MONETARY POLICY, FINANCIAL RISK MITIGATION AND UNEMPLOYMENT IN THE UNITED STATES
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Abstract
This paper uses time series data to investigate the effect of monetary policy on financial risk mitigation and unemployment. The literature generally reflects imprecise conclusions about the efficacy of the channels through which monetary policy is capable of achieving economic growth and stable prices. We have focused on stock prices, unemployment and monetary policy variables to see if there is a robust interaction among the variables and whether stock prices and monetary policy have significant explanatory power over employment, a very important variable for aggregate consumption. By subjecting our predictive hypothesis to tests and simulating the effects of macroeconomic shocks, we conclude that beyond the channels that directly impinge on the real sector, Tobin’s $q$ is important for understanding how and why monetary policy is relevant to financial risk mitigation and the level of unemployment.

Keywords: Financial risk, Liquidity, Monetary channels, Swap spread, Quantitative Easing

JEL Classification: E12, E51, E52, E62

1. Introduction

In general, the fundamental objectives of monetary policy are to promote economic growth and stable prices. There are various channels through which those objectives can be achieved. These include the interest rate channel, asset price channel (wealth transfer), exchange rate channel, equity price channel (Tobin’s $q$), and credit channel (bank lending and the balance sheets of depository institutions and households). Although it might not be straightforward to see how unconventional monetary policy impacts an aggregate economy, the essence of unconventional monetary policy is not estranged from conventional monetary policy and the channels of monetary policy provide helpful clues about such a correlation.

When risk aversion predominates, conventional or unconventional monetary policy could mitigate risk through one or more of the channels that have been identified by Mishkin (1996). In general, measuring the effects of monetary policy can be elusive when there is overconcentration on any one of the inconsequential channels. This work investigates the relationship between equity prices, an interest rate spread, and unemployment to ascertain whether the variables have any interdependent or empirical explanatory power in the absence of very noisy information. The empirical inquiry is twofold: (i) we examine the descriptive data of risk assessments to see whether monetary policy minimizes risk and (ii) we examine the response of stock (equity)
prices (optimism, pessimism, or animal spirits) to an output (unemployment) shock (innovation) and interest rate shock.

Conventional monetary policy fails when it is incapable of reducing the zero-bound short-term interest rate to obtain desirable economic outcomes of growth and stable prices. In effect, short-term monetary policy becomes inconsequential and alternative monetary policy must be explored, under the presumption that fiscal policy is passive. Without additional channels of consequence, the aim of unconventional monetary policy (UMP) could be implicitly seen as an effort to exploit alternative monetary channels when the credit and asset price channels are clogged and ineffective.¹

A recent and growing body of literature can be found in the area of unconventional monetary policy, a practice by central banks to increase the long-term liabilities of their balance sheets when conventional monetary policy fails to stimulate growth and is nonresponsive to short-term monetary stimulus. There is hardly any consensus on the nomenclature for such a policy (Klyuev et al., 2009). The Bank of Japan (BOJ) undertook a variety of unconventional policies between 2001 and 2006 under the heading of quantitative easing (QE). Klyuev et al. observe that a key feature of that approach was targeting the amount of excess reserves of commercial banks, primarily by buying government securities, which most commentators equate to QE.

Since the US Federal Reserve sought to improve the functioning of long-term bond markets and reduce long-term interest rates rather than simply increase the monetary base, Bernanke (2009) contrasted the US experience with the Fed’s approach to “credit easing” (CE) to that of the BOJ. Credit easing is defined to encompass all Fed operations to extend credit or purchase securities. CE is used to describe the focus on individual markets, and hence the composition of the Fed’s balance sheet, with its size being largely incidental, as opposed to the emphasis on the size under QE.

No generally acceptable definitions have been provided for the two terms and we will continue to refer to them as unconventional monetary policy (UMP). In normal and abnormal times, the wealth channel has been an unreliable metric for evaluating monetary policy, especially because of demographic and other reasons that have been discussed elsewhere (see Lettau and Ludvison (2004), Case et al. (2005) and Warburton (2012)).

Consequently, empirical studies that are highly dependent on the wealth channel for evaluating monetary policy are not likely to produce very robust and convincing results. A fundamental problem is that stock market wealth—which is usually in the hands of a few and the aged—is not necessarily robust enough to generate adequate and desirable national spending. Wealth may be used as saving against unforeseen contingencies and the categories and purposes for acquiring wealth are variegated. As a result, the conditions for full employment and consumption must be significant indicators of the propensity to recover from a deep recession or depression.

