what methods central banks take in attempting to control the economy and vice versa, how market reactions can determine monetary policy decisions.

The paper by Hilde C. Bjørnland and Kai Leitemo, named as "Identifying the interdependence between US monetary policy and the stock market", (2009) and published in the Journal of Monetary Economics, adopt a methodological approach based on a structural Autoregressive Vector (VAR) model in order to explore the relationship between the Fed policy and the US stock market.

This paper is thus unique, as it adopts a very innovative methodology that allows for identifying simultaneous interactions between monetary shocks and stock price shocks, a limitation in most earlier studies which could not highlight any meaningful connection between these two spheres. It represents an advance in the economics literature in that respect, capturing simultaneity and the immediate dynamics between monetary policy and the stock market, and therefore yielding new insights to possibly inform future policy decisions and investment strategies.

The significance of their work lies in recognizing and accurately modeling the true nature of the relationship between monetary policies and stock market movements, providing a more precise and immediate understanding of how these forces interact. By utilizing detailed data and rigorous econometric analysis, Bjørnland and Leitemo used detailed data and advanced econometric analysis to isolate the

specific effects of monetary and stock price shocks, demonstrating how changes in one area can quickly affect the other.

The authors, in their study, refer to the fact that unexpected monetary shocks could significantly contribute to stock prices. The authors state that previous studies had reached a consensus that unexpected monetary policy changes would have strong and instantaneous effects on stock prices, referring to the study of Christiano, Eichenbaum, and Evans (1999). This earlier research explored how monetary policy shocks can be identified and measured using a structural VAR approach and demonstrated how these shocks affect key macroeconomic variables, which in turn influence the stock market.

The author's literature review lays the ground for their study, which stands out due to the use of an enhanced VAR model incorporating methodological innovations to better distinguish between various types of shocks and to more precisely evaluate the impact of monetary policy on financial markets. The VAR model integrates key variables, including federal funds rates, the S&P 500 index, inflation, commodity prices, and industrial production. The set of variables is chosen to capture the complex and multifaced dynamics which govern the interactions between monetary policy and stock market movements.

Bjørnland and Leitemo's VAR model differs since it includes both short-term and long-term restrictions. These restrictions are instrumental to identifying and isolating structural shocks, enabling the authors to analyze the specific effects of monetary policy shocks separately from other simultaneous shocks affecting the economic system. The distinction between short run and long run effects essentially concerns the magnitude and persistence of monetary shocks. One of the more important assumptions in their model is that monetary policy does not have any effect on real stock prices in the long run. They assume long neutrality in line with economic theory, which permits shortcuts based on the premise that monetary policy can produce temporary ripples to infiltrate financial markets, especially through changes in the interest rate. In the long run, however, its effects wear off and do not affect equities' fundamental values. This assumption is fundamental because it allows the authors to

differentiate between temporary and permanent structural impacts, offering a clearer perspective on the influence of monetary policy.

The approach adopted by Bjørnland and Leitemo provides insights not only into the immediate responsiveness of equity markets to monetary shocks but also into the markets' capacity to absorb such shocks over time. This aspect is essentially of much greater value to policymakers and investors alike. In fact, it draws the line that differentiates panic-driven market reactions from those driven by real changes in economic fundamentals. Such an innovative econometric approach allows Bjørnland and Leitemo to give an extremely valuable contribution to the literature, enriching new insights into the efficiency of monetary policy and its interaction with one of the most crucial economic indicators: the stock market.

The empirical results of their study detail the dynamics between monetary policy and stock prices since 1983 up to 2002. In their paper, it has been shown that a shock in monetary policy, for example, a rise in the federal funds rate, instantly exerts a strong effect on the price of the stock. More precisely, with a 100 basis point increase in the federal funds rate, share prices have fallen by 7-9%. This is indeed a sensitive area for the stock market in case of interest rate changes, since it reflects the expectations of investors for the future cost of money in the general price valuation of companies.

The authors also notice that, when positive shocks occur, such as a rise by 1% in share prices, interest rates go up almost right away by some 4 basis points. This reaction can be explained by monetary policy's response to the inflationary and economic growth expectations that a rising stock market might signal. In such cases, the central bank may hike rates to keep overpowering optimism in check on the upside and lower possible inflationary pressures.

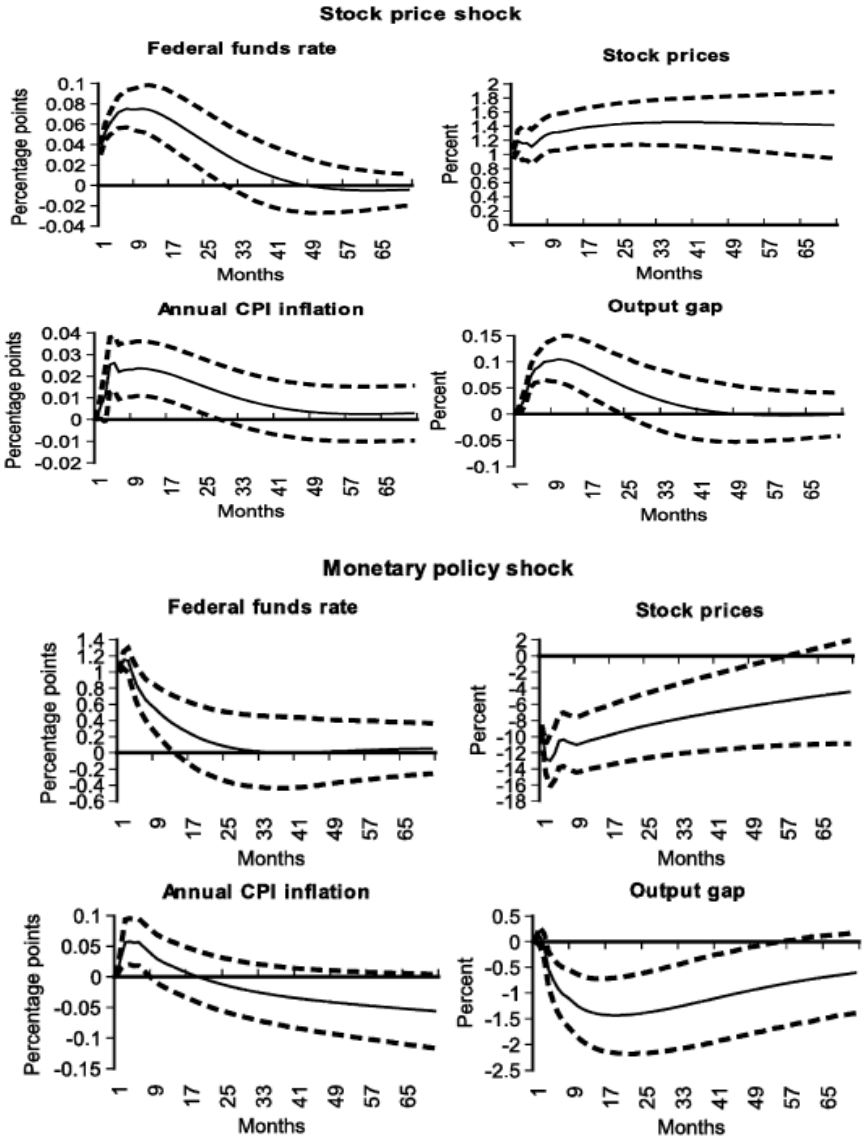

Figure 1.3: Impulse responses of the federal funds rate, stock prices, annual inflation, and the output gap to monetary policy and stock price shocks.

The probability bands in the graph around the estimates, indicated by the dotted lines in the graphs, provide a range within which the true response is expected with some statistical confidence. Both graphs highlight that the interactions between monetary policy and the stock market are bilateral, that is, taking place simultaneously. Both highlight that the shocks in one of these areas reach the other area very fast and strongly.

As the graphs show, a rise in fed funds rates, i.e., a tight monetary policy, depresses stock prices instantaneously, with a marked fall reflecting investors' reaction to the increase of the cost of money. This decline in stock prices is not transitory but rather tends to be persistent, with the magnitude of the effect diminishing gradually over time. At the same time, we see an annualized inflation impact that tends to initially register a small increase, likely due to a variety of factors including retail price adjustments in the face of higher financing costs. The inflation does, however, remain below the starting point in the medium to long term, which may suggest that the effects of monetary policy restraint are beginning to bite. From the perspective of the output gap, the impact of a higher interest rate is unambiguously negative. A higher interest rate tends to curb investment and consumption, implying a decline in output relative to its potential. The dynamic underlines the role of monetary policy in the stabilization process, as it tempers economic growth to avoid overheating, which leads to inflation.

Focusing on the shock to the stock price, interest rates respond positively. An increase in share prices can be interpreted, in some sense as a signal of improved future expectations concerning the economy and, thus, of upward inflationary pressures to which the central bank responds by increasing its interest rates. The output gap is positive in response to this type of shock, implying that higher stock prices may, in fact support economic activity, at least in the short run. Even more interesting is the impact that these shocks have on inflation, which seems to be positive. One of the many mechanisms through which this can happen is that higher stock prices improve the balance sheets of companies that could therefore borrow and invest more easily and, thereby, provide fuel to aggregate demand and inflation.

In their study, Bjørnland and Leitemo devoted a section to checking the robustness of the results to demonstrate that the observed interdependencies between monetary policy and the stock market were not an artefact of their particular VAR model or the chosen sample period. This is an important part of any econometric analysis to assure that the results are not subject to arbitrary choices or particular model configurations. This is to ensure that the dynamics between monetary policy and the

stock market are not only statistically significant but also apply universally outside the specific conditions set in their initial study.

They implemented a series of robustness tests, exploring how methodological variations and different data would affect the conclusions drawn.

Having changed the sampling period, the authors extended the original investigation beyond the time interval considered and found that the highlighted relationships also survive in a different temporal context. As a matter of fact, they also tested for the consistency of the results across different data frequencies, moving from monthly to quarterly data. This test is particularly relevant, as variations in data frequency could obscure or exaggerate the temporal dynamics between the variables of interest.

The robustness of the results using these various specifications gave greater strength and credibility to Bjørnland and Leitemo's work. The interdependence found proved robust, surviving methodological variations that might otherwise have altered the relationship. These views further solidified the perspective that the findings were not random or confined to a particular dataset or period but indicative of a strong and persistent relationship between monetary policy and the stock market, a factually fundamental finding for understanding the dynamics of macroeconomics and formulating efficient monetary policies.

Therefore, the study by Bjørnland and Leitemo gives solid proof of the fact that monetary policy and the stock market are interlinked in such a manner as had not been observed earlier with empirical methodologies. The monetary policy shock immediately affects stock prices and, through them, the real economy. On the other hand, significant stock price movements can feed back into monetary policy when the central bank reacts to lean against the potential inflationary consequences of a euphoric stock market. These findings are highly relevant both for policymakers, who have to take into account the effect of their actions on investor's expectations and behavior, and for market participants, who have to anticipate monetary policy reactions to market dynamics.

The paper enriches not only our theoretical understanding of economic interactions but also provides, in practical terms, several useful suggestions to policymakers as to how monetary policy decisions can be optimized with regard to stock market conditions. The link between monetary policy and stock market fluctuations is an issue of considerable relevance in contemporary economic and financial debate. The analysis of this relationship has evolved through a number of significant studies.

Works by authors such as Roberto Rigobon and Brian Sack, who in 2001 focused their attention on the reaction of stock to Federal Reserve policies, received a really strong base for further research from the work done by Hilde C. Bjørnland and Kai Leitemo. Their paper entitled "Measuring the reaction of monetary policy to the stock market" (2003) is a big step forward within the study of the dynamics between monetary policy and stock markets. Whereas this study deepens our understanding of how central banks react to key changes in the markets, it also puts together a sound empirical basis for further studies that may look into the correlation between monetary policies and the performance of stock markets, thus outlining more effective and efficient policy strategies.

The authors apply a very interesting methodological approach, using the heteroschedasticity of stocks' returns to evade the problem of simultaneity, a situation where two or more variables depend on each other in such a way that makes difficult to define from the relation exactly the direction of the influence between them. In fact, the simultaneity problem has traditionally been an important complication in the empirical analysis of this field.

Heteroschedasticity, or the variability of stock returns that changes over time is one of the privileged windows through which the role of stock prices in monetary policy can be isolated and measured. Conventionally, changes in the stock market and changes in interest rates by central banks influence each other, making it difficult to discern the direction and intensity of this interaction. However, the Rigobon approach exploits variations in market volatility to identify moments during which market shocks are relatively larger than monetary policy shocks, thus allowing a clearer and

less biased estimation of the monetary policy reaction. This happens because during periods of high volatility in markets, market shocks are predominant and hence estimation of the effects of monetary policy would be clearer and less biased.

Following this approach, Rigobon identifies those moments of time when the market shocks are stronger than monetary policy shocks and takes these periods to analyze changes in interest rates as a reaction of monetary policy to the periods of heightened market volatility. The technique here provided by the authors allows them to emphasize how monetary policy reactions are not merely an immediate and direct reaction to day to day stock market and share price fluctuations but reflect the calibrated response of long term expectations about the economy, that is, based on what the movements of stock markets suggest about the future performance of the economy. Central banks, in other words, react to the investors' and markets' expectations regarding the future of economic trends, implicitly reflected in stock prices, by trying to anticipate such expectations to pursue economic stability.

The performed analysis shows that when a large, unexpected 5 percent change in the S&P 500 index occurs, monetary policy decisions by the federal fund rate tend to rise by about 14 basis points in the period following the FOMC meeting. This quantitative link between stock market movements and central bank reactions bears relevance for understanding how fast and directly monetary policy can respond to significant shocks in financial markets. Such relationship not only emphasizes the central bank's responsiveness to stock market shocks, but also highlights the importance of such movements as key indicators that can guide policy decisions.

This type of reaction suggests that the Fed is keeping a close eye on the stock market, acting not only in response to traditional macroeconomic variables but also reacting to market dynamics. Such interaction would indicate that the Fed takes stock prices as one of the leading indicators of future economic conditions. Thus, sudden fluctuations in stock index could be seen as indices of changes in investor confidence, market liquidity, and expectations towards any eventuality, all of which directly influence monetary policy decisions. The ability to respond to such signals allows the

Federal Reserve to operate proactively, seeking to mitigate the effects of volatility before they can fully manifest themselves on the real economy.

Rigobon and Sack identify this interplay of monetary policy and the stock market as the proactive approach which is important to maintaining economic stability. The sensitive response of the stock market to the Federal Reserve allows it to temper endeavors in support of the economy as a whole, without risking overreactions that might serve instead to amplify rather than dampen market fluctuations. This therefore calls for an important balancing strategy that is crucial during economic uncertainty, where timely and well informed decisions are very essential in preserving investor confidence for sustainable growth.

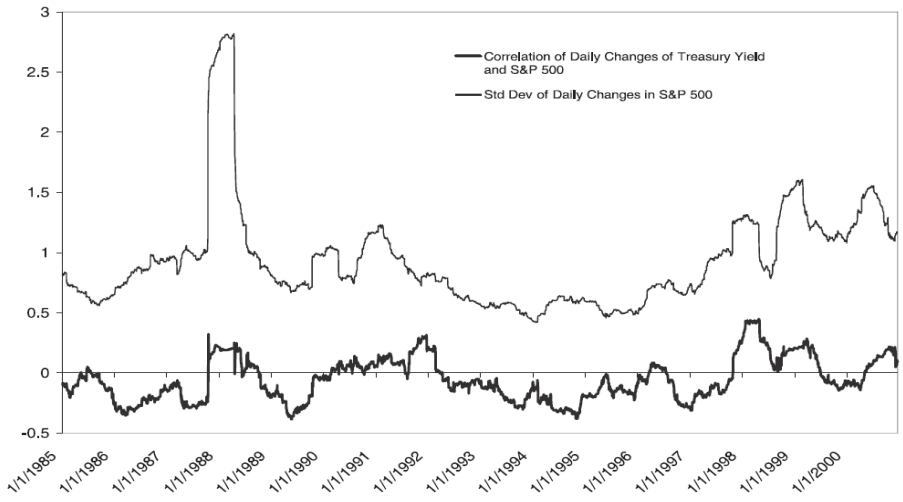

Figure 3: Comovements in Equity Prices and Interest Rates

Figure 1.4: The graph displays the standard deviation of daily changes in the S&P 500 along with the correlation between daily changes in Treasury yields and the S&P 500. The notable peaks, especially in 1987, correspond to times of high volatility.

The comparison of works from Hilde C. Bjørnland and Kai Leitemo with work by Roberto Rigobon and Brian Sack has given a broad and varied overview of the dynamics between monetary policy and the stock market. Accordingly, both investigations try to reach out for this complex relationship with new methodologies, taking somewhat different approaches, hence pointing out the importance of understanding not only the direct impact of monetary shocks on financial markets but also the response of monetary policy to stock market movements.

The integration of evidence from these two studies really allows an understanding of the supports of monetary policy coupled with the stock market to be far more interesting. The ongoing dialogue between market and central bank reveals a complex dance in which each movement is both a reaction and a potential cause of further movements, in a continuous cycle of action and reaction that defines long term economic stability.

The ability of these methodologies to figure out these dynamics not only informs policy decisions but also offers valuable lessons for investors, who must navigate an environment where monetary policies and market movements are intertwined in increasingly intricate ways.

1.4 Stock Market Reaction to Central Bank Policies

Among the various factors that can easily and strongly influence the capital flows in financial markets, monetary policy by central banks stands as one of the strongest. The interplay between these policy decisions and the actual performance of stock markets is an essential field of enquiry for economists and investors.

Having depicted the fundamental linkage between monetary policy and behavior of the stock market, it is necessary to further develop how specific actions on part of the central bank can trigger only certain and relevant responses in the market. This becomes quite indispensable for comprehension not only of a short term market response but long term expectations of investors and their response strategy. The clear analysis of these policies throws more light on how the various aspects of the stock market are influenced by monetary policy decisions, hence offering a deeper insight into the underlying economic dynamism. It also affords extremely valuable tools for the prediction and understanding of future market movements.

In the next segment of analysis, therefore, we will turn into the beating heart of market reactions. We will take into account how investors interpret and respond to unexpected changes in monetary policy. While doing this, we want to reveal not only

the mechanics of such a response but, secondly, larger implications for financial stability and investment strategy.

Among the complex analyses as to monetary policy influences on financial markets, Ben S. Bernanke and Kenneth N. Kuttner's work "What Explains the Stock Market's Reaction to Federal Reserve Policy?" (2005) is a cardinal study in understanding exactly how the decisions made by the Federal Reserve influence the functioning of the stock market. Accordingly, Bernanke and Kuttner nail down the immediate and narrowly observable effects of unexpected changes in federal funds rates on the part of stock prices, a very instructive window into the dynamics of the market's reaction to central bank policies yielded.

The heart of their analysis lies in the distinction between anticipated and unanticipated monetary policy actions. This allows them to isolate the pure effect of monetary surprises, i.e. those changes in interest rates that were not anticipated by the markets.

Unanticipated actions are actually monetary policy decisions that have been surprising the market by being in deviation from given expectations. It also entails the rate of interest, announcement of new asset purchase programs, and significant changes in the Fed's economic projections that trigger immediate and significant market reactions. Surprises can prompt wide realignments in asset prices as market participants hurry to incorporate the new information into their valuations.

To isolate the effect of monetary surprises, Bernanke and Kuttner use econometric techniques to distinguish between market reactions from expected and unexpected news. This is possible by looking into market movements released after monetary policy decisions, using comparative analysis with rate futures earlier in order to show expectations of that market prior to the time when an announcement was made. By doing so, the authors can infer, with better precision, the particular effect of monetary surprises on the pattern of behavior exhibited by the stock market.

The authors indicate that such reactions of the stock market are not mechanical responses to the rate of interest but reflect the reworking of expectations of returns in the future. This is because financial markets are amazingly quick to incorporate

information, including information on the actions of central banks, through the recalibration of valuations of stocks based on expected changes in cash flows and discount rates in the future. The immediate consequences of an unexpected rate change made by the Federal Reserve include the correction in the stock prices. Surprised by the rate cut that was not foreseen, investors actually anticipate an economic environment whereby, in the near future, the cost of money will remain low for longer, boosting investment and consumption and, consequently, corporate profits. Conversely, an unexpected rate increase may indicate a liquidity squeeze and a slowing down of the economy, hence forcing down the price of stocks.

Bernanke and Kuttner note that the largest effect of monetary policy shocks works through changes in expectations of future excess returns, a finding which underlines the role of the "risk premium". Monetary shocks affect investor perceptions of risk, with their changed premium demanded to hold risky securities like shares. On the contrary, if monetary policy is expected to remain accommodative, then risk tolerance will likely increase, which will depress the risk premium, thereby pushing up stock prices.

As Bernanke and Kuttner point out "on average, a hypothetical unanticipated 25 basis point cut in the Federal funds rate target is associated with about a 1% increase in broad stock indexes." This observation gives significant empirical confirmation to the evidence that monetary policies have a direct and quantifiable impact on the overall valuation of the stock market. Indeed, this result not only testifies to the magnitude of the impact of Federal Reserve decisions but also gives a reason for market responsiveness, which is essential to understand how monetary policies affect market valuations. This is not only crucial for comprehending such movements but can be interpreted as an indicator of investor confidence in the economy and future financial stability. Investors may interpret a rate cut positively and, hence, look at a positive signal for access to capital and general economic conditions that increase their stock market exposure and pushing up the stock prices.

The bridge between the fundamental analysis of monetary policies and the specific market dynamics explored by Bernanke and Kuttner can be found in the work

by Gurkaynak, Sack and Swanson, known as “Do Actions Speak Louder than Words? The Response of Asset Prices to Monetary Policy Actions and Statements” (2004). It extends the research not only to direct impact of changes in interest rates but also for the powerful effect of Federal Reserve communications.

Whereas Bernanke and Kuttner focus their attention on the immediate, measurable consequences of unexpected changes in the Federal Funds rate, Gurkaynak, Sack, and Swanson open new leads into the market responses by showing that even expectations shaped by FOMC statements can produce large market swings. The insight provides a far more complex view of how central banks influence markets with not only their actions but also with words, underlining the importance of communication in monetary policy.

What emerges from the market’s reactions after each of the Fed’s pronouncements is sensitivity that goes well beyond the mechanics of rate changes: there is a continuous dialogue between the central bank and the market, according to which every sentence may realign expectations and investment strategies. Only through such kinds of analyses that has become possible to get a more detailed and articulated vision of the interaction between monetary policy and financial dynamics, a fundamental prerequisite for anyone who operates in today’s environment.

To do this the authors have tried to develop a two factor model that can carry more insights regarding how the price of assets and bonds responds to monetary policy announcements. This two factor model is a huge leap in understanding the dynamics of financial markets in response to central bank announcements.

Traditionally the literature has mainly focused on a single factor: the surprise in the federal funds rate, or “current federal funds rate target” factor, which represents the difference between the actual federal funds rate announced by the FOMC and the rate expected by the market before the announcement. The target factor reflects the immediate changes in the federal funds rate, which are the Fed’s direct decisions regarding its primary monetary policy instrument. Changes in this factor tend to immediately affect all segments of the financial market. A surprise in this rate indicates

that the Fed has decided to deviate from market expectations, usually in response to changes in perceived economic conditions.

However, this one-dimensionality is deemed insufficient in the paper. As a consequence, it introduces another factor, known as the "future path of policy" factor, which captures the effect of expectations of future rates that would not be immediately evident through changes in the federal funds rate.

The path factor therefore captures changes in future rates independent of immediate changes in the federal funds rate. This factor tends to be associated with significant changes to FOMC statements, as in the case of the reported discussion of the FOMC meeting of 28 January 2004 when the Committee replaced the phrase "policy accommodation can be maintained for a considerable period" with "the Committee believes it can be patient in removing its policy accommodation". The change in language, while not altering interest rates at the time, suggested that the Fed might be less inclined to keep rates low for a prolonged. Markets took it as a signal that the Fed might raise rates sooner rather than later. This caused an immediate spike in long term bond yields and jitters in equity markets, which feared the implications of a rising rate environment. The new phraseology conveyed more flexibility and less urgency in policy accommodation, with the implication that rate hikes could occur sooner if economic conditions warranted. This directly fed into the path factor, as it changed the market's future expectations of interest rates.