¹ The US Federal Reserve made three notable purchases that are considered to be unconventional: (i) the purchase of US$600 billion in the mortgage-backed securities (QE1, 2008–10), (ii) the purchase of US$600 billion in the treasury securities (QE2, 2010–2011), and (iii) the purchase of US$40 billion of mortgage-backed securities (MBS) per month since September 2012 until October 2014 (QE3); see also Fawley and Neely (2013).
Unconventional monetary policy must implicitly suggest that when the credit and wealth channels become clogged, investment spending should be increased as a response to any kind of monetary stimulus that is intended to increase employment, consumption and national income (economic growth). In effect, for UMP to be successful it must have some stabilizing influence in the form of risk mitigation that is intended to increase the level of national employment and perceptions of future consumption. Accordingly, Tobin’s marginal $q$ can be instructive; meaning that the propensity to invest must be contingent on the expected returns to capital or investment (the perceived trajectory of equity prices) and the replacement cost of capital, which includes the cost of borrowing money.

As a result, the correlation between the performance of financial markets (in terms of optimism, pessimism, or animal spirits) and the real economy is an enticing area of inquiry. Relatively recent adjustments to available liquidity channels have made the understanding of such a correlation even more pertinent. Capital markets have played an increasing and critical role in the supply of credit, a role that was traditionally thought to be under the control of depository institutions, or so it seemed. The changing structure of access to leverage has forged an intricate relationship between financial markets and intermediaries, and the exuberance that can be reflected in equity prices.

It is reasonable to contemplate the manner in which anticipated stock (equity) prices should have some relationship to newly issued stocks—implying that higher stock prices can naturally induce firms to issue larger amounts of new stock. Businesses will not issue new stock unless they have incorporated risk into their investment decisions and confidently reached the conclusion that the prospects of investment, and therefore employment and consumption, are very promising. We argue that assessments of monetary policy that miss such a correlation run the risk of misdiagnosing the effects of conventional and unconventional monetary policies on the real sector and the aggregate economy. Of course, monetary policy uncertainty (risk) has been discovered to be significantly related to the three-month and two-year treasury yields’ sensitivities to news (Swanson and Williams, 2014).

The issue of risk is confounding for a variety of reasons. It presupposes probabilistic outcomes and uncertainties. Therefore, preannounced monetary policies assuage risks but may not be good indicators of risk tolerance or aversion; except of course, if there is a presupposition that there exists a time inconsistency problem based on the perception of the willingness of monetary authorities to renege on prior commitments (signaling). This uncertainty is not trivial or irrational. Purchasing longer-term government securities is aimed at reducing long-term private borrowing rates when short-term policy rates are near their lower bound and the (explicit or implicit) commitment to keep policy rates low does not effectively translate into lower long-term interest rates (Klyuev et al., 2009). Similarly, the sensitivity of medium- and long-term Treasury yields to news is closely related to the length of time that the federal funds rate is expected to be at the zero lower bound (Swanson and Williams, 2014).

Alternatively, businesses must measure investment risk beyond the time inconsistency metric to determine whether investment spending is desirable or not; for example, by gauging consumer optimism and expected returns. Since investment
decisions cannot be delinked from monetary policy, employment, and consumption possibilities, the effects of UMP on macroeconomic performance cannot be considered to be an exogenous development. A meaningful discussion of UMP must therefore incorporate the ex post performance of financial markets, the degree of proactive or reactive fiscal policy, and, to a very significant extent, the essence of monetary policy and the perception of risk. Empirical studies that strenuously strive to evaluate the elusive effects of unconventional monetary policy without providing an assessment of investment risk mitigation run the risk of missing the essence of monetary policy and its relevance to the equity-price channel.

The remaining portion of this paper is structured to provide (i) an overview of the literature on monetary policy and financial stability, (ii) the methodology for empirical analysis, (iii) the empirical findings, and (iv) a comprehensive conclusion.