In their study, Gurkaynak, Sack and Swanson explore the specific reactions of stock and bond markets to interest rate changes and to the communications of the Fed. Using high frequency data, the research sheds light on how financial markets respond immediately and measurably to FOMC announcements, both through concrete actions and verbal communications.

For instance, bond markets exhibit a unique sensitivity to signals about potential future monetary policy. The paper demonstrates that in bond markets, the path factor has a much bigger effect on long term yields than the federal funds rate target factor that is in place at the moment. The authors report that they find that, relative to the target factor, the path factor has a larger positive impact on the long end of the term

structure but a smaller negative impact on equity prices, after measuring the bond prices' immediate responses to Fed announcements using intra-daily data. This implies that rather than sudden changes in interest rates, communications about the direction of future monetary policy have a greater impact on long term bond yields. Changes in the FOMC's view on interest rates, or even hints at future monetary policy changes, tend to exert strong bond market responses motion of the yield curve, particularly in longer term government bonds.

More precisely, if the FOMC indicates stronger monetary tightening, this tends to result in an immediate rise in the long term Treasury yields. This is because the markets anticipate that higher rates in the future will make the outstanding, lower yielding securities less attractive. When this happens, investors start liquidating their current long term investments, which drives up yields while bond prices decline. Since the market is anticipating higher interest rates, the selling behavior is driven by the desire to prevent additional losses as the market value of the securities held already declines.

Surprises in any FOMC communication, therefore, that alter perceptions of future interest rates can have significant repercussions through the realignment of portfolios in bond markets, with immediate consequences for investor behavior and overall market perception of risks. Bond markets also tend to remain highly sensitive with regard to the path factor, while target factor elicits more violent and immediate reactions in equity markets. This may be attributed to the nature of assets involved in the response to the two factors, and also the type of investors dominating each market. The stock market, typically focused on short term returns and highly sensitive to current economic conditions, responds acutely to immediate changes in interest rates. For example, a sudden 25 basis point increase in the federal funds rate can induce a drop of more than 1% in the S&P 500 index. The primary cause of this response is the belief held by investors that higher interest rates increase the cost of borrowing money, which might hinder economic growth and decrease the liquidity required to fund operations and business expansions. Higher rates may also result in higher financing

costs and less appeal for stocks in comparison to other investments like government bonds, which gain value as interest rates rise.

However, the stock market's softer response to the path factor implies that shifts in the long term outlook for monetary policy, despite their influence, do not have the same immediate and direct effects as shifts in interest rates. Even if the path factor changed future expectations, such changes take longer to impact company valuations significantly. Firms can gradually adapt to the new expected economic conditions. Investors may thus have time to consider actual impacts of the economic outlook on company performance.

Lastly, investors in the equity market typically concentrate on immediate indicators that show the state of the economy and the profitability prospects of companies, while shifts in the path factor may indicate shifts in the monetary policy's direction that could have long term effects on the economy. Such variables can more quickly and visibly impact investment decisions by offering direct insights into the health of the economy, having the power to mask or lessen their impact of long term expectations on day to day investment decisions.

The different reactions between bond and equity markets highlights the importance of monitoring both monetary policy factors in order to fully understand the impact of Fed choices on different asset classes.

These conclusions from the studies of Bernanke and Kuttner, as well as Gurkaynak, Sack and Swanson, reveal that financial markets are much more active and complex than what is usually believed. They don't take a passive attitude against policies imposed on them by central banks but react very sensitively and differentially to each variation in monetary policy. Indeed, these markets serve as an indicator of global economic conditions, and every signal, whether a changed interest rate, an official announcement, or even the nuances in the communication of a central bank, is interpreted by them and acted upon. Every indication from central banks can trigger a series of calculated responses from investors, who try to anticipate future monetary policy moves and their possible impact on the economy. The dynamic clearly shows

that financial markets possess a remarkable capacity to influence directly economic policies following their reactions.

For example, in the case of a monetary policy decision to which the market reacts particularly badly, it may prompt a central bank to reconsider its future actions to avoid unfavorable economic consequences. Thus, markets and central banks are in a constant, though not always explicit, dialogue where each side continues to influence the other. Moreover, the speed and breadth with which markets react to central bank decisions serve as a telling example of the investor's high connectivity and sophisticated interpretation of global economic information. This ongoing feedback cycle between central banks and the financial markets emphasizes how crucial it is to have predictable and transparent monetary policy, as these are essential components for preserving financial stability and promoting sustainable economic growth.

To put it briefly, financial markets constitute important and flexible agents that actively affect the economic environment through their prompt and informed responses, rather than being passive recipients of monetary policy decisions. Central banks need to carefully track and learn about this dynamic interaction for the purpose to effectively navigate the intricate global economic surroundings.

1.5 Empirical evidence and cross-country analysis

The final section of this chapter provides a deeper investigation of the monetary policies that central banks around the world have set in place, showing how these policies have an immediate effect on financial markets within specific regulatory and economic frameworks. Upon assessing the various approaches employed by central banks, an extensive range of strategies becomes apparent, each effectively suited to address the unique requirements and hurdles of the respective economic context. The chapter demonstrates the significance of a strategic balance to minimize risks while stimulating a growth that is sustainable by exploring the relationship between monetary policy and financial health in specific scenarios.

The paper “Monetary Policy and Financial Stability: Cross-Country Evidence” (2015) written by Christian Friedrich, Kristina Hess and Rose Cunningham, and published by the Bank of Canada, offers a detailed methodological analysis of the interaction between central bank monetary policies and global financial market stability. The authors look at how different bodies, each operating in a unique regulatory and economic environment, affect and reply to market dynamics through an exhaustive empirical analysis. This multifaceted method is important for recognizing the dynamics shaping the global financial security and the choices regarding investments.

Friedrich, Hess, and Cunningham’s work is significant because it informs about the prudent strategies adopted by different central banks in a number of advanced economies in order to maintain market instability and fluctuations. The study analyses the impact of monetary policies on financial dynamics, and it underlines the fact that the actions of central banks are anything but confined to the maintenance of price stability but go ahead with active regulation of economies in order to avoid financial crises. They show that responses to diverse economic challenges are not standard, but rather they are customized to the unique circumstances of each nation.

The writers emphasize the importance of a coordinated and well-informed approach to dealing against market uncertainties. They suggest that monetary policy decisions should balance the need to stabilize prices with the need to mitigate wider financial risks and vulnerabilities. This equilibrium is crucial not only for the domestic economic health of countries but also has significant impacts on the global financial landscape, influencing investment decisions and investor confidence internationally.

The procedure employed by Friedrich, Hess and Cunningham uses a quantitative approach to examine how central banks shape their monetary policies in response to the challenges of financial market stability.

The study introduces the financial stability orientation (FSO) index, that evaluates the amount that each central bank provides to financial stability in its policies, as a key component. This index is especially relevant for comprehending how monetary policies directly affect the dynamics of the world’s financial markets. The

FSO consists of three main dimensions: the nature of the legislative frameworks governing central banks, the breadth of monetary and regulatory policy instruments at their disposal, and the frequency with which financial stability risks are mentioned in monetary policy communications. Each of the dimensions adds to defining, in a differentiated way, the profile of the responsiveness of a central bank to financial risks, with an overall score that may change depending on the degree of proactivity concerning the management of financial stability. Banks with a high FSO score are those that take preventive measures, tending to act proactively against potential imbalances before these have manifested themselves in financial crises.

These interventions are crucial because they directly impact financial markets by anchoring investor expectations and maintaining equilibrium in the flow of credit. For example, the most widely used method by these banks in attempting to dampen the excessive growth in credit is raising interest rates. When a central bank raise interest rates, the cost of money rises. As a result, both consumers and companies borrow less conveniently. The deceleration in lending aims at reducing the oversized economic growth and prevents the buildup of unbearable debt, which is risky for financial stability.

High interest rates make investors and firms more conservative in investment decisions, hence reducing speculation and assuming excessive risk. Increasing interest rates directly influence financial markets as well. The return from government bonds becomes comparatively much more attractive with higher rates of interest than other forms of investment, which are considered to be riskier, such as shares. This might reallocate capital in the markets, shifting them to invest in seemingly safer investments. This shift in investment preferences serves to moderate asset prices and make the occurrence of asset price bubbles less likely.

Several significant examples illustrate how nations with high FSO index values tend to adopt proactive monetary policies with the purpose of stabilize their financial systems.

The UK is very prominent in particular due to the high index of the FSO, which testifies that this country is very active towards financial stability management. The

work of Heinlein and Lepori named “Do financial markets respond to macroeconomic surprises? Evidence from the UK” (2022) provides a clear indication of how macroeconomic surprises influence the UK financial markets through the use of daily data from 1998 to 2017. This period comprised a variety of macroeconomic surprises. In that era, the BoE was outstandingly proactive, with one of the exemplary policies in interest rate adjustments.

Heinlein and Lepori prove that the BoE did not passively react to either inflation or to GDP growth but actively used the information carried in retail sales as an anticipatory indicator to modulate monetary policy. Retail sales, when continually higher than expected throughout the economic boom period, constituted a wake-up call for the BoE, interpreting these data as a prelude to possible inflationary pressures. To this, the BoE often reacted by increasing the base interest rates, a measure to restrain consumption and investment, consequently dampening a market that was likely to overheat. This kind of intervention, though apparently at odds, was actually made to maintain economic balance without constraining growth.

What the BoE did had direct and significant consequences for the responding financial markets. While the raising of interest rates at first depressed the stock market, this action helped to stabilize the economy in the longer term and prevented asset bubbles from occurring. This is also supported by the analysis of Heinlein and Lepori, which showed that these interventions have generally been followed by positive market reactions with average stock returns increasing 0.4 percent in response to positive economic surprises.

In any case, the monetary policy management of the BoE during the period under review was not just a reaction to the actual economic data but proactive and well calibrated, aimed at long term stabilization of financial markets. Anticipating those economic indicators, such as retail sales, and acting way in advance not only restored investor confidence but also ensured a more measured and effective response to economic fluctuations without getting into the trap of a purely reactive policy that is likely to have destabilizing effects.

A low value of the FSO index means that the central banks apply their monetary policy in a more reactive rather than preventive manner. The adjustments occur in the wake of taking place after the crisis or financial shock has hit the economy. This reactive policy, for the most part, takes the form of setting the interest rate according to negative economic events that have transpired.

This time the influences run in the opposite direction, and investment and consumption are stimulated by means of the lowered money cost. The purpose is to stimulate the economic activity. Credit is to be facilitated to firm and consumer, who are to be able to finance new investments or outlays on more advantageous conditions, stimulating the aggregate demand. This approach, however, has its own flaws. Mainly, it works only when problems have actually begun to set in and, for the large part, have worsened. Acting late can suggest that measures resorted to must be extreme to be effective and their adverse consequences can lead to greater instability.

For example, during an extended deflationary period that pounded the Japanese economy, monetary policy maintained by the BoJ was considerably rearward looking. Rather than attempting to anticipate and lean against emerging risks to financial stability, it has mostly waited until the symptoms of economic crisis had fully appeared. This approach led to the use of key stimulus measures, extremely low interest rates, and massive purchases of financial assets only after the economy had already showed severe stagnation and deflation.

A case-specific analysis of the Japanese economy over this period is provided in the work of D.E. Allen and H. Mizuno titled “Monetary Policies, US Influence and other Factors Affecting Stock Prices in Japan” (2021). In this paper, the authors analyze the efficiency of monetary policies of the Bank of Japan, focused on the Quantitative and Qualitative Easing program, to indicate the way this affects stock markets in conditions of an international finance crisis combined with deep and long deflation.

From the analysis done by Allen and Mizuno, the introduction of QQE markedly raised the stock prices. Precisely, this increase was estimated at about 27% over what ensued without such expansionary interventions. This is mainly brought about by large

scale purchases of the long term Japanese government bonds and ETFs by the BoJ. These purchases not only lowered the long term interest rates but also provided huge liquidity to the market and, as a consequence, substantially increased the attractiveness of equity investments, pushing up stock prices. Increased liquidity and a corresponding decline in interest rates tended to temporarily decreasing the deflationary pressures.

However, while these measures were effective in the short term in boosting the economy, they were applied in response to already manifest signs of crisis, which may have limited their overall effectiveness in stimulating a sustainable growth and preventing prolonged deflation. The preceding example demonstrates the urgency of carrying out monetary policies in a balanced and timely manner to alleviate market uncertainties and support stability.

CHAPTER 2

MARKET DYNAMICS AND CENTRAL BANK RESPONSES

In the first chapter, after delving into the theoretical foundations of monetary policy and its connection to the stock market, the analysis focused on various theories and tools of monetary policy, as well as the role and objectives of central banks in stock markets and the interdependence between monetary policy and financial conditions. Specifically, the stock market's reaction to central bank policies was analyzed, presenting empirical evidence through a comparative analysis between countries.

It was also highlighted how the perception of central bank interventions can influence market volatility and contribute to overall financial stability. The analysis showed that monetary policy, through both conventional and unconventional mechanisms, has a profound and varied impact on financial markets, shaping market expectations and influencing asset valuations.

The aim of this second chapter is to further analyze market dynamics and central bank responses, with the specific goal of examining how monetary policies influence asset valuation, market expectations, and financial stability.

The first segment will be devoted to the transmission mechanisms of monetary policy, analyzing the various channels through which central bank decisions explain their effects in the economy, such as the interest rate channel, the credit channel, the asset price channel and the expectations channel. In particular, for each of these channels, the ways in which they operate in practice and their specific implications for asset valuation and investment decisions will be examined.

Subsequently, the analysis will focus on the effects of monetary policy on asset valuation, including the study of the so called "Fed put" and its impact on market expectations. The concept of the "Fed put" refers to the perception that the Federal Reserve will intervene to support financial markets during periods of significant

turmoil. The analysis will then explore how this perception influences investor behavior and asset price formation.

The second chapter will also examine the debate on whether and how central banks should “lean against the wind” to prevent financial instability risks. This section will include a cost-benefit analysis of such interventions, evaluating the effectiveness and long term implications of proactive policies aimed at preventing financial crises.

Another crucial aspect will involve the analysis of financial vulnerability and market stress indicators. In this context, the tools and methodologies used to assess the vulnerability of financial markets and identify early signs of financial stress will be examined, while also providing an overview of the means through which central banks monitor and respond to emerging risks in financial markets to maintain stability. This is particularly important, given that the role of central banks in ensuring financial stability is a central theme, especially in scenarios of high uncertainty and volatility. In this regard, the ways in which monetary policies are adapted to address periods of economic stress and financial market turbulence will be examined, including a review of real world cases and the methods employed by central banks to support economic stability and mitigate risks.

In summary, the goal of this chapter is to provide a comprehensive understanding of the complex circumstances that influence the impact of monetary policies on financial markets and the real economy. It will explore not only the direct effects of central bank decisions, but also how market expectations and perceptions affect asset prices and overall financial stability.

2.1 Monetary policy transmission mechanisms

The transmission mechanisms of monetary policy are a crucial element in a country’s economic management, as they define how central bank decisions affect the real economy and financial markets. These mechanisms are essential for understanding the impact of monetary policies on various aspects of the economy, including interest rates, inflation, investment levels, and financial stability. Understanding the

transmission mechanisms of monetary policy is essential for central banks, as it enables them to assess the effectiveness of their strategies and adjust them in response to economic changes.

The decisions made by central banks have profound and immediate repercussions on financial markets, influencing investor expectations, the availability of financing, and overall confidence in the economic system. This occurs because monetary policies, through their transmission mechanisms, can significantly affect the functioning of these markets; changes in monetary conditions can, for instance, alter financing costs for businesses, modify investment behavior, and impact the levels of perceived risk among investors. Hence, the need for central banks to continuously monitor financial markets and adopt proactive measures aimed at maintaining balance and confidence in the financial system.

The ability of central banks to effectively manage the transmission mechanisms of monetary policy is particularly important during periods of economic turbulence. In such situations, central banks must be ready to intervene swiftly to support markets and prevent systemic crises.

Effectively managing the transmission mechanisms is therefore crucial to preventing financial contagion and ensuring that the economy can quickly recover from negative shocks. This task requires both a detailed understanding of how monetary policies impact various sectors of the economy and the ability to adapt to changing economic conditions, as well as continuous monitoring and accurate assessment of the transmission mechanisms, to ensure that policies promote stable and sustainable economic growth.

On this specific topic, the paper “Q-Monetary Transmission” (2022) by Priit Jeenas and Ricardo Lagos is of particular importance. The authors, by exploring changes in monetary policy and their effects on corporate investments and capital structure, develop a theoretical framework, provide empirical evidence, and quantify the impact of the transmission mechanism on aggregate investments.

In particular, this study highlights three main channels through which monetary policy influences the economy: the interest rate channel, the asset price channel

(Tobin's q), and the credit channel. Each of these channels has significant implications for financial markets, including equity and bond markets.

The most common of the monetary policy transmission mechanisms is the interest rate channel, which has already been discussed in the analysis of central bank tools. However, it is useful here to further explore how this mechanism operates and affects financial markets.

As is well known, the interest rate channel primarily operates through changes in the cost of capital: when the central bank decides to raise nominal interest rates, often with the goal of curbing inflation or cooling an overheated economy, real interest rates tend to rise as well. Higher real interest rates, however, imply a greater cost of financing, resulting in reduced incentives for businesses to borrow money to finance new investment projects.[1]

The relationship between interest rates and investments is well established in economic theory. When the real interest rate increases, the cost of using capital rises, reducing the demand for capital. This consequently increases business investments. When the central bank unexpectedly raises the nominal policy rate, part of this increase typically passes through to real interest rates, which are a crucial component of the cost of capital. Since the demand for capital is determined by the cost of capital, higher real interest rates make investing in new capital assets more difficult form firms. As a result investments decline because firms respond by lowering their demand for capital.

Such a mechanism can directly influence share prices. In fact, higher interest rates make borrowing more expensive, reducing the profitability of investments and, consequently, a company's ability to generate future cash flows.

This can have a negative impact on a company's value, as firms facing higher financing costs may decide to scale back their expansion plans or delay new investment projects, reducing expected cash flows. Consequently, investors, anticipating lower future returns, may choose to sell shares, leading to a decline in stock market prices.

[1] As originally expressed by Jeenas and Lagos in *"Q-Monetary Transmission"* (2023, p. 2, paragraph 2).

The effect on bond markets is equally significant. On one hand, companies face higher financing costs (increasing the risk of default), and on the other hand, investors, perceiving greater risk associated with corporate bonds, demand higher returns to compensate for this added risk. The impact is amplified when the interest rate hike is substantial and prolonged, as investors' expectations quickly adjust to the newly perceived risks.

Secondly, the asset price channel, particularly through "Tobin's q" (the ratio of a firm's market value to the replacement cost of its capital), plays a crucial role in the transmission of monetary policy. When the central bank lowers nominal interest rates, the prices of financial assets, including stocks, tend to rise.

Indeed, a higher Tobin's q indicates that the market values a company's assets more than their replacement cost, encouraging firms to invest more in new capital. This increase in investment is financed through the issuance of new shares, leading to a further rise in stock prices due to higher demand from investors.

Jeenas and Lagos provide empirical evidence showing how changes in Tobin's q, driven by monetary policy, significantly influence firms' investment and capital structure decisions.

The empirical method used involves exploiting stock turnover as a source of cross-sectional variation. This allows to identify the effects of monetary policy on Tobin's q. Specifically, the authors exploit the differences in stock turnover rates across firms in order to estimate the responsiveness of stock prices to monetary policy shocks. The approach is based on the idea that stock turnover correlates with the liquidity of stocks and influences how the stock price of a firm reacts to monetary shocks. In this way they can create an instrument for the firm's level of Tobin's q, interacting monetary policy shocks with the firm specific stock turnover, and can estimate the causal impact of Tobin's q on the investment and equity issuance decisions of the firm.

For instance, according to their study, a 1% increase in Tobin's q leads to a 0.08% rise in the ratio of net equity issuance to the total book value of assets in the quarter of the monetary shock. This effect occurs because, as previously highlighted,

a higher Tobin's q makes it more advantageous for firms to issue new shares, as the market values their capital more highly than its replacement cost.

Moreover, over a two-quarter horizon, this increase in Tobin's q results in approximately a 1% rise in the investment rate, as firms, with greater access to capital from equity issuance, can more easily finance new investment projects.

This positive feedback underscores the crucial role that stock markets play in the transmission of monetary policy.

In this context, central banks play a fundamental role in utilizing this transmission mechanism to influence financial markets. By adjusting nominal interest rates, central banks can manipulate Tobin's q, inducing significant changes in firms' market valuations. Additionally, as stock prices rise, the perceived risk for firms decreases, leading to lower yields and higher prices for corporate bonds. This reflects improved creditworthiness of firms, as a strong stock market is often associated with greater confidence in a company's ability to meet its financial obligations.

In summary, through the Tobin's q channel, central banks can effectively influence stock markets and, through them, corporate investment decisions, demonstrating their ability to wield a powerful lever for driving economic growth and stabilizing financial markets.

From this perspective, the credit channel amplifies the effects of monetary policy through changes in the net worth of borrowing firms, caused by tightening or easing lending conditions. In fact, when interest rates rise, the net worth of borrowing firms can decrease, reducing the value of their assets.

This deterioration in balance sheets makes external financing more expensive, as risk premiums increase and lending conditions become more burdensome. Consequently, firms may face greater difficulties in securing financing, leading to a reduction in investments and a decline in stock prices.

Jeenas and Lagos also highlight that the credit channel operates in combination with the other two channels, amplifying their effects.

For example, a restrictive monetary policy that raises interest rates can simultaneously lower stock prices through the asset price channel and weaken the

balance sheets of borrowing firms via the credit channel. This dual impact can lead to a significant reduction in corporate investment and overall economic activity. Additionally, the bond market responds to these changes with higher risk premiums, reflecting the increased credit risk of firms. This leads to higher yields and lower bond prices, creating further challenges for companies in securing financing at sustainable costs.

The credit channel can be seen as an amplification mechanism that operates together with other transmission channels. An unexpected increase in the nominal policy rate leads to a reduction of asset prices and it weakens borrowers' net worth. Financial positions are the deteriorated, which leads to an increase of the external finance premium on debt (Bernanke and Gertler (1989)), or to tighter borrowing constraints (Kiyotaki and Moore (1997)). This implies that firms that rely on debt financing on their investments face higher borrowing costs or reduced access to credit. This bring to a decrease in debt financed investments.

A scenario like this highlights how central banks, by raising interest rates, can not only directly influence financing costs but also indirectly worsen credit conditions. This amplifies the restrictive effect on businesses, limiting their ability to invest and grow. Consequently, a restrictive monetary policy can have deep and widespread effects on financial markets, negatively impacting both equity and bond markets, while also reducing overall economic activity.

In conclusion, interest rates represent the primary transmission tool through which central banks influence stock markets, as highlighted by the work of Jeenas and Lagos. The three transmission mechanisms -the cost of capital channel, the asset price channel (Tobin's q), and the credit channel- are all affected by changes in interest rates.

The manipulation of interest rates by central banks allows them to indirectly influence stock markets: by lowering or raising rates, they alter the cost of capital, asset prices, and credit conditions. This strategic intervention on rates enables central banks to exert significant control over stock valuations and investment decisions, demonstrating how monetary policy can shape financial market behavior.

In addition to the three monetary policy transmission mechanisms previously discussed, another significant channel that central banks can leverage to influence stock markets is the wealth effect. This process plays a crucial role in shaping investors' perceived wealth through fluctuations in asset prices, thereby impacting their spending and investment decisions. By incorporating the wealth effect into monetary policy mechanisms, central banks can amplify the impact of their actions on financial markets, either supporting or adjusting market dynamics in line with macroeconomic objectives.

The wealth effect has been the subject of numerous studies in the field of monetary policy, particularly regarding its impacts on financial markets. It refers to the ability of monetary policy to alter the wealth of households and businesses, thereby influencing their spending and investment behavior. More specifically, the wealth effect occurs when changes in interest rates affect the prices of financial assets, which in turn alter the perceived wealth of investors. This transmission mechanism is crucial in the context of monetary policy, as it enables central banks to indirectly influence the real economy through the dynamics of financial markets.

In the paper "Comparing Wealth Effects: The Stock Market Versus The Housing Market" by Karl E. Case, John M. Quigley, and Robert J. Shiller, published by the National Bureau of Economic Research in November 2001, the authors analyze the impact of financial wealth, particularly that derived from the stock market, on household consumption. Their study provides a significant contribution to understanding how changes in financial wealth can influence spending behaviors.

The analysis utilizes annual panel data from 14 developed countries, observed over various periods during the last 25 years, as well as a quarterly U.S. panel from the 1980s and 1990s. By examining these data, the authors estimate the aggregate value of financial assets and measures of aggregate consumption for each geographic unit over time.

The results of their statistical analyses demonstrate a significant impact of financial wealth on household consumption, influenced by central banks' monetary policy. In particular, Karl, Quigley, and Shiller highlight the renewed interest in

economic and monetary policies concerning the effects of household wealth on consumption levels, especially in light of the rising stock market values during the recent economic expansion in the United States.

They point out that the increase in stock prices likely fueled higher consumer spending during the prolonged boom period. However, they also warn that if stock prices stagnate or decline, there are valid concerns that this could deepen an economic slowdown by dampening household consumption. This highlight the fear that declining or stabilizing share prices may exacerbate an economic slowdown by depressing the consumption spending of households.[2] This marks the vulnerability of consumption to fluctuations in asset prices, which becomes a crucial factor for policymakers.

So, the wealth effect identifies the causal impact of exogenous changes in wealth, directly influencing consumption behavior.

To demonstrate this thesis, the authors use two datasets: a panel of annual observations from 14 countries over the period from 1975 to 1999, which measures aggregate consumption and stock market wealth capitalization; and a similar panel of quarterly observations on the United States, between 1982 and 1999, which estimates consumption and stock ownership.

The study first demonstrates that stock market wealth has an impact on consumption. However, the authors explain that: “The evidence suggests that housing market wealth has a more important effect on consumption than does financial wealth.”[3]

[2] See Case, Quigley, and Shiller, *"Comparing Wealth Effects: The Stock Market versus the Housing Market"* (2001, p. 1, paragraph 1).

[3] “Nevertheless, the evidence of a stock market wealth effect is weak... However, we do find strong evidence that variations in housing market wealth have important effects upon consumption. This evidence arises consistently using panels of U.S. states and individual countries and is robust to differences in model specification. The housing market appears to be more important than the stock market in influencing consumption in developed countries” (Case, Quigley, and Shiller, 2001, p. 15, paragraph 1).

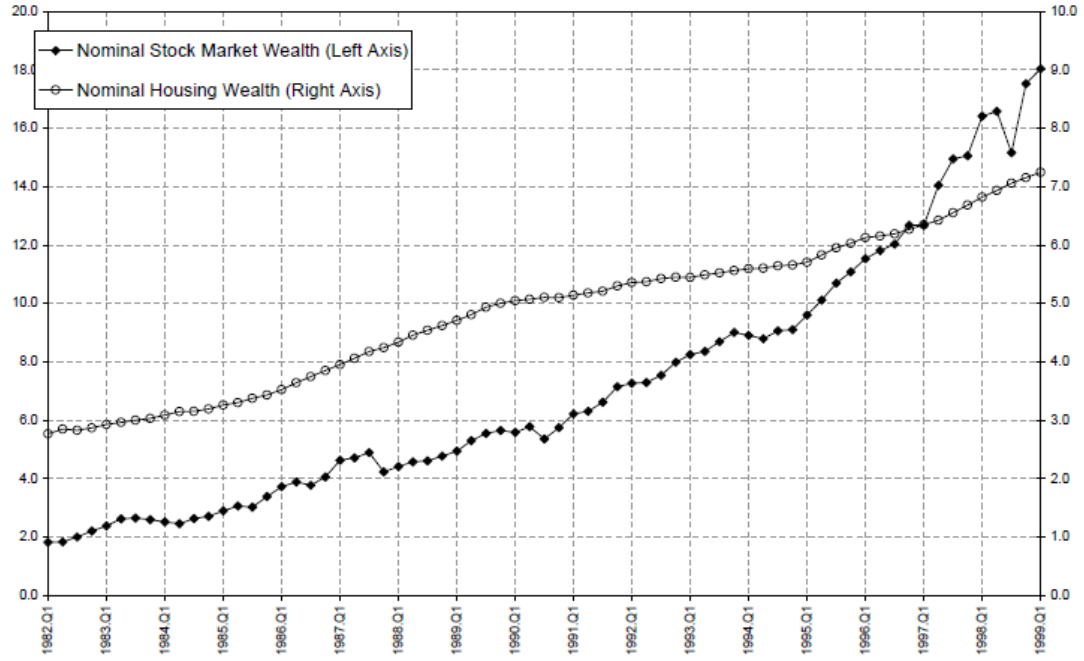

Figure 2.1: Nominal U.S. stock market and housing wealth (in trillions of dollars) from 1982 to 1999, showing significant growth in both categories.

The two lines on the graph show how both forms of wealth have increased over time. The black line with dots represents nominal stock market wealth, which grew from about 2 trillion dollars in 1982 to nearly 10 trillion dollars in 1999. The gray line with circles represents the nominal wealth of owner-occupied housing, which increased from about 4 trillion dollars in 1982 to around 9 trillion dollars in 1999.

Despite the greater relative importance of housing wealth, it is important to highlight that financial wealth still has a significant effect. In international comparisons, the elasticity of financial wealth ranges from 0.02 to 0.10, indicating that a 1% increase in financial wealth leads to an increase in consumption between 0.02% and 0.10%. This increase, although it may seem small, is significant in macroeconomic terms, as small changes in consumption can have amplified effects on the overall economy.

The authors use various econometric specifications to isolate the effect of financial wealth on consumption.

In the basic regressions, which focuses on the direct relationship between financial wealth and consumption without additional controls or fixed effects, the effect of financial wealth on consumption is often smaller and less significant compared to housing wealth. For example, in international comparisons, the estimated elasticity of financial wealth is about 0.02, with a t-statistic of 2.05, indicating statistical significance (we can assert with some confidence that the observed effect is not due to chance). Furthermore, in the United States, the elasticity of financial wealth ranges between 0.03 and 0.07 across different model specifications.

In one of the more robust specifications, which includes fixed effects specific to country and year, the coefficient of financial wealth is estimated at 0.07 with a t-value of 14.97, indicating a significant effect and thus demonstrating that financial wealth has an important impact on consumption.

In light of the analyses, it is demonstrated that central banks can use the wealth effect to intervene significantly in stock markets and the real economy; changes in interest rates can influence the prices of financial assets, altering the perceived wealth of investors. The increase in financial wealth stimulates household consumption, as highlighted by the authors Case, Quigley, and Shiller, creating a virtuous cycle that supports economic growth.

The ability of central banks to modulate perceived wealth through stock markets, understood as the wealth based on the value of the assets that investors hold, represents an effective tool for supporting aggregate demand and stabilizing the economy. By using this lever, central banks can effectively influence the spending and investment behavior of economic agents, thereby intervening in financial markets in line with macroeconomic objectives of stability and growth.

Leaving behind the wealth effect, in the literature on central banking and monetary policy, there is a significant focus on how central banks can influence financial markets indirectly through their policy decisions.

One of the critical channels of this influence is the risk-taking channel, which has been examined extensively in the context of its impact on bank behavior and, consequently, on financial market stability.

The paper "Banking Sector and Monetary Policy Transmission: Bank Capital, Credit and Risk-Taking Channels" (2013) by Philippe Gilles, Marie-Sophie Gauvin, and Nicolas Huchet, instead focuses on the role of central banks in the transmission of monetary policy and the impact of such policies on financial markets through the risk-taking channel.

This channel becomes particularly relevant when central banks adopt low interest rate policies to stimulate the economy; such a context drives banks to seek higher returns by accepting greater risks. In particular, the behavior of banks, incentivized by these policies, can have profound effects on stock markets, as the reduction in interest rates leads to a decrease in the returns of traditionally safe financial instruments, such as government bonds.

This, in turn, reduces the attractiveness of such investments for banks and other institutional investors, who are then pushed to invest in riskier assets that offer higher returns. Such a shift towards higher risk assets is driven by the pursuit of higher yields to compensate for the decrease in gains from safe investments.

The phenomenon underscores that banks tend to prioritize speculative investments over productive lending during periods of economic expansion. This allows to take advantage of the higher yield opportunities offered by equity markets. As markets rise, banks shift their focus towards riskier, high yield financial assets in search of short-term gains. However, when the market reverses, banks abruptly change their strategy, rushing towards safer assets. This, in turn, neglect productive credit lines. The behavior illustrates the cyclical nature of bank investment strategies, depending on market conditions.[4]

This behavior is also incentivized by regulatory arbitrage. The latter allows banks to improve their returns, preferring equity investments that often require less regulatory capital compared to productive loans.[5] The increased demand for stocks by

[4] Such a mechanism is explained by Gilles, Gauvin, and Huchet in *"Banking Sector and Monetary Policy Transmission: Bank Capital, Credit and Risk-Taking Channels"* (2013, p. 77, paragraph 2).
[5] On this point, the authors identify that "the new business model leads to an increase in leverage and in regulatory capital arbitrages: this strategy raises the return on equity (ROE), even if non-interest incomes are more volatile than interest incomes. Moreover, this business model entails a weakening of

banks and institutional investors contributes to rising stock prices and it creates favorable but potentially unstable market conditions. The liquidity and volatility of equity markets can increase due to the greater presence of banks in these markets. However, the shift towards equity investments can contribute to greater financial market fragility. The reason why this happens is that an excessive increase in demand for stocks can lead to asset overvaluation, thereby increasing market volatility.

A crucial aspect of the impact of monetary policy on financial markets is its influence on investors' risk perception. Low interest rates improve growth prospects, leading banks to underestimate the risks associated with stock investments. In a low rate environment, banks and other institutional investors seek higher returns compared to those offered by government bonds and other safe assets. This shift towards riskier investments can result in the overestimation of stock assets, as the demand for stocks and other high yield financial instruments increases.

As Gilles et al. Argues that monetary policies can play a role in triggering crises. This is possible because persistently low interest rates encourage economic agents to take on greater risks. Excessive confidence in risky investments can lead to the formation of speculative bubbles, where stock prices rise rapidly beyond their intrinsic values.[6] Central banks, aware of this risk, might still use low interest rate policies to support stock markets, especially during periods of recession.

However, this strategy carries risks. The underestimation of risk can lead to less prudent investment decisions, and the presence of systemic risks in the financial sector can make the economy vulnerable to sudden shocks. In fact, if a speculative bubble were to form, stock prices could experience a sharp decline in value, resulting in significant losses for investors and causing negative repercussions on the real economy.

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the bank lending channel and a strengthening of the risk-taking channel" (Gilles, Gauvin, and Huchet, 2013, p. 78, paragraph 2).

[6] As a consequence, the result is that "monetary policies can be responsible for crises, because whenever rates remain durably low, they lead agents to take more risks" (Gilles, Gauvin, and Huchet, 2013, p. 78, paragraph 2).

This scenario highlights the delicate position of central banks, tasked with balancing the goal of stimulating economic growth with the need to maintain financial stability.

In conclusion, the influence of central banks on stock markets through the transmission mechanisms of monetary policy is crucial for ensuring economic stability and promoting sustainable growth. The ability to adjust interest rates, Tobin's q, credit, and the wealth effect are all tools that allow central banks to intervene promptly and effectively during periods of economic turbulence. These tools help prevent systemic crises and support investor confidence, but they require careful and skillful balancing to avoid the creation of excessive risks and speculative bubbles.

Central banks must pursue a monetary policy that supports the real economy without compromising the stability of financial markets. Their interest in intervening in stock markets through these mechanisms lies in the need to maintain a delicate balance that promotes stable and long term economic growth, while ensuring confidence in the financial system and resilience against negative shocks.

2.2 Effects of monetary policy on asset valuation. Study of the "Fed put" and the impact on market expectations

In recent decades, monetary policy in industrialized countries has increasingly been characterized by low and stable inflation, accompanied by significant movements in stock, bond, and exchange rates, or more generally, in financial assets. This scenario has raised several questions about the role of monetary policies in shaping the dynamics of financial markets.

The relationship between central bank decisions and changes in financial asset prices, particularly in the stock market, has become a topic of growing interest for researchers and investors alike.

The main objective of this work is to analyze the effect of monetary policy on asset prices, with a particular focus on the stock market.

While in the past, studies did not always reveal a strong connection between stock price behavior and monetary policy decisions, recent research has uncovered evidence confirming a significant link between monetary policy variables and the stock market. The evidence of this connection has important implications for understanding market mechanisms and for the formulation of capital allocation strategies and economic policies.

But how and why do central bank monetary policy decisions influence financial asset prices? The answers must also consider that investors are influenced in their choices not only by current conditions but also by future expectations regarding monetary policy. These expectations shape risk perception and affect the valuation of future cash flows, leading to significant changes in asset prices.

The following analysis aims to explore how changes in central bank decisions can cause fluctuations in asset prices, by examining the dynamics through theoretical models and empirical evidence. Understanding these processes is essential for predicting market reactions to central bank decisions and for developing more informed investment strategies.

A first answer can be found in the paper "Monetary Policy and Asset Valuation" (2016) by Francesco Bianchi, Martin Lettau, and Sydney C. Ludvigson, published by the National Bureau of Economic Research (NBER). The paper provides an in depth analysis of the impact of monetary policies on stock markets, focusing on the changes in asset prices resulting from variations in monetary policy.

The authors employ an innovative macro financial model to analyze how fluctuations in interest rates and monetary policy expectations influence long term asset valuations and risk premiums.

The paper begins with the observation that the values of financial assets, especially long term ones such as stocks, respond significantly to central bank decisions and announcements. This phenomenon occurs despite traditional macroeconomic models, like New Keynesian models, asserting that the effects of monetary policy on real variables are temporary in nature. According to these models, central bank interventions should have only short term impacts on the real economy,

such as interest rates and inflation, and thus should not influence the long term values of financial assets.

However, empirical evidence suggests the opposite, namely that monetary policies can have prolonged effects on stock markets. This creates a paradox: if monetary policies are not supposed to influence real variables in the long term, how can we explain the persistent fluctuations in stock prices? The authors resolve this inconsistency by considering that certain aspects of monetary policies have a lasting impact on the real economy and, consequently, on financial markets.

They argue that changes in monetary policy regimes, between phases of restrictive policies and phases of accommodative policies, can explain the long term variations in financial asset prices.

In particular, Bianchi, Lettau, and Ludvigson highlight that regime changes in the conduct of monetary policy can have persistent effects on real interest rates, thereby influencing financial asset prices, as monetary policies are not static but fluctuate between “hawkish” (restrictive) and “dovish” (accommodative) periods.

In dovish periods, when monetary policy is more accommodative, asset valuations tend to be higher, and risk premiums lower. Conversely, during hawkish periods, characterized by restrictive policies, asset valuations tend to be lower, and risk premiums higher. This demonstrates that monetary policy can have a prolonged impact on asset price dynamics, promoting stock value growth during accommodative phases, while in restrictive phases, it leads to a reduction in risk premiums.

The authors use an empirical approach based on a joint Markov-switching system to estimate the variations in asset values and monetary policy spread. For instance, they estimate that two-thirds of the reduction in real interest rates observed since the 1980s can be attributed to regime changes in monetary policy, implying that monetary policy has had a lasting impact on real interest rates, thereby influencing asset prices.

One of the main empirical findings from the paper is that monetary policy regimes characterized by a low monetary policy spread (MPS), indicative of a dovish, accommodative policy, are correlated with higher financial asset valuations and lower

risk premiums. In other words, when the central bank maintains an expansionary monetary policy, stock market values tend to be higher, and investors require lower risk premiums.

Conversely, regimes with a high MPS, signaling a restrictive monetary policy, coincide with lower asset valuations and higher risk premiums. This means that during periods of restrictive policies, the value of financial assets decreases, and the risk premiums demanded by investors increase.

This relationship is demonstrated by the authors through a detailed statistical analysis using the Hamilton filter, a statistical modeling technique that allows for the identification of regime changes in economic time series. In practice, this method estimates the probability that the economy is in a specific monetary policy regime at any given point in time. By using this filter, the authors are able to distinguish periods of restrictive monetary policy from those of accommodative policy, isolating their effects on financial markets and thereby providing a clear picture of how these different measures influence asset prices and risk premiums.

The precision of the Hamilton filter allows for detecting transitions between monetary policy regimes with a high degree of accuracy, enabling the authors to directly attribute variations in asset prices and risk premiums to changes in monetary policies.

A significant example provided in the paper is the analysis of U.S. monetary policy regimes from 1961 to 2017. The authors identify two main periods of restrictive monetary policy: from the fourth quarter of 1978 to the third quarter of 2001, and from the second quarter of 2006 to the second quarter of 2008.

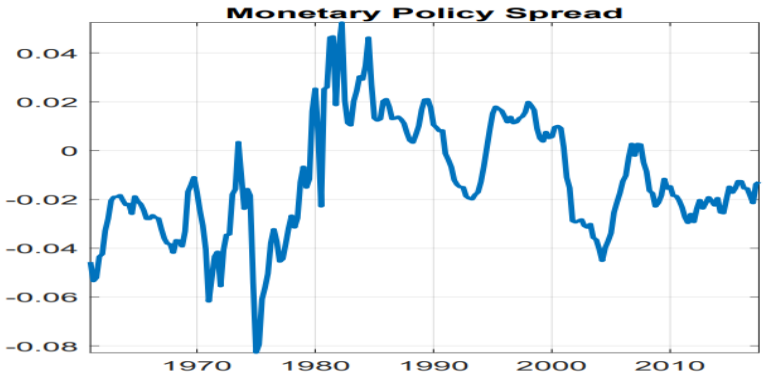

Figure 2.2: Evolution of the U.S. monetary policy spread from 1960 to 2020, showing periods of accommodative and restrictive monetary policy regimes.

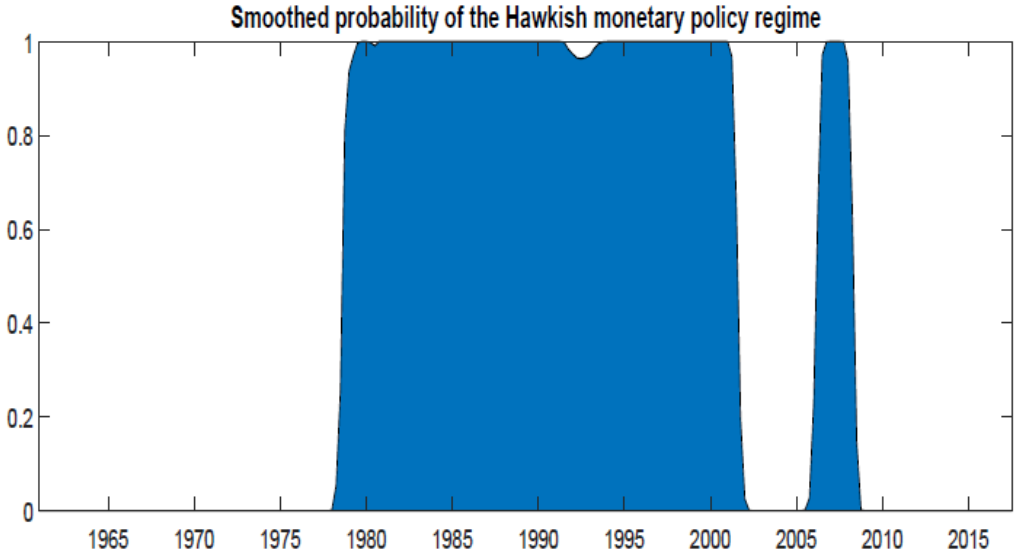

Figure 2.3: Smoothed probability estimates of the U.S. hawkish monetary policy regime from 1965 to 2015, indicating prolonged periods of restrictive policy during the 1980s and early 2000s.

During these periods, the monetary policy spread was elevated, indicating a restrictive monetary policy.

A high MPS demonstrates that the real federal funds rate was significantly higher than the natural interest rate, suggesting that the central bank was aiming to contain inflation and slow down the economy. During these periods, asset valuations were

relatively low, reflecting the higher cost of capital and the increased risk perceived by investors.

Conversely, during periods of accommodative monetary policy, such as the period following the 2008 financial crisis, the MPS was low. This indicates that monetary policy was geared toward stimulating the economy with real interest rates below the natural rate. A low MPS implies that the central bank was taking measures to encourage investment and spending by reducing financing costs for businesses and individuals. During these periods, asset valuations were high, as lower interest rates made equity investments more attractive compared to bonds, increasing demand for stocks and, consequently, their prices.

The model also suggests that investors tend to develop a “faded memory” regarding past monetary policy regimes.

The concept implies that, over time, investors tend to forget the characteristics of previous monetary policy regimes and come to believe that the current regime will persist into the future. Consequently, when an accommodative regime lasts for an extended period, investors tend to overestimate its persistence, believing that low interest rates and favorable investment conditions will continue longer than they actually will. This behavior leads to fluctuations in risk premiums and asset prices.

Risk premiums are the additional compensation that investors require for holding risky assets compared to risk free ones. If investors overestimate the duration of an accommodative regime, they may underestimate future risks, leading to lower risk premiums and driving asset prices higher. Conversely, if they suddenly perceive that a regime change is imminent or underway, they may quickly react by raising risk premiums, causing a drop in asset prices.

These mechanisms are crucial for understanding why stock markets react not only to immediate changes in interest rates but also to long term expectations about monetary policy regimes.

Investors’ expectations regarding the duration and nature of monetary policy significantly influence their capital allocation decisions and, consequently, financial asset prices. The perception of the persistence of an accommodative regime can lead

to overly optimistic valuations, while an unexpected shift toward a restrictive regime can trigger sharp market corrections.

From a quantitative perspective, the paper provides a range of statistical evidence and empirical results that strongly support its conclusions.

The authors analyze the correlations between financial asset valuations and the monetary policy spread (MPS) over medium term cycles, defined as time intervals between 8 and 50 years, finding that these correlations are significantly negative. This means that when the MPS is low (indicative of an accommodative monetary policy), asset valuations are high.

For example, the paper shows that the correlation between the MPS and the price-dividend (P/D) ratio in the corporate sector is -0.60. This indicates that when the MPS decreases, the P/D ratio increases, signaling that stock prices are high relative to the dividends paid. Similarly, the correlation between the MPS and the price-earnings (P/E) ratio in the corporate sector is -0.30. Although this correlation is less pronounced than that with the P/D ratio, it still confirms that a lower MPS tends to be associated with higher stock valuations.

These results empirically demonstrate the central thesis of the paper: central banks' monetary policies significantly and persistently influence stock markets.

In conclusion, the paper by Bianchi, Lettau, and Ludvigson provides a robust theoretical and empirical analysis of the impact of monetary policies on stock markets. The results demonstrate that monetary policies significantly influence stock markets and related financial instruments, and are particularly important for understanding the influence and interest exerted by central banks in financial markets.

A second perspective on the influence of central bank decisions on asset values is provided by the study "The Impact of Monetary Policy on Asset Prices" (2002) by Roberto Rigobon and Brian Sack, which delves into the impacts of monetary policies on asset prices.

This study, published in the Journal of Monetary Economics, focuses on the analysis of stock values and long term interest rate responses following monetary policy interventions. The authors consider these responses fundamental for

understanding the close interaction between asset prices and monetary policy, both for policymakers and investors.

Given the presence of numerous variables that simultaneously intervene during monetary policy decisions and the corresponding asset price reactions, making the analysis of this phenomenon extremely complex, Rigobon and Sack propose an innovative estimator based on the heteroscedasticity present in high frequency data. This approach allows for isolating and better understanding the dynamics at play, providing a clearer view of the interaction between monetary policy and markets.

The principal innovation in Rigobon and Sack's study lies in their analysis of the simultaneity of variables: short term interest rates influence asset prices, but asset prices also shape monetary policy expectations. Additionally, the study considers other macroeconomic variables that simultaneously affect both interest rates and asset prices, further complicating the identification of effects.

In summary, the authors hypothesize that the variance of monetary policy shocks, namely the measure of the dispersion of the effects of these shocks, is greater on the days when FOMC meetings are held and during the Fed Chair's semiannual testimonies to Congress.

The hypothesis is based on the proven fact that such events generate a large amount of new information during monetary policy decisions, causing an increase in financial market volatility. By identifying these periods of higher variance, the authors are able to isolate the specific impact of monetary policy on asset prices, providing a more accurate and reliable estimate of the influence of such actions on the markets.

This method allows for the isolation of assumptions considered in the traditional "event-study" approach, which is based on the principle that all other factors remain constant during the analysis of the effects of monetary policy decisions.

The empirical analysis by Rigobon and Sack clearly shows that an increase in short term interest rates leads to a decline in stock prices. Specifically, the results indicate that a 25 basis point increase in the short term interest rate causes a 1.7% decrease in the S&P 500 index. This effect is even more pronounced in the Nasdaq index, which shows a 2.4% decrease, presumably due to the fact that technology

companies tend to have more distant future cash flows, making them particularly sensitive to changes in discount rates. In other words, when interest rates rise, these companies' future cash flows are discounted at a higher rate, reducing their present value.

In contrast, the Dow Jones Industrial Average (DJIA) shows a more muted reaction, with a decrease of 1.2%. This can be explained by the nature of the companies included in the DJIA, which often have more stable cash flows and are less susceptible to significant variations due to interest rate changes.

Regarding long term interest rates, the results show that an increase in the short term rate has a significant positive effect on market interest rates, with the most pronounced effect on short term rates. For example, a 25-basis point increase in the three month rate results in an increase of over 25 basis points in short term Eurodollar futures rates. However, this effect gradually diminishes as the contract horizon lengthens.

Yields on short- and medium-term Treasuries increase significantly, while long term yields, such as the 10 and 30 year Treasury yields, show more modest increases of approximately 0.61 and 0.35 basis points, respectively. This suggests that investors expect the effects of monetary policy to diminish in the long term, reflecting greater uncertainty and variability in long term economic forecasts.

The study also compares the results obtained with those derived from the traditional event-study approach, identifying some significant differences.

First, the heteroscedasticity-based approach tends to indicate a greater negative impact of monetary policy on stock prices compared to the event-study approach, as well as a smaller positive impact on long term interest rates. For example, the event-study approach shows that a 25 basis point increase in the short term interest rate results in a 1.4% decline in the S&P 500 index. In contrast, the heteroscedasticity-based approach estimates a more significant decrease of 1.7% for the same increase in short term interest rates.

This difference tends to demonstrate that the event-study approach presents an upward bias in its estimates, likely because it is unable to fully isolate the effect of

monetary policies from other economic variables that simultaneously influence markets. The event-study method assumes that all observed changes in asset prices during monetary policy interventions are exclusively determined by monetary policy shocks. However, on central bank intervention days, other events or economic communications may occur that influence markets, creating interference in the results.

The heteroscedasticity-based approach of Rigobon and Sack, on the other hand, works by identifying days with greater variance in monetary policy shocks and isolating the pure effect of monetary policy on asset prices.

Despite the differences in the results, statistical tests do not always succeed in challenging the conclusions of the event-study approach. Essentially, although the heteroscedasticity-based approach provides outcomes that highlight a more significant impact of monetary policy on stock prices and less on long term interest rates, the days considered in the analysis remain heavily dominated by monetary policy news.

This confirms that monetary policy decisions play a crucial role in stock value fluctuations, even though the accuracy of measuring these impacts can be improved with more sophisticated methods, such as the one used by Rigobon and Sack.

In conclusion, the paper by Rigobon and Sack provides a significant contribution to the economic literature studying the impact of monetary policy on financial markets, introducing a new estimation method aimed at observing only the necessary assumptions and allowing for a more accurate assessment of stock price responses. The results indicate that monetary policies have a significant impact on stock markets and interest rates: increases in short term interest rates tend to significantly reduce stock prices, with more modest effects on long term rates.

However, several questions arise that require further investigation. If monetary policies can significantly alter asset prices and risk premiums within a single country, what might be the impact of these policies on a global scale? While empirical evidence demonstrates the lasting influence of monetary policy decisions on domestic financial markets, it is unclear how these decisions may affect the financial dynamics of other countries and the global financial system as a whole.

These reflections then lead to other important questions: can the fluctuations induced by monetary policies have uniform effects on international markets as well? How do financial globalization and the interconnectedness of markets influence the transmission of monetary policy shocks from one country to another?

In this regard, the findings of Bianchi, Lettau, Ludvigson, Rigobon, and Sack are confirmed and strengthened in the work of Silvia Miranda-Agrippino and Hélène Rey, "US Monetary Policy and the Global Financial Cycle" (2015), published as NBER Working Paper No. 21722, which examines the impact of US monetary policy on global financial markets. The authors, from Northwestern University and the London Business School, respectively, conducted an in depth study to understand how US monetary policy shocks generate comovements in international financial variables, characterizing what is known as the "Global Financial Cycle."

In particular, the first part of the paper delves into the radical transformations that have taken place in the international financial world since the 1990s, characterized by an unprecedented level of financial globalization, with an exponential increase in capital flows crossing national borders and greater integration of global financial markets.

Despite these profound changes, the dominant role of the United States in the international monetary system has remained largely unchanged, continuing to hold a position of substantial hegemony and significantly influencing global financial dynamics through its monetary policy decisions.

In light of these scenarios, the paper by Miranda-Agrippino and Rey focuses on analyzing how international financial flows alter the way US monetary policy is transmitted beyond national borders. The paper also examines the effects that the structure and functioning of the global banking system have on changes in the prices of risky assets, credit growth, and leverage in various economies.

In summary, the authors aim to understand how global financial interconnectedness amplifies or mitigates the impact of Fed decisions in the United States on a global scale. To this end, Miranda-Agrippino and Rey employ a dynamic

factor model combined with a global Bayesian VAR, using monthly data collected over the past thirty years.

To identify U.S. monetary policy shocks, the authors use an external instrument based on high frequency price adjustments in the federal funds futures market, made around Federal Open Market Committee announcements. This approach allows them to precisely isolate the causal effects of a U.S. monetary policy shock on the dynamics of a wide range of economic and financial variables, eliminating the need to impose rigid timing restrictions on the observed responses.

In this way, they are able to capture the direct and immediate impact of Federal Reserve decisions on international financial markets and national economies, providing a detailed and robust analysis of the international transmission of U.S. monetary policy.

The empirical results show that the repercussions of U.S. monetary policy generate significant financial spillover effects on the rest of the world. In other words, the decisions of the Federal Reserve, even if originally aimed at the U.S. domestic economy, still have significant repercussions on the global financial landscape. When the Federal Reserve tightens monetary policy by raising interest rates, domestic demand contracts. Consequently, prices of goods and services also tend to decline, reflecting reduced inflationary pressure.

The consequences of restrictive policies are reflected in several areas. Firstly, an increase in corporate spreads (the difference between interest rates on corporate debt and government securities) is observed, which in turn leads to higher financing costs, reflecting a perceived increase in risk or a reduced availability of credit.

Furthermore, a credit contraction occurs: banks and other financial institutions reduce the amount of loans granted, both due to a decrease in demand from borrowers and greater caution in extending credit, thereby amplifying the economic contraction.

Another visible effect of the Federal Reserve's restrictive monetary policies is the decline in financial asset prices. In particular, the stock market tends to experience significant drops in response to monetary tightening, as investors, perceiving higher risks and financing costs, sell stocks, leading to a further decrease in their prices.

Observing the consequences following the FED's interventions, the authors demonstrate that a U.S. monetary policy shock causes an immediate and sharp international contraction in risky asset prices, confirming significant changes in the global financial cycle as well.

Using a dynamic factor model, the paper identifies a unique global factor that accounts for approximately 20% of the variance in risky asset prices worldwide and serves as a common denominator in the variation of risky asset prices across the globe.

A monetary contraction in the United States leads to a reduction in this global factor, implying an approximate 8% decrease in local stock index prices. In other words, if the global factor decreases by 40%, this results in an 8% reduction in local stock index prices, considering that the global factor explains 20% of the variance.

FIGURE 1: GLOBAL FACTOR IN RISKY ASSET PRICES

Figure 2.4: Path of the estimated global common factor in risky asset prices from 1975 to 2012. The figure illustrates the variation over time, with significant peaks during economic expansions and declines during recessions (shaded areas).

This phenomenon is accompanied by a strong deleveraging of global banks both in the United States and Europe. Deleveraging refers to the reduction of financial leverage by global banks, including both U.S. broker-dealers and large European banks, meaning a decrease in the ratio between their debt and equity.

The authors note that a significant reduction in credit provision and a marked retrenchment of global capital inflows typically follow a tightening of US monetary policy[7], with the result that banks, in order to maintain financial stability and respond to the new and higher funding costs, tend to reduce their leverage. This leads to a contraction in credit supply not only domestically, but also internationally.

Furthermore, a significant increase in risk appetite is observed in global asset markets. Risk appetite reflects investors' willingness to take on risks and varies inversely with risk aversion. When U.S. monetary policy becomes more restrictive, global investors tend to become more risk averse, demanding higher returns to compensate for the perceived increase in risk.

The authors highlight that there is a notable increase in overall risk aversion. Investors become significantly more reluctant to engage in risky investments. This behavior results in a widespread selling of risky assets and an increase in bond spreads. As a consequence, companies must pay higher interest rates to issue debt, reflecting the increased cost of capital.

These results demonstrate how U.S. monetary policy significantly influences global financial conditions.

[7] See Miranda-Agrippino and Ray, "US Monetary Policy and the Global Financial Cycle" (2019, p.19, paragraph 2).

The close connection between U.S. monetary tightening and the contraction of domestic credit and international liquidity is also confirmed in countries with floating exchange rate regimes. The paper demonstrates that the global factor in risky asset prices is negatively correlated with implied volatility indices, such as the VIX for the United States, the VSTOXX for Europe, the VFTSE for the United Kingdom, and the VNKY for Japan.

FIGURE 2: GLOBAL FACTOR AND VOLATILITY INDICES

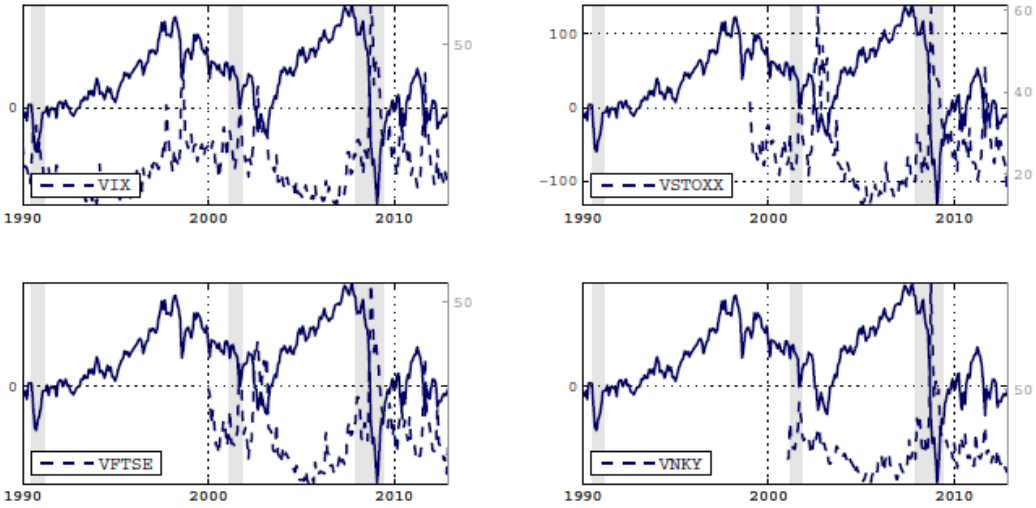

Figure 2.5: Comparison of the global factor in risky asset prices with volatility indices (VIX, VSTOXX, VFTSE, VNKY) from 1990 to 2012. The figure highlights strong comovements, especially during periods of financial stress.

This negative correlation shows that when the global factor increases, implied volatility indices tend to decrease, and vice versa.

Implied volatility indices ("fear indices") are used to measure expected volatility in financial markets; by considering both the price and the amount of risk associated with assets, they can capture investors' expectations of future realized volatility. In this way, they provide a measure of market expectations specifically regarding future price fluctuations of assets.

Implied volatility indices thus become essential tools for understanding market sentiment. For example, the VIX is often used as a barometer of expected volatility in the U.S. stock market. An increase in the VIX indicates that investors expect higher

future volatility, generally associated with periods of market uncertainty or turbulence. Similarly, the VSTOXX, VFTSE, and VNKY serve the same purpose for the European, British, and Japanese markets, respectively.

The response of the global factor to changes in U.S. monetary policy demonstrates how shifts in international investors' risk appetite influence global financial conditions. In fact, when international investors perceive an increase in risk and funding costs, they tend to reduce their exposure to risky assets, and implied volatility indices rise, reflecting an increase in risk aversion driven by fears of asset price fluctuations.

The concept of "Fed Put"

It now becomes necessary to analyze the different strategies that central banks can adopt in response to signals from the stock market.

One of the most relevant aspects of the interaction between monetary policy initiatives and the value of financial assets is the "Fed Put", a term used in economics to describe the Federal Reserve's reactive interventions during periods of negative shocks in the stock market. The goal is to stabilize financial markets, mitigate losses, and support economic growth.

These interventions typically occur through accommodative monetary policies, such as lowering interest rates or implementing asset purchase programs, and must be particularly responsive to prevent a sharp stock market correction from negatively impacting the real economy. Such effects could include reducing household wealth, depressing consumer spending, and increasing economic uncertainty.

In summary, central bank strategy can only be considered effective when it successfully balances the need for financial market stability with the requirement to maintain market discipline.

However, the use of the Fed Put can also entail certain risks. One of the main risks is moral hazard, which occurs when investors, relying on the Fed's intervention, continue to take excessive risks, amplifying financial imbalances and increasing the financial system's vulnerability to future crises. Additionally, the continuous use of

accommodative monetary policies, characterized by repeatedly reduced interest rates, may limit the Fed's ability to respond to future economic shocks due to the lack of available maneuvering room.

On this point, the paper "The Economics of the Fed Put" (2020) by Anna Cieslak and Annette Vissing-Jorgensen serves as a key reference in studying the dynamics of Federal Reserve policies and the use of the Fed Put.

The paper analyzes the interactions between the Fed's monetary policy decisions and stock market fluctuations through a combined methodological approach, which includes both an empirical analysis of market data and an in depth textual analysis of the Federal Open Market Committee's documents.

The empirical analysis examines historical data on stock returns and interest rate changes, identifies the correlation between stock market fluctuations and monetary policy interventions, and highlights cases where changes in stock returns and prices influenced the Fed's decisions.

In parallel, the analysis of FOMC documents allows for an understanding of the dynamics and motivations behind the Fed's decisions. The authors carefully examine the minutes and transcripts of FOMC meetings to identify explicit references to the stock market and analyze the context in which these references were made. In this way, they pinpoint key moments when the stock market influenced monetary policy decisions and analyze the reasons behind these choices.

The individual references to the stock market are subjected to advanced textual analysis techniques to classify the type of reference based on tone (positive, negative, or neutral) and content: driver (a factor directly influencing the economy), predictive (an indicator of future economic conditions), or descriptive.

Specifically, the authors conduct an in depth textual analysis of the minutes from the period between 1994 and 2016 and find that, during this time frame, there were as many as 975 mentions of the stock market in the official FOMC documents.

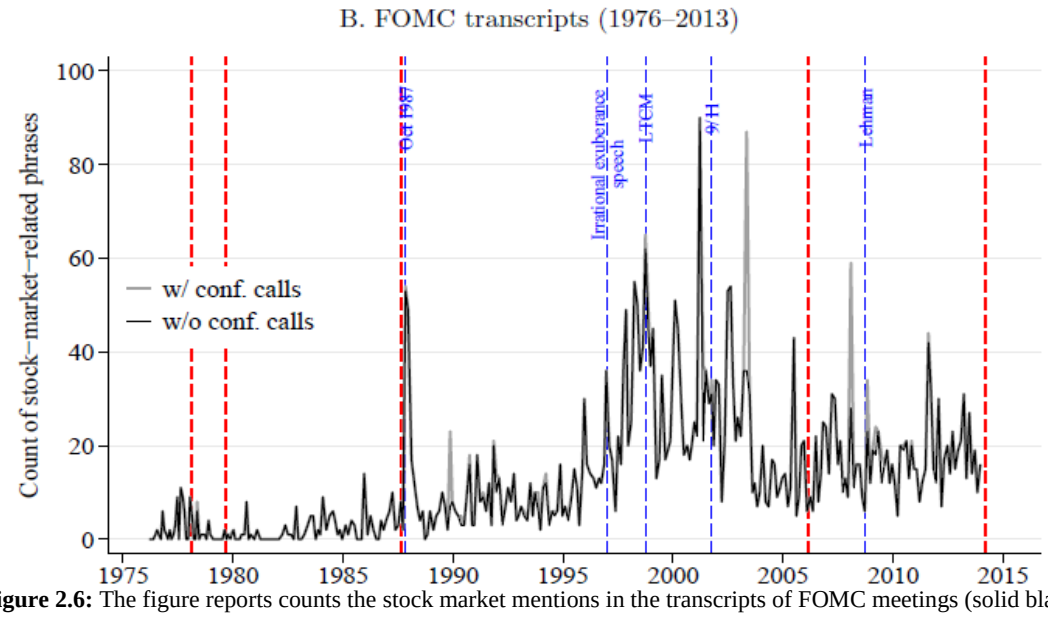

Figure 2.6: The figure reports counts the stock market mentions in the transcripts of FOMC meetings (solid black line) and those combined with counts in the transcripts of FOMC conference calls (solid grey lines).

The tone of the mentions is strongly correlated with previous stock returns: negative mentions of the stock market tend to follow periods of negative returns, while positive mentions follow periods of positive returns.

Particularly significant in this analysis is the fact that negative mentions of the stock market in the FOMC minutes predict future reductions in the federal funds rate.

The combined analysis of quantitative and qualitative data provides a comprehensive view of the interaction between the strategies implemented by the Fed and movements in the stock market.

In summary, the empirical data confirm that the Fed's decisions are directly influenced by stock returns, highlighting a clear causal relationship; the textual analysis demonstrates how the Fed interprets and reacts to stock market movements.

More specifically, the paper demonstrates that since the mid 1990s, the Fed has systematically responded with more accommodative monetary policies to every major stock market decline. This relationship was documented through an analysis of intermeeting stock returns, returns recorded between one Federal Open Market Committee meeting and the next, and changes in the federal funds rate (FFR) target.

To quantify the close relationship between negative stock markets and FFR reduction interventions, the authors use a regression model, a statistical approach that allows for the examination of the influence of one or more independent variables (negative and positive stock returns) on a dependent variable (change in the FFR target).

The analysis results indicate that negative stock market returns predict more accommodative monetary policy. The empirical data quantify the effect, showing that a 10% decline in the stock market predicts a reduction of approximately 32 basis points in the FFR at the next FOMC meeting. The study also highlights that the correlation persists even after the meeting in which the decision is made and continues over time for about a year, with a cumulative reduction in the FFR reaching around 127 basis points after one year.

Moreover, the paper also analyzes situations of positive returns and finds a significant asymmetry: unlike during stock market declines (when the Fed responds with more accommodative policies), stock market gains do not necessarily lead to a tightening of monetary policy. This asymmetry essentially demonstrates a protective stance by the Fed during periods of market turbulence, which is not matched by a similar reaction during periods of growth.

The coding results show that 38% of the stock market mentions in the FOMC minutes align with the driver perspective, implying that the Fed views the stock market as a factor having a direct impact on the economy, primarily through the so called "wealth effect", discussed in the previous paragraph.

The wealth effect on consumption is the most significant finding, accounting for 22% of all stock market mentions. For example, a 10% decrease in the stock market would reduce household wealth by approximately $1.78 trillion, which, assuming a 4% wealth effect, would lead to a $71 billion reduction in consumer spending and a decrease in GDP growth by about 0.49 percentage points.

Only 8% of the mentions refer to future economic conditions, showing that the Fed views the stock market primarily as an element to be analyzed in the present.

To reinforce their findings, the authors also examine the statements of Federal Reserve Chairs (Alan Greenspan, Ben Bernanke, Janet Yellen) in the transcripts of FOMC meetings. Here too, the driver view accounts for the majority of stock market mentions, supporting this perspective (43%). In this regard, Greenspan's statements are particularly significant, as they demonstrate a direct impact of the stock market on policy.

The paper also analyzes the implications of the Fed Put, including the possibility of moral hazard effects. Similar to previous studies, this paper confirms the idea that the Fed Put may encourage investors to take on greater risks, considering the presumed future intervention of the Federal Reserve to support the stock market in case of significant declines through accommodative monetary policies.

The paper, however, highlights that concerns about financial stability remain a priority for the Fed, which, while aware of the potential moral hazard risks associated with the Fed Put, considers it essential to safeguard the financial system from dangerous market shocks.

To examine how the Fed Put is perceived by the public and market participants, the authors of the paper analyze articles published in two of the leading financial newspapers: the Wall Street Journal and the Financial Times. Through this analysis, the authors discover that awareness of the Fed Put dates back to at least 2000, demonstrating that the phenomenon has been known and referenced for many years.

The strength and perceived effectiveness of the Fed Put are, however, still debated today, especially during the appointment of a new Fed Chair, which brings uncertainty about the direction the central bank will take. This means that while investors generally take on greater risks, trusting in a Fed intervention to stabilize markets, they might hesitate to take such risks in the case of a new Chair's appointment.

Using the intermediary model of Adrian and Shin (2014), the authors delve into the relationship between the risk premium of risky assets and the level of leverage in the economy, seeking the explanation in the Fed Put. The model allows for an analysis

of how variations in risk premiums influence the decisions of financial intermediaries regarding the level of leverage.

The results show that the active management of the financial leverage, in response to the reduction in the risk premium, primarily concerns the broker-dealer sector in the pre-crisis period. Specifically, the model demonstrates that when risk premiums decrease, broker-dealers tend to increase their leverage, as the reduction in risk premiums makes it less costly and less risky to take on larger positions, encouraging an expansion of speculative activities.

However, this active management of leverage can heighten the vulnerability of the financial system, increasing the risk of instability in the event of adverse shocks. In a pre-crisis context that presents the outlined scenarios, the perception of a Fed Put can only contribute to an increase in leverage and systemic risk.

In conclusion, central banks closely monitor stock markets to determine the most appropriate monetary policy decisions, especially during periods of financial instability and recession. The integration of market dynamics into central banks' decision making process is a key factor in developing effective and resilient monetary policies. However, the debate remains open on what is truly the most valid strategy to implement in these scenarios.

2.3 Whether to "lean against the wind" to prevent risks of financial instability. Cost-benefit analysis associated with it

To understand central banks' strategies in response to stock market fluctuations, it is essential to also examine the "leaning against the wind" (LAW) approach, which significantly contrasts with the Fed Put.

There are many differences that distinguish them. Firstly, while, as mentioned in the previous paragraph, the Fed Put assumes a reactive intervention by central banks to stabilize markets during periods of negative shocks, the LAW represents a preventive strategy that involves restrictive monetary policy interventions aimed at preventing and mitigating long term financial instability risks, especially those

stemming from speculative bubbles resulting from excessive and uncontrolled stock market growth.

Secondly, unlike the Fed Put, which acts to protect investors during periods of negative market shocks, the LAW assumes that intervention is necessary even during periods of growth, closely monitoring signs of euphoria in financial markets and adopting restrictive measures, such as raising interest rates, to prevent excessive risk-taking.

The LAW, however, presents some challenges in terms of investor expectations. Unlike the Fed Put, which can create a sense of security and encourage moral hazard behavior, the LAW seeks to maintain investor caution to prevent excessive risks, regardless of central bank interventions aimed at supporting the stock market in case of a downturn. In such cases, effective communication with the markets becomes essential to avoid restrictive central bank policies being interpreted as signs of an overall tighter monetary policy.

The LAW also has the ability to reduce stock market volatility. In fact, monetary policies inspired by this approach can limit boom and bust cycles in financial markets, stabilizing asset prices and reducing the risk of sharp corrections.

The use of LAW has been customized by various central banks, but always with the aim of addressing potential financial shocks resulting from excesses in the stock market. For example, the Bank for International Settlements (BIS) has often emphasized the importance of monetary policies that account for long term financial risks. The European Central Bank has introduced macroprudential measures, such as stricter capital requirements for banks, with the goal of strengthening financial stability.

In conclusion, considering the different characteristics and objectives of the two approaches, central banks, when making their decisions, are called upon to consider the delicate balance between reactive intervention and proactive prevention.

Interesting are the studies that, through the analysis of past results, highlight the impacts of the different approaches adopted on the stock market and the maintenance of financial stability.

The article by Anastasios Evgenidis and Anastasios G. Malliaris, “To lean or not to lean against an asset price bubble? Empirical evidence” (2020), analyzes central bank interventions in stock markets to counter speculative bubbles through restrictive monetary policy actions.

The study utilizes a time-varying Bayesian VAR model (TV-VAR), a sophisticated econometric technique that allows for the analysis of the evolving dynamics of relationships between different economic variables over time. The TV-VAR model captures how the responses of economic variables change in reaction to exogenous shocks, including changes in monetary policy. The analysis enables the identification of market reactions to variations in interest rates introduced by central banks.

The authors use the Cyclically Adjusted Price/Earnings ratio, known as CAPE (an indicator developed by Robert Shiller, calculated by dividing the price of the S&P 500 index by the average of real earnings adjusted for inflation over the past ten years) to mitigate short term fluctuations and capture a more stable and long term measure of stock market valuations.

In the context of the study, the CAPE is used to distinguish between fundamental and speculative components of asset valuations: the fundamental component considers the intrinsic value based on discounted future dividends, while the speculative component represents the excess over this intrinsic value, often driven by irrational or euphoric market behavior.

The authors’ analysis uses a comprehensive dataset covering the period from 1960 to 2017, with key variables including the Industrial Production Index (IP), the Producer Price Index (PPI), the Federal Funds Rate (FFR), and the two components of the CAPE. Specifically, by utilizing the TV-VAR model, the authors examine how changes in the FFR influence the fundamental and speculative components of the CAPE.

The main results of the analysis indicate that an increase in the Federal Funds Rate initially causes a significant reduction in the fundamental component of the CAPE. This occurs because a rise in interest rates makes capital more expensive,

reducing the present value of expected future dividends from stocks. In other words, investors, facing higher interest rates, apply a greater discount to future cash flows, thereby lowering the present value of stocks.

Subsequently, a decrease in the speculative component of the CAPE is also observed, which is the portion of stock prices that exceeds their fundamental value, often driven by irrational investor behavior or expectations of further price increases based on speculative logic rather than solid economic fundamentals.

However, about a year after the FFR increase, the speculative component tends to rise again, reaching a sort of long term equilibrium. This phenomenon suggests that, although restrictive monetary policy initially lowers stock prices by reducing both their fundamental and speculative value, over time, prices tend to recover. This recovery occurs without further fueling the speculative bubble. The consequence of this phenomenon is the stabilization of the stock market at more sustainable levels.

This result contrasts with the conclusions of Gali and Gambetti (2015). They argued that restrictive monetary policy could increase the size of the speculative bubble. According to the authors, the rise in interest rates would reduce the fundamental component of stock prices, but at the same time increase the speculative component, leading to an overall increase in stock prices and, consequently, the bubble.

It is highlighted, in this regard, that the response of the CAPE to variations in the FFR is nonlinear. In other words, the effects of an interest rate increase do not follow a simple direct and proportional relationship but vary over time and in intensity.

To support their conclusions, the authors conduct a series of counterfactual experiments aimed at demonstrating how monetary policies contribute to the formation of speculative bubbles in stock markets. These counterfactual experiments consist of simulations that model different critical periods, hypothesizing central banks adopting monetary policies different from those actually implemented, in order to verify the potential consequences on the markets.

[8]A first experiment examines the impact of a hypothetical aggressive increase of 200 basis points in the Federal Funds Rate during the period preceding the burst of the dotcom bubble, which affected Internet related companies in the late 1990s and early 2000s. The authors demonstrate that a more restrictive monetary policy before the speculative bubble would likely have limited the expansion of the stock market, reducing the impacts of the speculative bubble that was forming.

Figure 11. Counterfactuals; the impact of a strong monetary tightening on asset prices

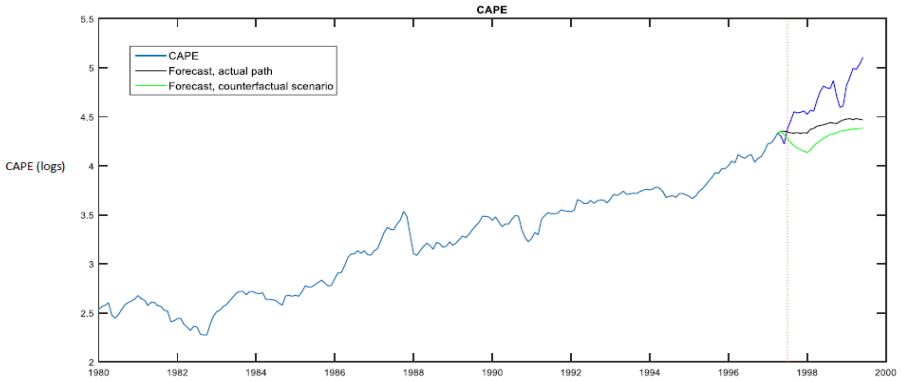

Figure 2.7: Counterfactual scenarios showing the impact of strong monetary tightening on CAPE. It illustrates the forecast under actual policy versus a counterfactual scenario with a 200 basis point increase in the Federal Funds Rate.

In the graph, the blue line (Actual CAPE) shows the historical trend of the CAPE, highlighting how asset prices actually changed from 1980 to 2000. The black line (Forecast, actual path) represents the forecasted CAPE based on the monetary policy actually implemented by the central bank. The green line (Forecast, counterfactual scenario) represents the forecasted CAPE in a counterfactual scenario that assumes the central bank had adopted a more restrictive monetary policy, with a 200 basis point increase in the Federal Funds Rate.

The authors emphasize that the forecasted CAPE under the actual policy was significantly higher than it would have been in a counterfactual scenario. This is particularly noteworthy given that the federal funds rate (FFR) remained relatively stable at around 5% during the period in question. Their analysis suggests that the

[8] Source: Evgenidis, A., & Malliaris, A. G. (2020). "*To lean or not to lean against an asset price bubble? Empirical evidence"*. SSRN Working Paper No. 4361830, p. 24, Figure 11.

growth of the asset price bubble could have been curtailed. This would have been possible if the Fed had implemented a more restrictive monetary policy at that time. This means that the impact of the bursting internet bubble could have been lowered, potentially reducing the severity of the contraction.[9]

In a second experiment, the authors examine the impact of Quantitative Easing (QE) policies implemented by the Federal Reserve from 2010 to 2014, noting that QE led to a prolonged increase in asset prices, contributing to the formation of speculative bubbles. This occurs because QE reduces financing costs and increases liquidity in the financial system, driving investors to seek higher returns in stock markets and other assets, thus pushing prices upward.

Figure 12. Counterfactuals; the impact of QE on asset prices

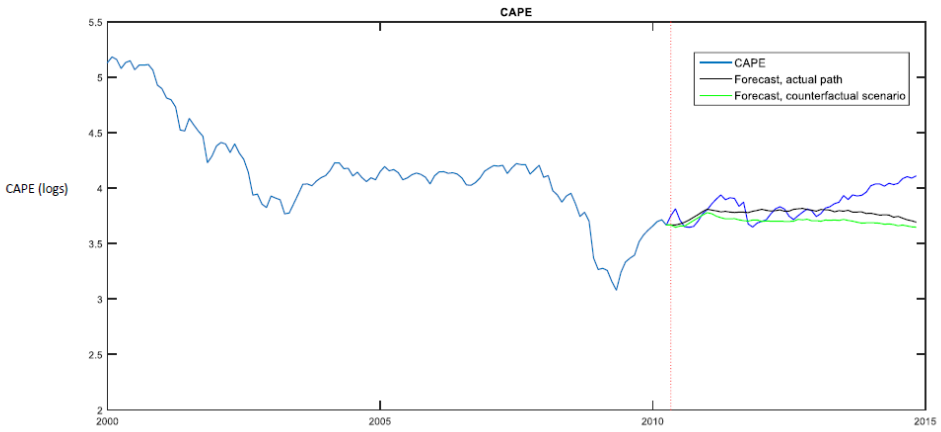

Figure 2.8: Counterfactual analysis of the impact of quantitative easing (QE) on CAPE. It compares the actual path of asset prices with a forecasted scenario assuming quantitative tightening

The effectiveness of unconventional monetary policies, such as QE, has been widely debated among economists.

Evgenidis and Malliaris, for example, argued that while these policies are effective in supporting economic recovery and preventing deflationary pressures, they

[9] More precisely, "the forecast of CAPE under the actual policy implemented is much higher compared to the forecast under the counterfactual experiment... this finding indicates that if the Fed had followed a tougher contractionary policy during that period, it would have reduced the asset price bubble and thus, it would have probably mitigated the impact of the internet bubble" (Evgenidis and Malliaris, 2020, p. 24, paragraph 1).

can produce side effects such as rising asset prices, contributing to the formation of speculative bubbles.

The authors the importance of the LAW approach. They argue that their findings provide some evidence supporting the hypothesis that the large scale asset purchases during QE from 2010 to 2014 contributed to keeping asset prices elevated for an extended period. Based on the evidence from the two experiments, a more aggressive monetary tightening could have limited the excessive stock market expansion in the late 1990s, following the LAW approach.[10]

The authors' study focuses on a series of sensitivity tests aimed at verifying the reliability of their results. One of these tests examines the impacts of varying the threshold used to identify speculative bubbles in stock markets, starting with a 10 year moving average to calculate the CAPE, and then testing the robustness of the results by using 8 year and 12 year moving averages.

Additionally, the authors adjust the standard deviation multiplier used to define the bubble threshold. Instead of using the traditional multiplier of 1.5, they also test multipliers of 1.2 and 1.8 to verify whether the bubble is sensitive to the tolerance level for variability in asset prices.

The results of the sensitivity tests applied confirm the study's conclusions and support the thesis that the outcomes do not depend on a single methodological choice. Additionally, the analyses consider the Consumer Price Index (CPI) instead of the PPI.

The reliability of the results is also confirmed through the use of different identification schemes for monetary policy shocks. More precisely, the authors use the Cholesky decomposition (a statistical technique that orders variables in a predefined way) to identify the shocks and apply sign restrictions that impose additional conditions on the expected effects of the shocks.

In all cases, the results are confirmed; the absence of specific choices or particular conditions further strengthens the robustness of the study's conclusions.

[10] See Evgenidis and Malliaris, *"To lean or not to lean against an asset price bubble?"* (2020, p. 25, paragraph 1).

In conclusion, their study offers a significant contribution to the existing literature. They provide a solid empirical foundation by using a rigorous and methodologically robust approach. It supports the notion that a proactive and balanced monetary policy can effectively reduce the accumulation of excessive risks in financial markets. Central banks could reduce the need for drastic measures in the future by intervening in a timely manner. As a result, they can foster a stable and predictable economic environment, less prone to disruptive financial crises.

However, it is important to note that Evgenidis and Malliaris's perspective does not enjoy unanimous support within the academic community. The debate on the effectiveness of LAW remains ongoing and contentious. Various researchers question whether this approach is truly beneficial. While proponents of LAW argue that it helps prevent the buildup of excessive risks on the markets, by intervening early, other studies highlight the potential limitations and drawbacks of such a strategy.

In this regard, the paper "Leaning against the Wind and Crisis Risk" (2020) by Moritz Schularick, Lucas ter Steege, and Felix Ward stands out. Based on an extensive set of historical data covering the financial cycles of advanced economies from the 19th century to the present, the paper analyzes the effects of monetary policy interventions on financial stability, with particular focus on the LAW approach.

To identify the causal effects of interest rate changes, they employ an advanced methodology called the local projections instrumental variable strategy (LP-IV). The LP-IV strategy is an econometric technique that combines two approaches: local projections and the use of instrumental variables.

Local projections are used to track the temporal evolution of economic variables in response to monetary policy shocks, allowing for the estimation of the dynamic effects of these changes. This technique makes it possible to capture, year by year, how the probability of a financial crisis changes following an interest rate adjustment.

Instrumental variables, on the other hand, are used to address the problem of reverse causality and confounding factors. This means that, instead of simply observing the correlation between interest rates and financial stability, the authors use variables that influence interest rates but are not directly linked to the internal factors

of the economy under study. For example, they might use changes in interest rates in a large and influential country, such as the United States or Germany, which then affect the interest rates of other countries with fixed exchange rates relative to these base countries.

This approach allows for isolating the pure effect of interest rate changes on financial stability risks, ensuring that the results are not distorted by other local economic factors.

The paper first provides an overview of the debate on the effectiveness of LAW, focusing on two episodes considered significant for demonstrating the mistakes made in economic history, and more specifically, to prove that the absence of preventive measures to control market expansion facilitates the emergence of severe financial crises.

The first episode refers to the restrictive policy of the United States Federal Reserve during the period 1928-1929, when interest rates were raised from 3.5% to 6% between January 1928 and August 1929 to curb speculation in the stock and real estate markets, which had driven up stock and property prices. History remembers this decision as a key factor in the Great Depression, as the sudden and significant reduction in liquidity caused by the interest rate hike led to one of the worst economic crises in modern history, with the collapse of stock prices and the failure of banks.

The second episode concerns the 2000s. During a period marked by strong credit expansion and a booming real estate market in the United States, the Federal Reserve (led by Alan Greenspan and Ben Bernanke) decided to keep interest rates relatively low, in line with the prevailing economic thinking of that time, which limited the role of central banks to monetary policies aimed solely at maintaining price stability and promoting economic growth. Once again, the central bank's stance was considered one of the main causes of the 2008 global financial crisis, which led to the collapse of housing prices, defaults on subprime mortgages, and the failure of major financial institutions.

Additionally, the two episodes are used to verify the effectiveness of the LAW in promoting financial sustainability. To do this, the authors start from the

consideration that a financial boom is essentially a prolonged deviation from the normal trend of credit growth and real asset prices.

To support their thesis, the authors use the JST Macrohistory Database, an archive that collects annual data on both the real economy and the financial sector of 17 developed countries starting from 1870. The depth of the database thus allows for the observation of financial cycles over the long term, comparing periods of expansion and crisis that have occurred in individual economies at different historical moments.

The main explanatory variable of the study is the stance of monetary policy, which is measured through changes in short term nominal interest rates.

The results clearly show that leaning against the wind policies can have counterproductive effects on the risk of a crisis, as it is demonstrated that a one percentage point increase in the interest rate during a period of financial boom can increase the risk of a financial crisis by about 10 percentage points in the short term. The results of this analysis lead the authors to argue that raising interest rates does not mitigate the risks of instability but tends to worsen the situation, making the onset of a crisis more likely.

This phenomenon is also confirmed over time. The paper indeed demonstrates the absence of benefits from the LAW strategy by showing an increase in risk that persists for about two years after the central bank raises interest rates, thereby supporting the thesis on the ineffectiveness of the LAW approach as a tool for preventive monetary policy.

The analysis continues by examining whether LAW policies can still offer benefits by mitigating, in the presence of crisis risk, the economic impact of the crises themselves. The authors demonstrate that, in the five years following a financial crisis, real gross domestic product tends to decrease by about 8% relative to the trend, regardless of the monetary policy followed by the central bank before the crisis. Therefore, regardless of whether the central bank adopted restrictive policies before the onset of the crisis, the negative economic impact remains essentially the same.

The severity of crises, measured as the loss of real GDP relative to expected growth, does not appear to be limited by LAW policies. This thesis is supported by the

authors through several empirical analyses, which are further confirmed by using different methods to define periods of financial boom and crises.

Nevertheless, it follows that, regardless of the criteria used, the results remain consistent, demonstrating that LAW policies do not reduce the magnitude of economic losses associated with financial crises, as they are ineffective in mitigating the risks of financial instability.

In conclusion, the study tends to suggest macroprudential policies as an effective tool to counter the risks of financial instability associated with credit and asset booms, deemed more appropriate than monetary policies.

After examining the study by Evgenidis and Malliaris, who advocate for the application of LAW, and the analysis by Moritz Schularick, Lucas ter Steege, and Felix Ward, who contest its effectiveness, the question naturally arises regarding the balance between the costs and benefits of this approach. On this point, Lars E.O. Svensson's study "Cost-benefit analysis of leaning against the wind" (2017) takes on particular relevance.

Svensson's analysis first focuses on the costs of LAW, starting with the most evident ones, such as a weaker economy characterized by higher unemployment and lower inflation due to higher interest rates (which can lead to a recession or an economic slowdown if no financial crisis occurs).

However, the less obvious but potentially higher cost emerges when a crisis occurs in an economy that has already been weakened by LAW policy; in these cases, the magnitude of the crisis will be greater, with more severe impacts compared to a scenario without LAW.

This thesis is supported by the following example: suppose that without LAW, the unemployment gap in non-crisis periods is zero and that a crisis increases the unemployment gap by 5 percentage points. The unemployment gap is defined as the difference between the actual unemployment rate and the benchmark unemployment rate. The benchmark unemployment rate is the rate under optimal policy with flexible inflation targeting, where the possibility of a financial crisis is disregarded. With LAW, the unemployment gap in non-crisis periods increases to 0.5 percentage points,

raising the unemployment gap in crisis periods to 5.5 percentage points. It follows that the loss in non-crisis periods increases marginally, but the loss during crises increases significantly, making the cost of a crisis higher with LAW.

The study then proceeds to analyze the benefits of LAW: in particular, the potential reduction in the probability of a crisis and the decrease in the severity of a crisis if it occurs. Recent studies, such as those of Borio and Drehmann (2009), Gourinchas and Obstfeld (2012), and Schularick and Taylor (2012), have emphasized the role of credit growth and credit booms in predicting crises and their magnitude.

The channel of LAW's benefits occurs through the effect of the policy rate on credit combined with the effect of credit on the probability and magnitude of a crisis. However, Svensson highlights that the effect of monetary policy on credit growth and, therefore, on the probability of a crisis is limited and often uncertain.

Svensson's empirical analysis uses representative estimates to calculate the costs and benefits of LAW. For example, to numerically represent these effects, Svensson uses empirical estimates from the Swedish central bank (Sveriges Riksbank) regarding the effect of the policy rate on household debt, estimates from Schularick and Taylor (2012) on the effects of debt on the probability of a crisis, and estimates from Flodén (2014) and Jordà et al. (2013) on the effect of debt on the magnitude of crises.

The results, supported by robust tests (which consider scenarios of monetary non neutrality, permanent effects of the policy rate on real debt, lower effectiveness of macroprudential policy, and crises of greater magnitude or longer duration), indicate that the costs of LAW significantly outweigh the benefits.

For example, it is demonstrated that to reverse the outcome and make the benefits of LAW exceed the costs, the effects of the policy rate on the probability and magnitude of crises must be larger than 5-40 standard deviations compared to the representative estimates. This implies that the empirical estimates of the benefits of LAW are too small and do not allow for compensating the costs associated with a weaker economy.

In summary, Svensson's cost-benefit analysis shows that the economic costs of LAW outweigh the benefits derived from the reduction of financial crises and

concludes by expressing a negative opinion of LAW as a monetary policy tool to mitigate financial risks, effectively supporting the conclusions of Schularick, Steege, and Ward and criticizing the evidence presented by Evgenidis and Malliaris.

2.4 Financial vulnerability and Market stress indicators. Role of CBs in financial stability: monetary policy in scenarios of high uncertainty and volatility.

Central banks play a fundamental role in maintaining financial well-being, especially in contexts of high uncertainty and volatility. Regardless of the contrasting theories on the various strategies (Fed Put and LAW) that central banks may adopt, it is widely accepted that economic stability can only be maintained through targeted interventions.

As explored in the previous paragraph, the strategies present substantial differences (the Fed Put focuses on reactive responses to market declines, while LAW proposes a preventive approach against excessive euphoria), and it is not possible, despite the studies conducted so far, to identify a solution that proves effective in every case. Undoubtedly, the importance and complexity of stock markets require central banks to closely monitor economic developments, in order to promptly capture both positive signals of economic confidence and early indicators of potential financial crises.

Studies such as those by Cieslak and Vissing-Jorgensen have also demonstrated the clear influence of stock market movements on monetary policy decisions. It is now widely accepted that stock markets play a role in central banks' decision making processes. Constant monitoring of the markets, therefore, allows for the definition of appropriate policies on a case by case basis, carefully balancing the need to stimulate economic growth with the obligation to preserve financial stability.

On this point, the paper "Asset Prices, Financial and Monetary Stability: Exploring the Nexus" (2002) by Claudio Borio and Philip Lowe represents an important contribution.

The authors argue that, in a low inflation environment, traditional monetary policies are unable to detect financial imbalances that arise within the economic system, such as rapid credit growth and significant increases in asset prices, including stocks and real estate.

The empirical analysis of this view is based on data from 34 industrialized and emerging economies, covering a historical period starting from the 1970s.

Borio and Lowe use an aggregate asset price indicator, an analytical tool that combines various categories of assets, such as stocks, residential, and commercial real estate.

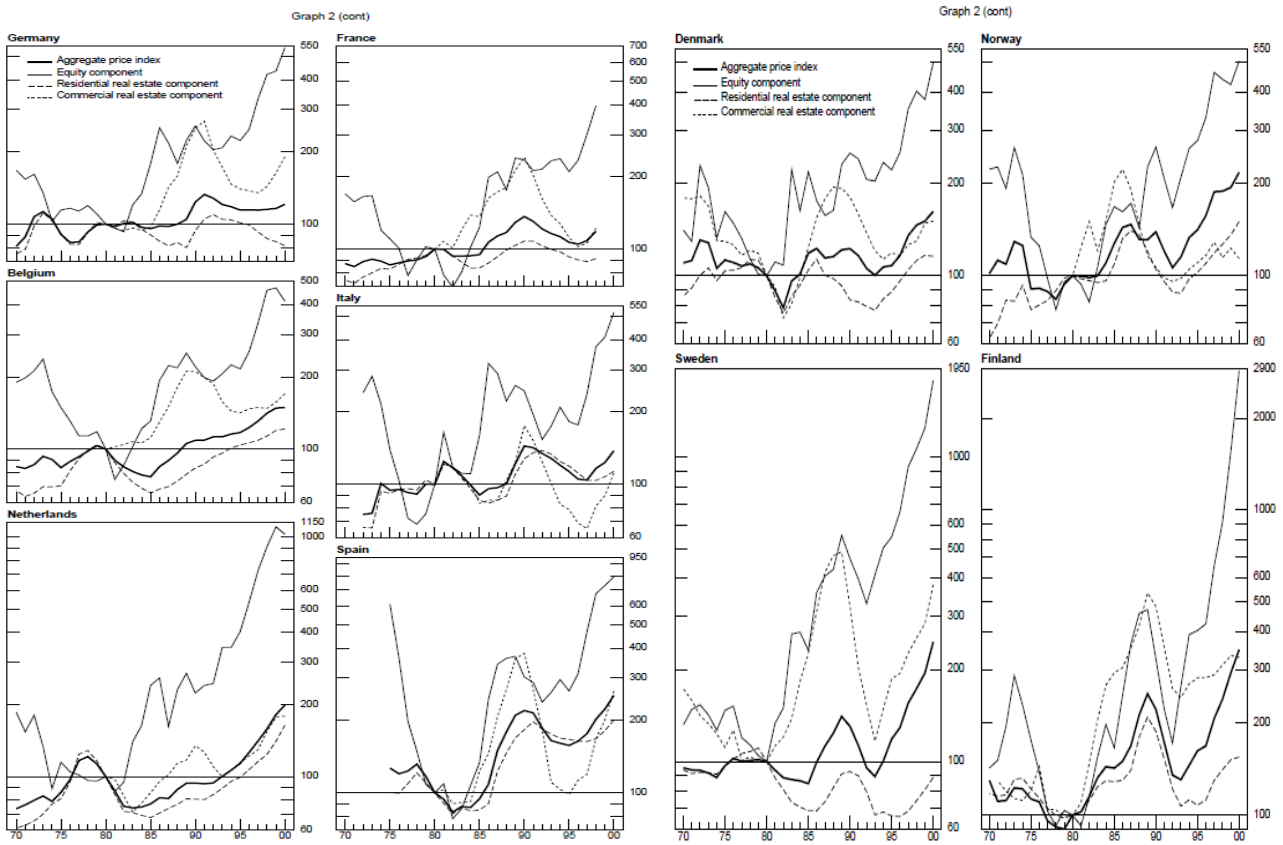

Figure 2.9: The figure shows the path of the aggregate price index and of its components over time (Equity, Residential real estate, Commercial real estate).

Through this indicator, it is possible to identify an overall measure of asset price changes within an economy, reflecting the underlying dynamics in financial markets. Each component of the indicator is weighted according to its proportion in the total

wealth of the private sector, in order to represent the relative importance of each type of asset in the overall portfolio of investors.

This approach is particularly useful because it allows for the observation of overall trends in asset prices, providing a comprehensive view that may obscure specific variations in individual components. In this way, the indicator helps identify potential financial imbalances that may emerge.

As shown in the following figure, significant fluctuations in the aggregate indicator are often associated with credit expansion cycles.

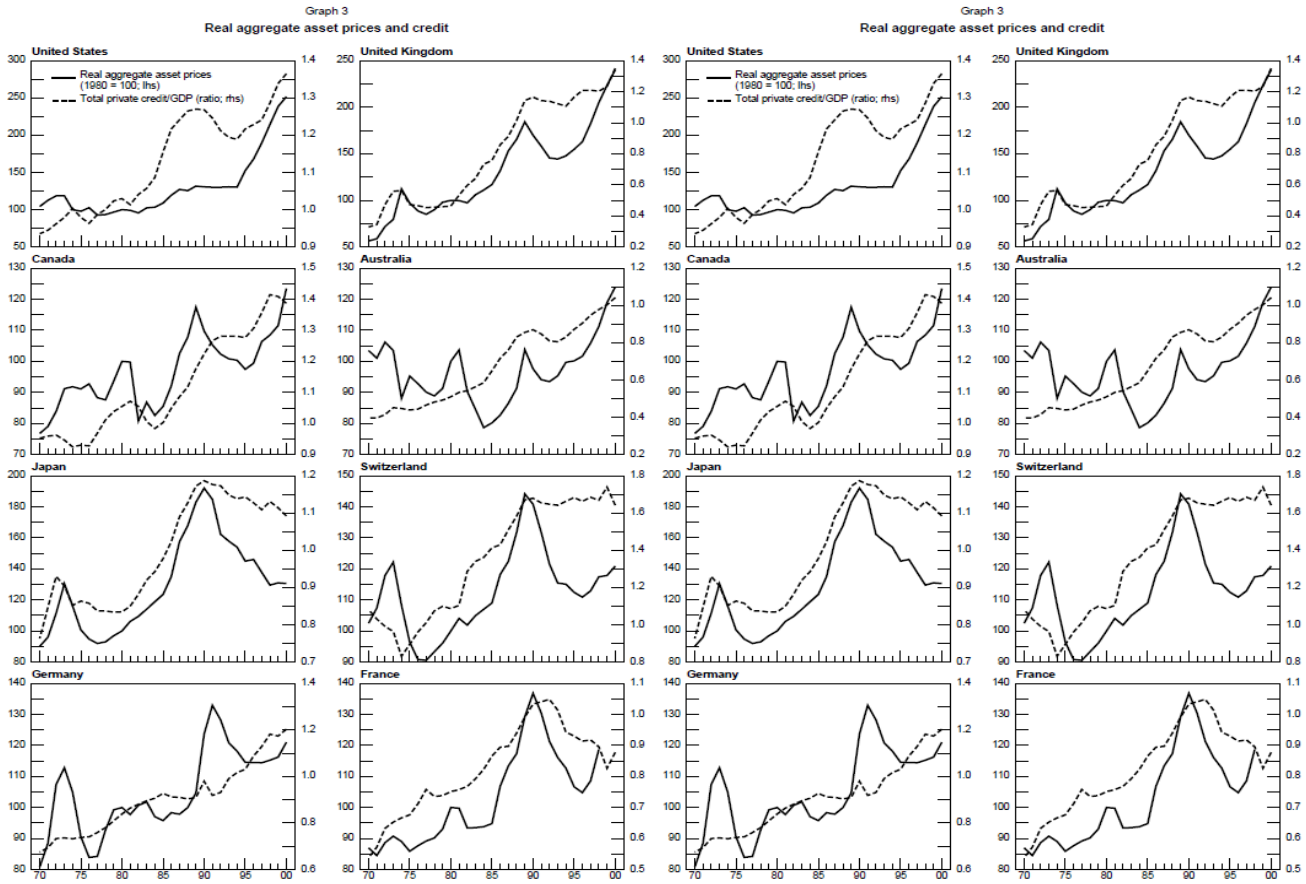

Figure 2.10: The figure shows the paths of the real aggregate asset prices (dark line) and of credit (dotted line).

The correlation between rising asset prices and credit expansion shows that when asset prices grow rapidly, the financial system becomes more vulnerable; furthermore, investors in such circumstances take on more risks, further fueling the growth of credit and prices, thereby increasing the risk of a potential crash. In such cases, rapid increases in asset prices can serve as warning signals for monetary authorities.

The study by Borio and Lowe emphasizes the importance of careful and constant monitoring of these imbalances by central banks, which can help mitigate the risks of potential future crises.

One of the central aspects of the document concerns the identification of financial vulnerability indicators, particularly the “credit gap” and the “asset price gap”.

The “credit gap” represents the difference between total credit extended in the economy and the gross domestic product, relative to the long term trend. This indicator is used to measure the extent of credit expansion in relation to economic growth, highlighting periods when credit grows much faster than the underlying economy. Therefore, a significant deviation serves as a warning signal for the central bank, as credit growth not supported by an equivalent increase in GDP can lead to financial imbalances.

Similarly, the “asset price gap” measures the deviation of asset prices from their historical trends and is calculated by assessing the percentage deviation of current prices from their historical average. The asset price gap helps identify periods when asset prices rise rapidly compared to historically normal levels, which also serves as a warning sign for the potential formation of speculative bubbles. In fact, the significant increase in asset prices can lead investors to become overly optimistic about the market, prompting them to take excessive risks and further fuel credit growth.

The findings of the paper indicate that when the credit gap exceeds 4-5 percentage points and asset price increases surpass 40-50%, a high risk environment for financial stability is created. These critical levels act as warning signals for monetary authorities, suggesting the need for intervention to prevent potential crises.

The approach proposed by Borio and Lowe, supported by empirical analyses, demonstrates the importance for central banks to promptly identify periods when financial imbalances reach concerning levels, allowing them to intervene with corrective measures.

More specifically, the statistical analysis reveals that a credit gap of around 4 percentage points is an effective indicator, as it can predict 79% of financial crises

within a one-year time horizon. This means that when credit exceeds the historical trend relative to GDP by 4 percentage points, there is a significant probability that a crisis will occur.

However, there is also an 18% chance of false positives, meaning that in some cases the model predicts a crisis that does not actually occur. For this reason, the authors suggest combining different indicators, such as the credit gap and the asset price gap, to reduce the risk of inaccurate predictions.

For example, when a credit gap of 4 percentage points is combined with an asset price gap of 40% (indicating that asset prices are significantly above their historical trend), the number of false positives is reduced by approximately 50% compared to using the credit gap alone.

However, the improvement in accuracy helps provide more precise analyses, but at the same time, it may lead to less accurate predictions of crises. Therefore, it is necessary for central banks to strike a balance between sensitivity (the ability to correctly identify crises) and specificity (the ability to avoid false alarms), in order to intervene appropriately in safeguarding the financial system.

Another aspect addressed in the paper, which central banks must consider when making their decisions, is the political implications. The authors discuss whether a monetary policy response to imbalances is appropriate, arguing that such intervention is justified when financial vulnerabilities pose a greater threat to stability than inflation alone. In this increasingly complex context, cooperation between monetary authorities and prudential supervisory bodies becomes crucial. A coordinated and integrated approach is essential for effectively monitoring and managing risks.

Among the indicators that can be used to identify speculative bubbles and financial vulnerabilities, the price to earnings (P/E) ratio is also considered, a key parameter for assessing the sustainability of stock prices relative to company earnings.

According to “Asset Price Bubbles: Implications on, and Approaches to, Monetary Policy and Financial Stability” (2004) by Olivia A. Vital and Lucia C. Laquindanum, a high P/E ratio may indicate that stock prices are inflated relative to expected earnings, suggesting the potential presence of a bubble.

The indicator, when compared to historical trends, can help identify instances of market overvaluation. In fact, during periods of continuous price growth, banks may tend to loosen credit standards, relying on positive asset performance. Such behavior can trigger a vicious cycle, as loans based on inflated valuations become vulnerable in the event of a sudden market collapse. Consequently, a reduction in asset prices leads to a decline in the value of banks' investments in stocks and real estate, and, in cases where loans are granted based on inflated asset prices, to an increase in non-performing loans.

This phenomenon was clearly evident during the Asian crisis, characterized by loans granted by banks based on inflated values. The non-performing loan ratio of Philippine banks rose from 5.4% to 18.2% during the crisis, showing a significant deterioration in credit quality and bank balance sheets. This had a negative impact on the banks' ability to lend, further worsening the economic situation.

It should be noted, however, that the active intervention of central banks in stock markets to prevent financial crises is critically viewed by some economists, who question the effectiveness and necessity of such interventions.

An example of this is the paper "Stock Market Crashes and Their Aftermath: Implications for Monetary Policy" (2002) by Frederic S. Mishkin and Eugene N. White, which provides a detailed analysis of fifteen historical episodes of stock market crashes in the United States over the past century, focusing on the consequences of these crashes and how such events have influenced monetary policy decisions.

According to Mishkin and White, central banks are tasked with protecting and defending the overall financial stability of the entire system. If this stability is not at risk, a stock market crash, though alarming, should not be considered a primary concern. In other words, monetary policy interventions must ensure that the financial system continues to function, that banks remain solid, and that credit remains available to businesses and consumers.

The paper highlights that bank failures or disruptions in credit markets caused by economic instability pose a greater threat than stock market crashes. Although these crashes may result from the bursting of speculative bubbles, as occurred in the 1920s

or more recently in 2008, they are not always the determining factor of financial instability.

For these reasons, Mishkin and White believe that central banks should focus their efforts not so much on stock price movements, but rather on the overall health of the financial system.

To understand the implications of such bubbles and the resulting stock market crashes, Mishkin and White examine past significant stock market crashes in the United States, including those from over a century ago. By analyzing these historical episodes, the authors aim to identify patterns that can help guide monetary policymakers in their future decisions.

In order to do this, the authors classify the crashes into four categories, based on the impact they had on the overall financial system.

The first category includes episodes where crashes did not put the financial system under stress: stock prices fell significantly, but the rest of the financial system continued to function without showing evident signs of difficulty or crisis.

The second category includes episodes where crashes were extremely significant and impacted the stability of the financial system, but timely intervention by the Federal Reserve, providing liquidity and support to the financial system, prevented a substantial widening of spreads.

The third category, on the other hand, includes episodes associated with a sharp increase in spreads, leading to severe financial stress. In these cases, stock market crashes were directly linked to the financial system, resulting in a significant increase in the cost of credit for riskier borrowers, indicating that lenders perceived a higher risk of default.

Finally, the fourth category includes episodes associated with a less pronounced increase in spreads, with limited financial stress. In these cases, stock market crashes led to a smaller increase in spreads compared to those in the third category, and the financial system was not severely compromised.

The authors then examined different time periods to assess how quickly and drastically stock prices fell. In order to do this, they used market indices such as the

Dow Jones Industrials, the S&P 500, and the NASDAQ Composite, which represent broad sections of the stock market and are commonly used to evaluate overall market performance.

By selecting the major crashes of the twentieth century, the authors analyzed the most significant episodes to better understand the dynamics and consequences of such events. They identified periods in which the markets experienced substantial losses over a short period of time, allowing them to focus on moments of heightened turbulence and financial instability.

In particular, Mishkin and White examined fifteen episodes of stock market crashes (from 1903 to 2001). For example, during the Great Crash of 1929, the U.S. stock market experienced a drastic loss. The Dow Jones lost 37% of its value between September and November 1929, with further losses after a brief recovery, leading to an overall decline of 81.8% by May 1932.

The severity of the 1929-1933 crisis was amplified by the weakness of the balance sheets of both financial and non financial institutions, which increased information asymmetries (discrepancies between what lenders and borrowers knew about each other's financial conditions). Additionally, issues of adverse selection, where lenders could not distinguish between good and bad risks, and moral hazard, where borrowers made riskier decisions because they did not bear the full consequences, further worsened the situation in credit markets.

Similarly, the 1987 crash (Black Monday) saw the Dow Jones lose 22.6% in a single day. In this instance, however, the timely intervention of the Federal Reserve, which injected liquidity into the financial system, managed to limit the widening of spreads and prevent broader repercussions on the financial system.

The analysis of the four different categories allows the authors to argue that stock market crashes are not necessarily the primary cause of financial instability, as in some cases they did not negatively affect the financial system. In other words, not every significant drop in stock prices automatically leads to a broader financial crisis.

However, in episodes of extremely sharp crashes, such as those in 1929 and 1987, there is stronger evidence that certain financial markets failed to function

properly due to the crash. These episodes demonstrate how credit markets and other segments of the financial system can be severely impacted, preventing them from operating normally.

The implications for monetary policy are, therefore, that financial stability should be the primary concern for policymakers, rather than stock market crashes themselves. If the balance sheets of financial and non financial institutions are initially strong, a stock market crash is less likely to lead to financial instability. In such situations, monetary authorities should respond to the standard effects of the stock market crash on aggregate demand, without the need for extraordinary interventions.

At this point, it is appropriate to reflect on the implications of the discussion, leaving open some fundamental questions that continue to fuel the debate on the role of central banks in managing scenarios of high uncertainty and volatility.

The words of Bernanke from 2002 can offer us a valuable perspective in this regard.

The words of Bernanke in 2002 can offer us a valuable perspective in this regard. Bernanke raises crucial questions about the Fed's ability to identify and manage speculative bubbles, in one of his speech in 2002.[11] He highlights that there are two key issues which complicate the use of monetary policy. First, the Fed lacks the ability to reliably detect bubbles in asset prices. Second, even if bubbles were identifiable, monetary policy is an imprecise tool that would struggle to effectively counteract them. Bernanke acknowledges that the practical difficulties of using monetary policy, for the purpose of eliminating bubbles from asset markets, make it a far more complex task than it appears.[12]

Bernanke emphasizes the inherent challenge of identifying bubbles as they occur. He points out that while the market price of a stock is easily visible, the underlying fundamentals, such as expected dividends and the risk premium investors demand, are much harder to gauge, even retrospectively. This makes difficult for

[11] See *https://www.federalreserve.gov/boarddocs/speeches/2002/20021015/default.htm*.

[12] Bernanke actually explains that "If we could accurately and painlessly rid asset markets of bubbles, of course we would want to do so. But as a practical matter, this is easier said than done… for two main reasons. First, the Fed cannot reliably identify bubbles in asset prices. Second, even if it could identify bubbles, monetary policy is far too blunt a tool for effective use against them."

policymakers to determine whether asset prices are being driven by speculation or by legitimate shifts in underlying economic factors. As a result, this lead to complications in attempting to address bubbles in real time.[13]

Although there have been advancements in understanding the dynamics of speculative bubbles and financial vulnerabilities, many dilemmas remain unresolved about how central banks should behave in these contexts.

Bernanke proposes a framework regarding asset market instability for the Fed's policy, summarized by the expression "Use the right tool for the job."[14] The approach implies that the Fed should focus on the use of monetary policy to achieve its macroeconomic objectives. This can be done by employing its regulatory, supervisory, and lender of last resort powers for the purpose of ensuring financial stability. Bernanke argues that it is neither desirable nor practical for the Fed to act as an arbiter of security speculation or values. He suggests that the Fed should not be responsible of the management of speculative behaviors in financial markets. However, he also emphasizes the importance of closely monitoring financial markets because of their critical role in the overall economy.[15] Bernanke points out that asset prices offer valuable, timely insights into broader economic conditions. These informations should be incorporated into the Fed's monetary policy decisions in order to ensure effective economic management.

[13] Bernanke then goes on saying that even if asset bubbles could be identified, raising interest rates could cause significant harm to the broader economy. He notes, "policymakers must weigh the potential damage to the broader economy of using monetary policy to address speculative excesses". He also stresses that rapid asset price increases don't necessarily signal a bubble and can be driven by fundamental economic factors, urging instead for regulatory reforms and improved financial transparency to manage financial instability.

[14] Bernanke's proposition to "use the right tool for the job" emphasizes a clear separation of roles between monetary policy and financial stability tools. He clearly states that *"Monetary policy cannot be aimed at achieving financial stability per se'".* By doing so, the Fed avoids the risks associated with trying to manage asset price bubbles directly through interest rates, a strategy that could disrupt broader economic conditions. This reflects a broader consensus in central banking to rely on macroprudential tools rather than traditional monetary policy for addressing financial market vulnerabilities.

[15] He notes, *"The financial markets are vital components of the economic machinery"* and thus must be carefully monitored. This mirrors the concept of the "financial accelerator", where fluctuations in financial markets can amplify economic cycles, making their monitoring critical for effective policymaking (Bernanke, Gertler, and Gilchrist, 1996).

In light of Bernanke's words, we can conclude that stock markets are a cornerstone for central banks in conducting monetary policy, regardless of the ongoing debates. Ignoring them would mean relinquishing a key tool for maintaining the balance of the global economy. The timeliness and methodology with which central banks respond to signals from the stock markets remain at their discretion.

On this point, the final part of my analysis focused on illustrating the various theories and available evidence. I provide interpretative frameworks and methodological approaches useful for understanding the optimal responses that central banks can adopt to maintain balance in financial markets in order to effectively overcome the challenges posed by the dynamics of the stock markets.

CHAPTER 3

DECODING MARKET MOVES: FOMC INFLUENCE ON STOCK PERFORMANCE

3.1 Stock Returns over the FOMC Cycle: Overview and Research Objectives

The second chapter revealed how monetary policy is not only a tool for maintaining stability, but also a force capable of influencing equity markets in subtle and decisive ways. Through transmission channels such as the cost of capital, the credit channel and Tobin's q effect, monetary policy acts on hidden levers that influence stock valuations and investment choices. Every central bank decision directly impacts markets, altering expectations, risk perceptions, and opportunities, creating a delicate balance that can easily shift between stability and volatility.

The way financial markets and central bank actions interact creates a broader reflection on the need to find a balance between stabilizing markets and encouraging risk-taking. In this context, the Fed Put has gradually established a kind of implicit agreement between the markets and the Federal Reserve. This phenomenon, far beyond emergency intervention, has gradually altered the behavior of market players, reinforcing their confidence in the central bank's ability to intervene at the most difficult times. The Fed Put actually translates into a predisposition of market actors to take risks in the belief that, in case of trouble, the Fed's support will not be lacking.

In this scenario, the debate on "leaning against the wind" goes beyond the traditional opposition between interventionism and laissez-faire, raising the question of how central banks should address speculative cycles in equity markets. The adoption of restrictive policies in an environment where financial markets have become accustomed to a prolonged period of accommodation could lead to unexpected shifts and unforeseen consequences in an increasingly interconnected global economic system. The idea of implementing restrictive monetary policies to prevent speculative

bubbles has gained a controversial dimension. While such policies may prevent imbalances, inadequate application could destabilize markets that have grown used to high liquidity conditions. Consequently, a thoughtful approach is needed to prevent the spread of uncontrolled risks and excessively restrictive reactions.

Market surveillance cannot be limited to traditional macroeconomic data, as demonstrated by the analysis of financial vulnerabilities using indicators such as the "credit gap" and the "asset price gap". The evolution of the financial system demands a more advanced understanding of risk dynamics, taking into account the interconnections between sectors and countries. Imbalance signals can be identified in advance using more complex monitoring tools, but managing market reactions once this information is disclosed remains a challenge. This raises a deeper issue: how can the response be managed without causing disruptions in the markets? Bernanke reminds us that the solution is not to try to resolve every bubble or imbalance through monetary policy. Adopting the correct strategy is essential: maintaining focus on primary economic goals and allowing financial regulation to take its course. Monitoring and intervening with moderation: a fine line that requires both intuition and flexibility. Beyond the tools at their disposal, central banks' ability to adapt to constantly changing markets will be crucial for their future. To maintain stability without undermining investor confidence, the best approach may be to manage expectations without falling into the trap of seeking total control.

After establishing the theoretical framework of the relationships between monetary policy decisions and financial markets, the third chapter aims to translate these insights into an empirical analysis. The goal is to understand whether the theoretical dynamics discussed in the second chapter are confirmed by real-world data, assessing their validity over time.

In this context, the paper "Stock Returns over the FOMC Cycle" written by Anna Cieslak, Adair Morse, and Annette Vissing-Jorgensen, published in 2019, has provided an essential interpretative framework for analyzing stock returns related to the FOMC cycle.

The behavior of daily excess stock returns during the FOMC cycle is a central element of Cieslak's analysis. The authors demonstrate that, between 1994 and 2016, excess returns on equities relative to Treasury securities are concentrated almost exclusively in the even weeks of the FOMC cycle, specifically weeks 0, 2, 4, and 6. In contrast, returns are often very low or even negative during the odd weeks (1, 3, and 5). This bi-weekly pattern is particularly evident: on average, excess returns are significantly positive in the even weeks, while in the odd weeks they are either null or negative.

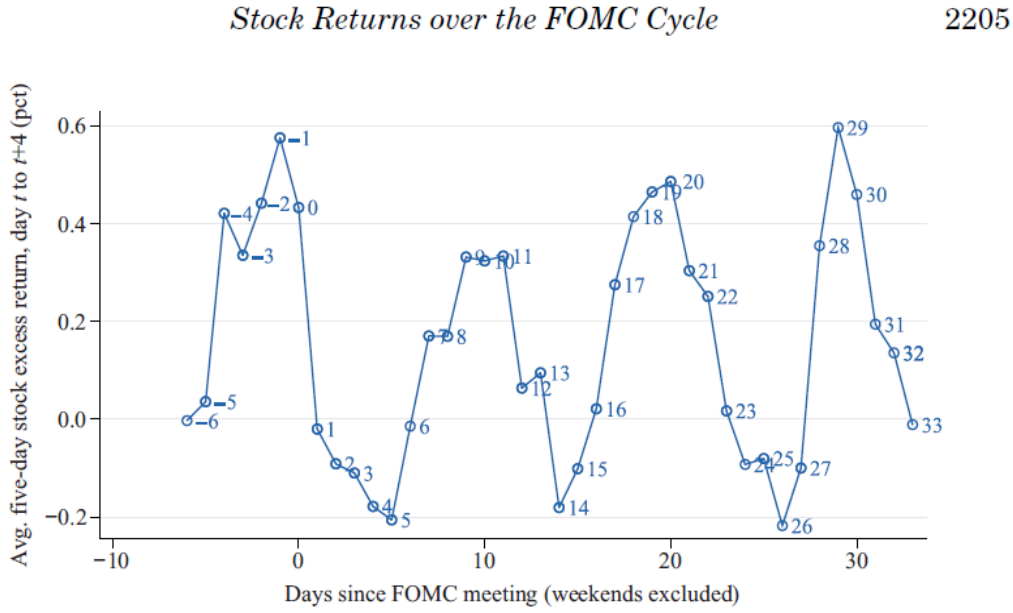

Figure 3.1: The average pattern of excess returns over a five-day window surrounding the Federal Open Market Committee meetings is depicted in the graph. In connection to the FOMC's decision-making process, it records fluctuations in the performance of the stock market at particular periods.

The horizontal axis shows the days representing a FOMC cycle, with day zero representing the expected date of an FOMC announcement. If the meeting takes place over two days, day zero refers to the second day, which is the day the announcement is released. Weekends and holidays have been excluded, with stock returns set to zero on those days. The vertical axis represents the five-day cumulative stock return,

computed as the difference between the five-day stock return and the 30-day Treasury bill return for the same period, expressed as a percentage.

In detail, average stock returns performed significantly better during the even weeks of the FOMC cycle compared to the odd weeks. For instance, the average excess return was 0.57% in the days immediately following the FOMC announcement (week 0). The positive trend continued in the subsequent weeks, with average returns of 0.33% in week 2, 0.46% in week 4, and 0.60% in week 6. In contrast, during the odd weeks, returns were notably lower, often close to zero or even negative. The average return was nearly zero in the week preceding the FOMC announcement (week -1). In the following odd weeks, average returns dropped to -0.18% in both week 1 and week 3, and to -0.09% in week 5.

The causal link with the Federal Reserve's monetary policy is evident. The results are explained by Cieslak, Morse, and Vissing-Jorgensen, who state that investor expectations of future Fed activity, rather than actual policy measures, are the primary mechanism driving these stock market movements. By creating a psychological safety net, the Fed Put enables market participants conclude that, even in the absence of an imminent change in policy, the Fed will step in to prevent large market falls. Investors modify their portfolios in anticipation of a policy reaction because the expectation of intervention lowers the perceived risk of holding equities. As Cieslak et al. point out, rather than sudden interest rate changes, what drives market activity is the promise of future Fed involvement. Investors expect that in response to economic challenges, the Fed will take actions, which will alter the probability distribution for potential economic outcomes. This shift causes the equity risk premium to contract, which boosts stock prices even in the lack of any real Fed move. Returns are greatly impacted by the Fed's capacity to affect market sentiment through simple communication or the likelihood of future action, particularly during volatile periods. This implies that the fact that stock returns spike in even weeks of the FOMC cycle, regardless of actual changes in the Fed funds rates, indicates that market expectations, rather than observable actions, are the key driver. The cycle of anticipatory market behavior is further reinforced by the fact that investors frequently view these weeks as times when

the Fed is most likely to respond to market conditions. Because of psychological elements linked to investor feelings and the Fed's well established track record of reducing downside risk, excess returns consequently accumulate.

To examine the relationship between daily excess stock returns and the weeks of the FOMC cycle, the authors used linear regression models, yielding clear statistical evidence. These models are divided into even weeks (0, 2, 4, 6) and odd weeks (1, 3, 5), with dummy variables that take the value of 1 when the days fall in an even week of the cycle and 0 otherwise. The even weeks include the following days: week 0 covers days from day -1 (the day before the announcement) to day 3; week 2 covers days from 9 to 13; week 4 includes days from 19 to 23; and week 6 spans days from 29 to 33. The odd weeks, on the other hand, include the following days: week 1 covers days from 4 to 8; week 3 covers days from 14 to 18; and week 5 covers days from 24 to 28. This approach is used to directly compare returns in even weeks with those in odd weeks.

The results showed a difference of 12 basis points per day and a very high level of statistical significance ($p < 0.01$). Average returns in the even weeks are significantly higher than those in the odd weeks.

The effect of the even weeks persists even when the authors add additional control variables to isolate the impact of external events. For instance, they include variables that account for significant macroeconomic announcements, such as employment, inflation, or economic growth data, which could have a substantial impact on financial markets. Moreover, corporate announcements, such as quarterly earnings, which might skew returns on specific days, are also considered. Despite these adjustments, the results remain unchanged: excess returns during the even weeks are still significantly higher than during the odd weeks.

The use of these estimation techniques, together with controlling for a range of economic and corporate events, demonstrates that the higher returns in the even weeks are not due to coincidences or external factors. Instead, they are a direct consequence of the Federal Reserve's monetary policies and communications.

Cieslak, Morse, and Vissing-Jorgensen found further evidence reinforcing the link between the Fed's monetary policy decisions and stock markets, in addition to the central mechanism tied to the Fed Put and the behavior of excess returns during the FOMC cycle. Specifically, they observed that fluctuations in the Fed's target interest rates primarily occur during the even weeks of the FOMC cycle, confirming the significance of these weeks for the transmission of monetary policy. Additionally, Fed funds futures rates tend to decline during the even weeks, indicating a perception of more accommodative monetary policies during these periods, which in turn influences financial markets.

The analysis shows that the Fed's meetings set a precise pace for financial markets, where the timing of decisions is as important as the policies themselves. The even weeks, which align with the Fed's policy actions, are true turning points in returns, not merely temporal intervals. Markets, anticipating the Fed's moves, begin reacting even before the interventions are announced, creating a repetitive cycle in which the timing factor punctuates the performance of returns. The Federal Reserve is more than just a reactive player to market turbulence; through precise timing, it constantly shapes and redefines investor expectations.

The main objective of my analysis is to replicate the empirical evidence presented by Cieslak et al. (2019) and verify its validity in the current context by extending the observation period until 2024. It will be crucial to examine whether the observed pattern, in which excess stock returns accumulate primarily during the even weeks of the FOMC cycle, persists in a period marked by extraordinary economic events, such as the COVID-19 pandemic, and during times of significant inflationary fluctuations, when inflation reached extreme levels, both in phases of growth and deflation.

European stock returns will be a key part of the analysis. The primary goal will be to compare the results for the U.S. market with those for the European market to determine whether a similar behavior regarding the Federal Reserve's monetary policy decisions is observed in Europe. The inclusion of European markets represents a significant extension compared to previous analyses, which primarily focused on the

U.S. market. It will be interesting to explore how, and to what extent, Fed policies, through the international transmission of monetary policy, impact not only the domestic market but also global markets. This comparison will allow us to determine whether the pattern observed in the U.S. is also reflected in European markets or if there are significant differences in returns caused by specific local macroeconomic characteristics or European monetary policies.

Additionally, my analysis will introduce a new economic factor: inflation. Beyond the factors already discussed, the goal is to determine to what extent inflation can explain a significant portion of excess stock returns in both the U.S. and Europe. Inflation, recently at the center of the global economic debate, may play a key role in understanding stock return dynamics, especially in a context of rising prices and restrictive monetary policies. Integrating inflation into the model helps estimate its significance as an explanatory variable and assess whether it can alter the return patterns already observed during the even weeks of the FOMC cycle. This approach is a further extension of previous analyses, addressing an important macroeconomic factor whose impact on markets has been amplified by recent global economic events, such as the pandemic and the resulting inflationary wave.

3.2 Quantitative model

The model I have chosen to use follows the econometric approach presented in the paper "Stock Returns over the FOMC Cycle Revisited" (2023) by Felix Reichel. Reichel's work directly builds upon the analysis by Cieslak et al. (2019), replicating the econometric model to analyze stock returns during the FOMC cycle. This approach was selected for its ability to isolate the effects of Fed decisions on the stock market, using dummy variables to clearly distinguish between the even and odd weeks of the FOMC cycle.

The basic equation of the model is expressed as:

$$ex1_i = \beta_0 + D_0 \cdot \gamma_1 + D_1 \cdot \gamma_2 + \varepsilon_i$$

Where:

- $\boldsymbol{ex1_i}$ represents the daily excess return of shares over the risk free rate.
- $\boldsymbol{D_0}$ & $\boldsymbol{D_1}$ are the dummy variables for the FOMC cycle weeks.
- $\boldsymbol{\beta_0}$ is the intercept estimated using the ordinary least square method (OLS).
- $\boldsymbol{\gamma_1}$ and $\boldsymbol{\gamma_2}$ are the regression coefficients of the dummy variables.
- $\boldsymbol{\varepsilon_i}$ are independent identically distributed OLS estimated residuals, which are assumed to be distributed as a normal with zero mean and costant variance.

A significant difference introduced by Reichel involves the use of dummy variables. While Cieslak uses a single dummy variable for all the even weeks (0, 2, 4, 6), Reichel divides them into two distinct groups: one dummy variable for week 0, when the Fed meets, and another for the subsequent even weeks (2, 4, and 6). This distinction allows for a better capture of the potential differences in returns between the week immediately following the FOMC announcement and the other even weeks, making the model more accurate and aligned with the observed cyclical pattern.

Week 0 includes the day before the official FOMC announcement (day -1) and the three days following it (days 1, 2, and 3). This is a critical period for the markets because it reflects investors' immediate reactions to the Fed's monetary policy decisions. Due to the adjustment of market expectations in response to the announced decisions, these days often witness increased volatility and the accumulation of excess returns.

The even weeks following the FOMC announcement, i.e. weeks 2, 4 and 6, are those weeks in which markets can continue to respond to the longer-term implications of the Fed's decisions. Investors have already assimilated the key information, so market reaction in these weeks may be more subdued than in week 0. However, they continue to adjust their investment strategies based on economic projections and future expectations.

The dummy variables are described as follows:

$$D_0 = \begin{cases} 1 & \text{if week is week 0 of the FOMC cycle} \\ 0 & \text{otherwise} \end{cases}$$

$$D_1 = \begin{cases} 1 & \text{if the week is week 2, 4, or 6 of the FOMC cycle} \\ 0 & \text{otherwise} \end{cases}$$

To calculate the daily excess return, we denote "m" as the value of 1 + stock return, which represents the stock market return, and "r" as the value of 1 + bill return, which represents the return on a risk-free asset such as a government bond. The excess return for a day (ex1) is calculated by subtracting "r" from "m" and multiplying the result by 100, according to the following formula:

$$\text{ex1} = 100 \text{ x } (m - r)$$

This expression allows us to obtain the excess return for a single day, in percentage terms. This measure reflects how much the stock market return has exceeded, or fallen short of, the return on a risk-free asset in just one day.

The variable "m" represents the stock return +1. This value is obtained by combining the market risk premium and the risk-free rate. Then, the sum is converted into decimal form and increased by 1. The stock return, expressed as a percentage, is thus transformed into a multiplicative factor.

The variable "r" represents the bill return+1. Similarly, the risk free rate is taken and expressed in decimal form, then 1 is added to it.

$$m = \left(\frac{\text{mktrf+ } r_f}{100}\right) + 1 \qquad r = \left(\frac{r_f}{100}\right) + 1$$

The model is then extended by including inflation as follows:

$$ex1_i = \beta_0 + D_0 \cdot \gamma_1 + D_1 \cdot \gamma_2 + \pi_i \cdot \delta_1 + \pi_{i-3} \cdot \delta_2 + \epsilon_i$$

Where:

- $\boldsymbol{\pi_i}$ represents inflation without lag.
- $\boldsymbol{\pi_{i-3}}$ represents inflation with a 3-month lag.
- $\boldsymbol{\delta_1}$ & $\boldsymbol{\delta_2}$ are the coefficients of the regression associated respectively with the inflation without lag and the lagged inflation.

3.3 Data Construction

The dataset used for the analysis was constructed to support the estimation of the econometric model previously described. It is contained in the file *fomc_week_dummies_1994_jul2024.csv*. The data covers the period from 1994 to July 2024, extending it to include Federal Reserve meetings that occurred after the period considered by Reichel (which ended in November 2023). Specifically, in extending the dataset, the following FOMC meeting dates from late 2023 to mid-2024 were included: October 31-November 1 2023, December 13-14 2023, January 30-31 2024, March 19-20 2024, April 30-May 1 2024, June 11-12 2024, and July 30-31 2024. These new observations allow the analysis to be updated, taking into account more recent events and increasing the relevance of the results in light of significant economic changes.

As stated by Cieslak in his paper, the dataset used organizes the weeks of the FOMC cycle according to a continuous time calendar that excludes weekends.

The weeks of the FOMC cycle are indicated by variables ranging from “w_t0” to “w_t6”. Specifically, “w_t0” takes the value 1 on the days that fall in the week when the Fed meets, while the variables “w_t1”, “w_t2”, “w_t3”, “w_t4”, “w_t5”, and “w_t6” represent the even and odd weeks following the announcement, respectively. Each of these variables takes the value 1 on the corresponding days of the week following the Fed meeting week, and 0 on all other days.

The distinction of FOMC weeks allows us to define the two dummy variables of the model that are fundamental for the analysis. The first, w_t0, which takes value 1 in week 0 of the cycle, and 0 in all other cases. The second, w_t2t4t6, which captures the effect of the even weeks of the cycle, taking value 1 when one of the variables representing the even weeks (w_t2, w_t4, w_t6) takes value 1, and 0 in the other cases.

The file also includes a cluster, which groups the days into weekly blocks of the FOMC cycle, and the Fed day count, which starts from the days preceding the meeting, counts down to 0 on the announcement day, and then progressively increases in the days following until the next meeting. These variables allow for better observation of the FOMC's temporal cycle and an analysis of market reactions at different stages.

The data used to calculate excess returns for both the U.S. and European stock markets were extracted from Kenneth R. French's data library[16] and stored in the files *us_returns_df_1994_jul2024* and *european_returns_df_1994_jul2024*. This resource provides daily data on the Fama-French three-factor model, a cornerstone of financial analysis for evaluating stock portfolio performance. The risk-free rate and the market risk premium, necessary to calculate the "m" and "r" variables, are included in the data.

For the U.S. analysis, market returns and 30-day Treasury bill data were used, available in the "U.S. Research Returns" section of the library. These data cover an extended period from 1994 to 2024. Similarly, for European returns, specific data from the "Developed Markets Returns" section were used, providing information on European stock markets for the same period.

For the integration of inflation into the excess returns analysis, I considered monthly inflation data for the U.S. and Europe, sourced from Bloomberg. Since the data is monthly, a transformation process was required to align it with the daily return analysis. I handled this transformation using Python's forward fill function, which propagates the monthly inflation values across the subsequent days until the release of the new data (the next month's inflation value). This procedure ensures that an

[16] See Kenneth R. French - Data Library (dartmouth.edu)

inflation value is associated with each day in the dataset, maintaining temporal consistency with the stock return data.

Additionally, a three-month lag was introduced to assess whether inflation had a delayed impact on excess returns. Specifically, a new column was added that displays inflation with a three-month shift, allowing the effect of inflation to be tested both in the short term and with a temporal delay.

3.4 OLS Regression Results

2014-2016

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0415	0.043	-0.971	0.331	-0.125	0.042
w_t0	0.1669	0.091	1.831	0.067	-0.012	0.345
w_t2t4t6	0.1534	0.068	2.249	0.024	0.020	0.287

1994-2014

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0190	0.022	-0.882	0.378	-0.061	0.023
w_t0	0.1439	0.049	2.959	0.003	0.049	0.239
w_t2t4t6	0.0877	0.037	2.366	0.018	0.015	0.160

1994-2016

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0243	0.020	-1.203	0.229	-0.064	0.015
w_t0	0.1484	0.045	3.271	0.001	0.060	0.237
w_t2t4t6	0.0990	0.035	2.852	0.004	0.031	0.167

1994-2023

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0020	0.019	-0.109	0.913	-0.039	0.035
w_t0	0.0862	0.041	2.089	0.037	0.005	0.167
w_t2t4t6	0.0754	0.030	2.481	0.013	0.016	0.135

1994-2024

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-4.826e-05	0.018	-0.003	0.998	-0.036	0.036
w_t0	0.0889	0.041	2.189	0.029	0.009	0.168
w_t2t4t6	0.0724	0.030	2.424	0.015	0.014	0.131

Table 3.1: Replicated OLS regression findings for U.S. stock returns over the four periods considered in Reichel's FOMC cycle revisited study, adding a regression that

takes the analysis all the way to 2024. The final regression integrates the latest data as additional contribution of the work. [17]

2014-2016

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0632	0.050	-1.264	0.206	-0.161	0.035
w_t0	0.1724	0.105	1.645	0.100	-0.033	0.378
w_t2t4t6	0.1100	0.077	1.434	0.151	-0.040	0.260

1994-2014

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0051	0.022	-0.237	0.813	-0.047	0.037
w_t0	0.1275	0.047	2.695	0.007	0.035	0.220
w_t2t4t6	0.0428	0.035	1.210	0.226	-0.027	0.112

1994-2016

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0129	0.021	-0.630	0.529	-0.053	0.027
w_t0	0.1388	0.045	3.094	0.002	0.051	0.227
w_t2t4t6	0.0553	0.034	1.650	0.099	-0.010	0.121

1994-2023

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0054	0.018	-0.299	0.765	-0.041	0.030
w_t0	0.0975	0.040	2.465	0.014	0.020	0.175
w_t2t4t6	0.0572	0.029	1.984	0.047	0.001	0.114

1994-2024

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0040	0.018	-0.225	0.822	-0.039	0.031
w_t0	0.0981	0.039	2.529	0.011	0.022	0.174
w_t2t4t6	0.0552	0.028	1.956	0.051	-0.000	0.110

Table 3.2: Replicated OLS regression findings for the European stock returns over four periods considered in Reichel's FOMC cycle revisited study, additing a regression that takes the analysis all the way to 2024. The final regression integrates the latest data as additional contribution of the work. [18]

[17] For the comparison of the results see Table 3.1. /3.3. of "*Stock Returns over the FOMC Cycle Revisited" (2023)*, Felix Reichel, pag 12

[18] For the comparison of the results see Table 3.2. /3.4. of "*Stock Returns over the FOMC Cycle Revisited" (2023)*, Felix Reichel, pag 12

2014-2016

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0161	0.048	-0.336	0.737	-0.110	0.078
w_t0	0.1657	0.092	1.807	0.071	-0.014	0.346
w_t2t4t6	0.1522	0.070	2.186	0.029	0.016	0.289
cpi_us_mm	-0.1153	0.150	-0.768	0.442	-0.409	0.179
cpi_us_mm_3m	-0.1125	0.139	-0.810	0.418	-0.385	0.160

1990-2024

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0022	0.031	-0.071	0.943	-0.062	0.058
w_t0	0.0868	0.041	2.131	0.033	0.007	0.167
w_t2t4t6	0.0693	0.030	2.311	0.021	0.011	0.128
cpi_us_mm	-0.0517	0.076	-0.685	0.493	-0.200	0.096
cpi_us_mm_3m	0.0738	0.075	0.979	0.328	-0.074	0.222

2021-2022

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	0.0306	0.195	0.157	0.875	-0.351	0.413
w_t0	-0.0891	0.187	-0.477	0.634	-0.456	0.277
w_t2t4t6	0.0817	0.131	0.622	0.534	-0.176	0.339
cpi_us_mm	0.0923	0.215	0.429	0.668	-0.329	0.514
cpi_us_mm_3m	-0.1786	0.234	-0.764	0.445	-0.637	0.280

2007-2009

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.2752	0.140	-1.965	0.049	-0.550	-0.001
w_t0	0.7375	0.278	2.652	0.008	0.193	1.282
w_t2t4t6	0.1384	0.206	0.671	0.502	-0.266	0.542
cpi_us_mm	0.0999	0.220	0.454	0.650	-0.332	0.531
cpi_us_mm_3m	0.3261	0.214	1.525	0.127	-0.093	0.745

Table 3.3: OLS regression findings where U.S. inflation has been included as an additional explanatory variable in two different forms: one without lag and another with a three-month lag. This analysis spans five distinct periods, each marked by extreme inflation values, examining the interaction of US inflation and FOMC-related dummy variables in explaining stock returns.

2014-2016

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.0340	0.044	-0.771	0.440	-0.121	0.052
w_t0	0.1686	0.092	1.823	0.068	-0.013	0.350
w_t2t4t6	0.1496	0.070	2.153	0.031	0.013	0.286
cpi_eu_mm	-0.0399	0.056	-0.714	0.475	-0.149	0.070
cpi_eu_mm_3m	-0.0836	0.056	-1.490	0.136	-0.193	0.026

1996-2024

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	0.0016	0.022	0.071	0.943	-0.042	0.045
w_t0	0.0861	0.044	1.978	0.048	0.001	0.171
w_t2t4t6	0.0698	0.032	2.172	0.030	0.007	0.133
cpi_eu_mm	0.0075	0.034	0.223	0.824	-0.059	0.074
cpi_eu_mm_3m	-0.0098	0.034	-0.292	0.771	-0.076	0.056

2021-2022

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	0.1488	0.154	0.964	0.335	-0.154	0.451
w_t0	0.0514	0.232	0.221	0.825	-0.404	0.507
w_t2t4t6	0.0623	0.149	0.418	0.676	-0.229	0.354
cpi_eu_mm	-0.1690	0.144	-1.172	0.241	-0.452	0.114
cpi_eu_mm_3m	-0.1424	0.123	-1.155	0.248	-0.384	0.099

2007-2009

	coef	std err	z	P>|z|	[0.025	0.975]
Intercept	-0.2653	0.150	-1.766	0.077	-0.560	0.029
w_t0	0.7157	0.277	2.581	0.010	0.172	1.259
w_t2t4t6	0.1497	0.205	0.730	0.466	-0.252	0.552
cpi_eu_mm	0.2498	0.229	1.089	0.276	-0.200	0.699
cpi_eu_mm_3m	0.0773	0.276	0.280	0.779	-0.463	0.618

Table 3.4: OLS regression findings where European inflation has been included as an additional explanatory variable in two forms: one without lag and another with a three-month lag. This analysis spans five distinct periods, each marked by extreme inflation values, examining the interaction of EU inflation and FOMC-related dummy variables in explaining stock returns.

3.5 Interpretation of Findings

At this point, we can examine the statistical significance of the variables and their impact on daily stock excess returns using the regression results. Let's start considering the results on US excess returns.

The coefficient associated with the w_t0 variable was positive in all the regressions performed, with values ranging from 0.0862 to 0.1669. This clearly indicates that excess returns tend to be higher during the week when the Federal Reserve meets compared to other weeks. The evidence of a positive effect aligns with

the hypothesis that financial markets react to the Fed's decisions and communications, especially in the days immediately following monetary policy announcements, when uncertainty decreases, and investors recalibrate their expectations.

In the analysis of the significance of w_t0, the p-value is a crucial element, as it measures the likelihood that the coefficient is equal to zero, meaning that the variable has no relevant impact on returns. In almost all the regressions, the p-value associated with this variable is below 0.05, except for the first regression, where it reaches 0.067 (2014-2016). Although slightly above the 5% threshold, this p-value is still very close to the significance limit, suggesting a potential real effect, albeit with less statistical certainty compared to the other cases. In the other regressions, a p-value below 0.05 further strengthens the idea that w_t0 has a robust and statistically significant impact on stock returns, supporting the hypothesis that Fed decisions directly influence market behavior.

The variable w_t2t4t6, representing the effect of the even weeks following the Fed meeting, also shows positive coefficients, ranging from 0.0724 to 0.1534. The associated p-values, generally below 0.05, confirm the statistical significance of this effect. These results suggest that not only does the week of the Fed meeting impact excess returns, but the subsequent even weeks also have a significant effect on market behavior, helping to explain the observed dynamics.

A key aspect in interpreting the results is the 95% confidence intervals (0.025-0.975), which provide a clear measure of the precision of the estimates. For both the w_t0 and w_t2t4t6 variables, the confidence intervals never include the value zero, suggesting with a high degree of certainty that the estimated effect is indeed different from zero. Practically, this reinforces the belief that these variables have a real and significant impact on stock returns. Additionally, the narrow width of the intervals indicates a high degree of precision in the estimates, reducing uncertainty around the coefficients and increasing confidence in the overall reliability of the results.

Finally, the analysis of the standard errors highlights low variability around the estimated coefficients. The standard errors are relatively small, indicating that the estimates are stable and reliable. This suggests that the variations in returns are

consistently explained by the variables included in the model, reinforcing the robustness of the conclusions. We can thus confidently state that both w_t0 and w_t2t4t6 play a key role in determining excess returns during the FOMC cycle, further supporting the idea that the stock market systematically responds to monetary policy dynamics.

Let's now move on to the results related to European excess returns, following the same analytical approach used for the United States.

From the five regressions conducted, the coefficients for w_t0 are generally positive, ranging from 0.0975 to 0.1724. This confirms that, even in the European context, excess returns tend to be higher during the weeks when the Federal Reserve meets. The p-values, mostly below 0.05, indicate strong statistical significance. However, for the period 2014-2016, a slightly higher p-value of 0.1 suggests less statistical certainty for that specific time interval, while still providing positive evidence of the effect.

The coefficients for the w_t2t4t6 variable are generally positive, ranging from 0.0428 to 0.11. However, they are less positive than those observed for the United States. The p-value is below 0.05 in only one case (1994-2023), indicating that the effect of the even weeks is weaker compared to the U.S. market, but still present. The statistical significance varies across regressions, with some values nearing the 5% threshold (1994-2016, 1994-2024), while others exceed this limit (2014-2016, 1994-2014).

In conclusion, the analysis confirms a significant impact of the even weeks of the FOMC cycle, although less pronounced compared to the results obtained for the U.S. market.

A possible explanation for the differences observed in the results may lie in the different sensitivity of European markets to Federal Reserve decisions. While the Fed is a key player in the global economy, the impact of its decisions on European markets may be mediated by other local factors, such as the European Central Bank's monetary policies, specific economic conditions in Europe, and the structure of European financial markets. It is possible that European investors' expectations are less directly

influenced by the Fed's meetings, with internal European macroeconomic events playing a more significant role in determining stock returns. European markets may respond more indirectly, reflecting a lower dependence on U.S. monetary policies. The international transmission of monetary policies could be another plausible explanation. Global markets are mainly influenced by the Fed's decisions through exchange rates and international capital flows. However, these dynamics may take longer to transmit within the European context. This could explain the variability in the statistical significance of w_t2t4t6. Moreover, the fact that even weeks have a stronger effect in the U.S. market than in the European market could be due to the weaker correlation between the economic cycles of the two continents. These factors might explain why the European stock market reacts more slowly to the Fed's monetary policy decisions compared to domestic stock markets.

The integration of inflation into the regression model represents a crucial extension of the analysis to understand how this variable can influence daily stock excess returns. I have chosen to divide the analysis into specific periods, each characterized by unique economic and inflationary dynamics, to explore the impact of inflation both in the short and long term.[19]

The period from 1990 to 2024 represents the entire dataset available and includes a series of significant economic events. The goal is to observe the influence of inflation over an extended time frame, encompassing periods of growth, crises, and recoveries, in order to gain a comprehensive view of its interactions with excess stock returns.

The choice of the 2021-2022 period is explained by the rapid inflation growth due to the consequences of the COVID-19 pandemic. Supply chain disruptions and increased demand for goods drove inflation to historic levels, peaking at 9.1% in June 2022, the highest since 1982. This period provides an opportunity to assess whether and how such high inflation had a significant impact on excess stock returns. Additionally, the analysis considers the effect of the Fed's restrictive monetary policies, which gradually reduced economic stimulus and raised interest rates to contain inflationary pressures.

[19] See *Historical Inflation Rates: 1914-2024 (usinflationcalculator.com)*

The 2014-2016 period was selected to provide a direct comparison with previous regressions where inflation was not included. During this time, the Federal Reserve implemented highly accommodative monetary policies and kept interest rates near zero to help stimulate the economy.

The 2007-2009 financial crisis period was selected to study the impact of an opposite context compared to the pandemic: near-zero inflation accompanied by episodes of deflation. During this period, inflation fell below 1%, reaching a negative level in July 2009 (-2.1%), reflecting a drastic reduction in aggregate demand and a deep economic recession. This deflationary scenario, comparable only to 1949 when inflation reached -2.9%, highlights the severity of the crisis and provides a unique framework to evaluate the interaction between inflation and excess stock returns during such a pronounced economic contraction.

The regression results for the various periods analyzed offer some interesting insights, both in terms of the impact of the variables related to the FOMC cycle and in relation to inflation, whose impact, although not statistically significant, deserves further attention.

First, the coefficients associated with w_t0 and w_t2t4t6 are generally positive and significant across nearly all the periods analyzed. The values for w_t0 range from -0.0891 to 0.7375, with p-values mostly below 0.05, indicating a positive and statistically robust effect of the weeks when the Fed meets on excess returns. Similarly, the values for the w_t2t4t6 variable maintain a significant positive coefficient, with values ranging from 0.0693 to 0.1522. This suggests that the Fed's decisions continue to positively influence the markets even in the subsequent even weeks following monetary policy announcements, even during periods of economic instability or crises.

Regarding inflation, although it does not appear statistically significant, its effects cannot be entirely ignored. For instance, during the 1990-2024 period, inflation with a lag presents a positive coefficient of 0.0738, with a p-value of 0.328. While not statistically significant, this value is close to a threshold that could suggest a potential influence. This indicates that inflation, with a certain delay, may have some effect on

stock returns. The differentiation between immediate inflation and lagged inflation highlights how markets might respond more slowly to inflationary pressures.

During the period of high inflation in 2021-2022, inflation reached record levels, peaking at 9.1% in June 2022. Despite the macroeconomic significance of these figures, the coefficients related to inflation, both with and without lag, are not statistically significant. This could suggest that in such contexts, stock markets tend to respond primarily to expectations of more restrictive monetary policies implemented to counter high inflation, rather than to inflation itself. However, the fact that the values are still close to the significance threshold indicates that, while not decisive, inflation remains a variable worth monitoring.

The regression results for Europe show dynamics similar to those observed for the United States.

The coefficients related to immediate inflation are not significant in any of the regressions conducted. However, it is interesting to note that in two out of four periods, with values of -0.0399 and -0.1690, immediate inflation has a negative sign. This suggests a possible downward pressure on stock markets during those times, indicating that in certain economic contexts, short-term inflation may have a negative effect on returns, particularly in situations of economic uncertainty. Although the effect is not robust enough to be statistically significant, this pattern suggests that short-term inflation could trigger negative reactions from investors.

Inflation with a three-month lag shows some signs of influence, albeit weak. In particular, in some cases, the p-value approaches the significance threshold, such as -0.0836 with a p-value of 0.136 during the 2014-2016 period. This could indicate that European markets tend to react to inflationary changes with a certain delay, rather than responding immediately.

APPENDIX

Python Code: The code implements an econometric analysis of U.S. and European stock returns in relation to the FOMC cycle. It loads historical data on stock and Treasury bill returns, calculates excess returns, and runs multiple linear regressions to assess the influence of the FOMC's even weeks. Additionally, the model is extended to include inflation as an additional explanatory variable, providing insights into how inflation dynamics affect stock market behavior over time.

```
import pandas as pd
import numpy as np
import os
import statsmodels.api as sm
import statsmodels.formula.api as smf
import matplotlib.pyplot as plt
import matplotlib.dates as mdates

# Load FOMC week dummies data
fomc_data = pd.read_csv("fomc_week_dummies_1994_jul2024.csv", sep=";")
fomc_data['date'] = pd.to_datetime(fomc_data['date'], format='%d/%m/%Y')
fomc_data.sort_values(by="date", inplace=True)
fomc_data.to_csv("fomc_data_2024.csv", index=False)

# Load U.S. stock returns data
us_returns_data = pd.read_csv("us_returns_df_1994_jul2024.csv",sep=";")
us_returns_data['date'] = pd.to_datetime(us_returns_data['date'], format='%d/%m/%Y')
us_returns_data.sort_values(by="date", inplace=True)
us_returns_data.to_csv("us_returns_data_2024.csv", index=False)

# Merge datasets on 'date'
merged_data = pd.merge(fomc_data, us_returns_data, on="date", how="inner")
merged_data.to_csv("fed_put_datamerged_data_2024.csv", index=False)

# Calculate 1+stock return and 1+bill return
merged_data['m'] = (merged_data['mktrf'] + merged_data['rf']) / 100 + 1
merged_data['r'] = merged_data['rf'] / 100 + 1

# Replace missing values
merged_data['m'] = merged_data['m'].fillna(1)
merged_data['r'] = merged_data['r'].fillna(1)

# Generate excess return
merged_data['ex1'] = 100 * (merged_data['m'] - merged_data['r'])

# Create observation number
merged_data['t'] = np.arange(1, len(merged_data) + 1)

# Run regression analyses
mlr1 = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=merged_data[(merged_data['date'] >= "2014-01-01") & (merged_data['date'] <= "2016-12-31")]).fit(cov_type='HC3')
mlr2 = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=merged_data[(merged_data['date'] >= "1994-01-01") & (merged_data['date'] < "2014-12-31")]).fit(cov_type='HC3')
mlr3 = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=merged_data[(merged_data['date'] >= "1994-01-01") & (merged_data['date'] <= "2016-12-31")]).fit(cov_type='HC3')
mlr4 = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=merged_data[(merged_data['date'] >= "1994-01-01") & (merged_data['date'] <= "2023-11-30")]).fit(cov_type='HC3')
mlr5 = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=merged_data).fit(cov_type='HC3')


# Additional regressions for European stock returns

# Load European stock returns data
eur_returns_data = pd.read_csv("european_returns_df_1994_jul2024.csv",sep=";")
eur_returns_data['date'] = pd.to_datetime(eur_returns_data['date'], format='%d/%m/%Y')
eur_returns_data.sort_values(by="date", inplace=True)
eur_returns_data.to_csv("eur_returns_data_2024.csv", index=False)

# Merge with FOMC data
eur_merged_data = pd.merge(fomc_data, eur_returns_data, on="date", how="inner")
eur_merged_data.to_csv("fomc_eur_ret_datamerged_data_2024.csv", index=False)

# Calculate 1+stock return and 1+bill return
eur_merged_data['m'] = (eur_merged_data['mktrf'] + eur_merged_data['rf']) / 100 + 1
eur_merged_data['r'] = eur_merged_data['rf'] / 100 + 1

# Replace missing values
eur_merged_data['m'] = eur_merged_data['m'].fillna(1)
```

```
eur_merged_data['r'] = eur_merged_data['r'].fillna(1)

# Generate excess return
eur_merged_data['ex1'] = 100 * (eur_merged_data['m'] - eur_merged_data['r'])

# Create observation number
eur_merged_data['t'] = np.arange(1, len(eur_merged_data) + 1)

# Run regression analyses for European stock returns
mlr1_eur = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=eur_merged_data[(eur_merged_data['date'] >= "2014-01-01") & (eur_merged_data['date'] <= "2016-12-31")]).fit(cov_type='HC3')
mlr2_eur = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=eur_merged_data[(eur_merged_data['date'] >= "1994-01-01") & (eur_merged_data['date'] < "2014-12-31")]).fit(cov_type='HC3')
mlr3_eur = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=eur_merged_data[(eur_merged_data['date'] >= "1994-01-01") & (eur_merged_data['date'] <= "2016-12-31")]).fit(cov_type='HC3')
mlr4_eur = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=eur_merged_data[(eur_merged_data['date'] >= "1994-01-01") & (eur_merged_data['date'] <= "2023-09-30")]).fit(cov_type='HC3')
mlr5_eur = smf.ols('ex1 ~ w_t0 + w_t2t4t6', data=eur_merged_data).fit(cov_type='HC3')
```

```
# Plot the US excess return time series
plt.figure(figsize=(14, 5))
plt.plot(merged_data.set_index("date"), merged_data['ex1'],  linestyle='-', color='r')  # Customize the line style, color, etc.
plt.xlabel('Date')
plt.ylabel('US excess return')
plt.title('Time Series Plot Excess returns US')
plt.grid(True)
plt.show()
```

sotto esempio di esito del modello US su periodo 2014-2016

```
mlr1.summary()
```

```
mlr2.summary()
```

```
mlr3.summary()
```

```
mlr4.summary()
```

```
mlr5.summary()
```

```
#EUR
```

```
mlr1_eur.summary()
```

```
mlr2_eur.summary()
```

```
mlr3_eur.summary()
```

```
mlr4_eur.summary()
```

```
mlr5_eur.summary()
```

```
# Adding inflation
```

```
# Load the US inflation data
inflation_us = pd.read_excel("inflazione.xlsx")
```

```
# introducing a lag
inflation_us['PX_LAST_3m'] = inflation_us['PX_LAST'].shift(periods=-3)
```

```
inflation_us = inflation_us.dropna()
```

```
inflation_us.columns = ['date', 'cpi_us_mm','cpi_us_mm_3m']
```

```
merged_data_test = merged_data.copy()
```

```
# Set 'date' column as the index
merged_data_test.drop_duplicates(subset='date', inplace=True)
merged_data_test.set_index('date', inplace=True)
```

```
inflation_us.set_index('date', inplace=True)
```

```
# Reindex the monthly inflation data to match the daily data, using forward fill to propagate values
inflation_us_daily = inflation_us.reindex(merged_data_test.index, method='ffill')
```

```
# Merge the daily data with the forward-filled inflation data
merged_data_test_2 = merged_data_test.join(inflation_us_daily)
```

```
merged_data_test_3 = merged_data_test_2.reset_index(drop=False)
```

```
model_test_us_infl= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_us_mm + cpi_us_mm_3m', data=merged_data_test_3[(merged_data_test_3['date'] >= "2014-01-01") & (merged_data_test_3['date'] <= "2016-12-31")]).fit(cov_type='HC3')
model_test_us_infl2= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_us_mm + cpi_us_mm_3m', data=merged_data_test_3[(merged_data_test_3['date'] >= "1990-07-31") & (merged_data_test_3['date'] <= "2024-07-31")]).fit(cov_type='HC3')
model_test_us_infl3= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_us_mm + cpi_us_mm_3m', data=merged_data_test_3[(merged_data_test_3['date'] >= "2021-03-01") & (merged_data_test_3['date'] <= "2022-12-31")]).fit(cov_type='HC3')
model_test_us_infl4= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_us_mm + cpi_us_mm_3m', data=merged_data_test_3[(merged_data_test_3['date'] >= "2007-06-01") & (merged_data_test_3['date'] <= "2009-07-31")]).fit(cov_type='HC3')
```

```
model_test_us_infl.summary()
```

```
model_test_us_infl2.summary()
```

```
model_test_us_infl3.summary()
```

```
model_test_us_infl4.summary()
```

```
# Plot the US inflation time series
plt.figure(figsize=(14, 5))
plt.plot(inflation_us.index, inflation_us['cpi_us_mm'],  linestyle='-', color='b')  # Customize the line style, color, etc.
plt.xlabel('Date')
plt.ylabel('US Inflation month to month')
plt.title('Time Series Plot US inflation')
plt.grid(True)
plt.show()
```

```
# EU
inflazione_eu = pd.read_excel("european_inflation.xlsx")
```

```
# introducing a lag
inflazione_eu['PX_LAST_3m'] = inflazione_eu['PX_LAST'].shift(periods=-3)
```

```
inflazione_eu.columns = ['date', 'cpi_eu_mm','cpi_eu_mm_3m']
```

```
merged_data_test_eu = merged_data.copy()
```

```
# Set 'date' column as the index
merged_data_test_eu.drop_duplicates(subset='date', inplace=True)
merged_data_test_eu.set_index('date', inplace=True)
```

```
inflazione_eu.set_index('date', inplace=True)
```

```
# Reindex the monthly inflation data to match the daily data, using forward fill to propagate values
inflazione_eu_daily = inflazione_eu.reindex(merged_data_test_eu.index, method='ffill')
```

```
# Merge the daily data with the forward-filled inflation data
merged_data_test_eu_2 = merged_data_test_eu.join(inflazione_eu_daily)
```

```
merged_data_test_eu_3 = merged_data_test_eu_2.reset_index(drop=False)
```

```
model_test_eu_infl= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_eu_mm + cpi_eu_mm_3m', data=merged_data_test_eu_3[(merged_data_test_eu_3['date'] >= "2014-01-01") & (merged_data_test_eu_3['date'] <= "2016-12-31")]).fit(cov_type='
model_test_eu_infl2= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_eu_mm + cpi_eu_mm_3m', data=merged_data_test_eu_3[(merged_data_test_eu_3['date'] >= "1996-02-29") & (merged_data_test_eu_3['date'] <= "2024-08-31")]).fit(cov_type='
model_test_eu_infl3= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_eu_mm + cpi_eu_mm_3m', data=merged_data_test_eu_3[(merged_data_test_eu_3['date'] >= "2021-06-01") & (merged_data_test_eu_3['date'] <= "2022-10-31")]).fit(cov_type='
model_test_eu_infl4= smf.ols('ex1 ~ w_t0 + w_t2t4t6 + cpi_eu_mm + cpi_eu_mm_3m', data=merged_data_test_eu_3[(merged_data_test_eu_3['date'] >= "2007-06-01") & (merged_data_test_eu_3['date'] <= "2009-07-31")]).fit(cov_type='
```

```
model_test_eu_infl.summary()
```

```
model_test_eu_infl2.summary()
```

```
model_test_eu_infl3.summary()
```

```
model_test_eu_infl4.summary()
```

```
# Plot the European inflation time series
plt.figure(figsize=(14, 5))
plt.plot(inflazione_eu.index, inflazione_eu['cpi_eu_mm'],  linestyle='-', color='b')  # Customize the line style, color, etc.
plt.xlabel('Date')
plt.ylabel('EU Inflation month to month')
plt.title('Time Series Plot EU inflation')
plt.grid(True)
plt.show()
```

Figure 3.2: The time series plot displays the excess returns for U.S. stocks over the FOMC cycle.

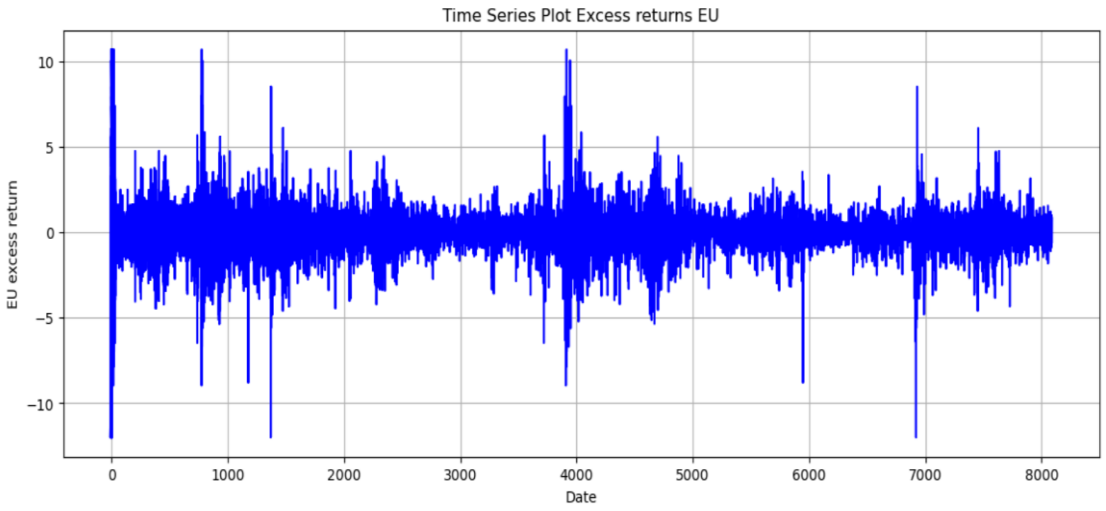

Figure 3.3: The time series plot displays the excess returns for European stocks over the FOMC cycle.

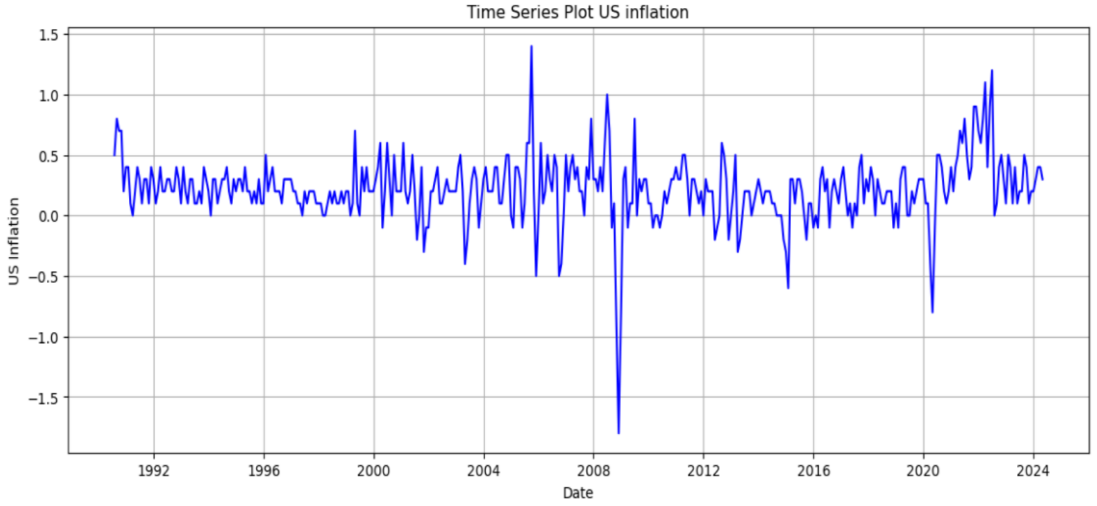

Figure 3.4: The time series shows the US inflation from 1990 to 2024. The plot displays both moments of stability and moments of significant fluctuations. Major spikes, such as those around the 2008 financial crisis and the more recent COVID-19 pandemic, highlight moments of economic stress. The chart clearly reveals inflation patterns, showing the impact of economic events and policy shifts on inflation over the years.

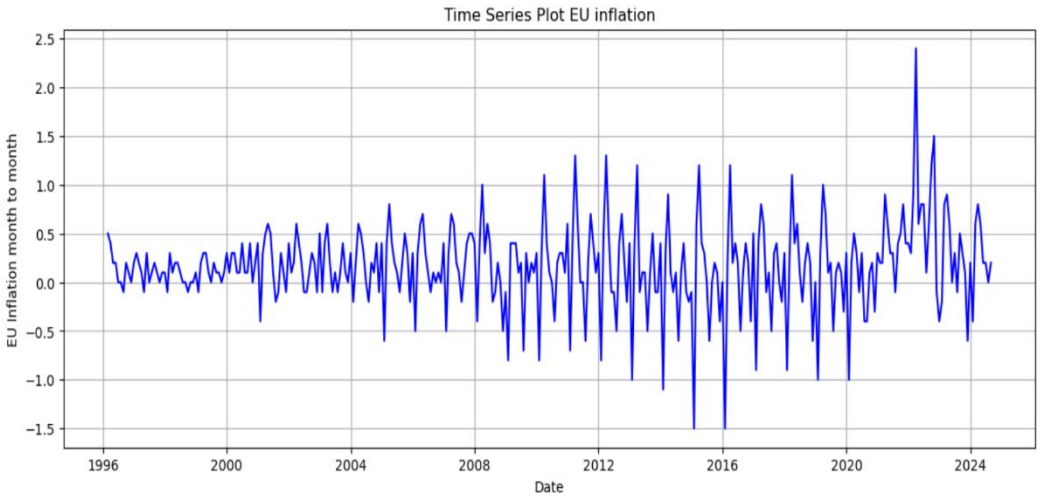

Figure 3.5: The time series shows the European inflation from 1996 to 2024. Graphically, it demonstrates that during the 2008 financial crisis, inflation swings were less pronounced than they were during the COVID-19 epidemic. This highlights how, in Europe, recent inflationary pressures have been more intense than they were during the 2008 crisis.

CONCLUSION

The analysis conducted reveals the central role of monetary policy and central banks in the complex system of the economy and the effects of their activities on financial markets. In fact, central banks not only intervene to maintain price stability and regulate inflation and the management of the economic cycle but have in fact assumed an active role in guiding the financial markets and the investment choices of companies and savers.

In particular, it emerged that central banks behave as active players capable of regulating market developments, promoting or containing their expansionary phases, in order to modulate growth, risk and return with the right balance.

A key element demonstrated in this paper is the ability of central banks, not only to shelter against possible imbalances in the financial system, such as by acting on interest rates in times of high inflation, but also to anticipate the needs of financial markets by shaping the operating environment in which investors move.

This phenomenon is increasingly evident in today's interconnected world, where central bank decisions can no longer be limited to domestic markets but must extend internationally, significantly influencing fund transfers, resource allocation strategies, and global expectations.

The analysis has also highlighted that, in order to fulfill this delicate role, central banks must adopt increasingly sophisticated approaches, considering not only the immediate needs of the markets but also the long term implications of their decisions.

Through their actions, they also influence investor expectations, steer market development, and guide the economic system towards continuous evolution. The effects of their actions are not limited to stabilizing the economic system, but also include guiding it to prevent potential imbalances.

Consider, for example, what is happening these days, as the Fed, in light of the inflation reduction data recorded in the United States, after a period of repeated interest rate hikes, is now adopting a policy of rate cuts through a cautious and gradual approach. This approach must necessarily account for the need to maintain low and

stable inflation while simultaneously stimulating a positive evolution of the economic cycle and financial markets, made possible by the lower cost of borrowing.

In the final part of this work, concrete evidence of the influence of central bank decisions on financial markets has been provided. Specifically, through an empirical investigation using stock return data, both from the U.S. and Europe, it has been demonstrated how the described dynamics have a tangible and measurable impact on stock values.

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