2. An Overview of the Literature on Monetary Policy and Financial Stability
The literature on monetary policy and financial stability is extensive and cannot be exhaustively presented and discussed in this work. For practical and empirical reasons, we have provided a comprehensive structure for understanding this empirical work. We have classified the literature into two broad categories and included some relevant, influential, and representative pieces of the conversation in the literature. The two categories of interest are (i) conventional monetary policy and the monetary and financial channels that are associated with such a policy and (ii) unconventional monetary policy and some of the studies that have expressed support and discontent over such a policy. Invariably, the methodologies are generally different and there are subcategories of arguments appertaining to the use and effectiveness of unconventional monetary policy.

One of the most influential papers dealing with the channels through which monetary policy can foster economic growth and stable prices was prepared by Mishkin (1996). The paper summarizes some of the traditional channels that include the Keynesian ISLM theory of the monetary transmission mechanism. Notably, interest rates, other asset prices, exchange rates, credit channels, and equity prices are of particular importance. The equity price channels can be singled out for their effects on investment (Tobin’s $q$) and consumption via the creation of wealth.

Although the relationship between the real and financial sectors has been of interest since the 1930s, not much attention was given to such an interdependent relationship. The features of bank balance sheets and the adverse asset price spirals that they can create were noted by Fisher as early as the 1930s. Fisher (1933) described the strong links between distressed asset (fire) sales and banks’ health. Contagious fire sales, exacerbated by disturbing margin calls, cause a downward spiral of asset prices, thereby depleting the value of balance sheets.

Invariably, the transmission channels that exist between the financial and real sectors of an economy are critically important when assessing financial stability. The Basel Committee on Banking Supervision (BCBS (2011)) highlighted this point in its Working Paper No. 18. The Committee identifies robust financial systems as those that do not adversely induce the propagation and amplification of disturbances that affect financial systems. Robust systems are capable of withstanding shocks and limiting disruptions in the allocation of saving to profitable investment opportunities.
The BCBS working group identified three transmission channels that exist between the financial and the real sector: (i) the borrower balance sheet channel, (ii) the bank balance sheet channel, and (iii) the liquidity channel. The first two channels are often referred to as the financial accelerator channel and the third channel emphasizes the liquidity position of banks’ balance sheets. The borrower balance sheet channel applies to both firms and households and stems from the inability of lenders to (i) assess fully borrowers’ risks and solvency, (ii) monitor fully their investments, and/or (iii) enforce fully their repayment of debt; in effect, information asymmetry.2

Shocks that affect borrowers’ net worth are projected to affect their cost of financing, which will then affect the volume of expenditures that borrowers ultimately desire to undertake which ultimately impacts aggregate demand. Fluctuations in asset prices—a financial shock—affect borrowers’ net worth, thereby causing the external financial premium to transmit financial shocks to the real economy. Financial shocks leading to a fall in the value of borrowers’ assets that are used as collateral will tighten the collateral constraint, which in turn lowers production and spending and depresses asset prices further. If borrowers’ net worth is affected by shocks to aggregate demand and the real economy, the BCBS working group finds that the presence of the external finance premium serves to propagate shocks to the real economy and amplify business-cycle fluctuations; hence, the channel is called the “financial accelerator.” The first class of balance sheet models is associated with the works of Bernanke and Gertler (1989) and Carlstrom and Fuerst (1997). The second category (financial accelerator) has been attributed to the work of Kiyotaki and Moore (1997).

In the second model, it is argued that assets play a dual role in the economy. Assets are used to produce goods and services and they also provide collateral for loans. Collateralized loans, which require debt-contract implementation, create interactions between credit limits and asset prices through within-period (static) and dynamic (inter-temporal) multipliers.

The bank balance sheet channel has been divided into two separate components (BCBS): the traditional bank lending channel and the bank capital channel. Both channels include consideration of the adverse shocks to financial institutions’ balance sheets that may arise from changes in monetary and regulatory policy or bank capital losses. The shocks can entail sharp contractions in credit that result in magnified macroeconomic effects. One condition that has been identified for such amplified effects to occur is for some borrowers to be highly dependent on banks for credit.

Dependence on bank credit implies that if the supply of bank loans is severely disrupted, these borrowers—while not completely cut-off from credit—face sizable difficulties and costs in finding and forming relationships with new lenders, resulting in the reduction of expenditures. In assessing the traditional lending framework, Bernanke and Blinder (1988) note that on the liability side, a monetary policy

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2 The operation of the balance sheet channel is contingent on two mechanisms: (i) external finance premium (costs of raising external and internal funds) and (ii) collateral requirements because of the inability of lenders to collect debt payments without such a precondition for making funds available. The external finance premium is attributed to the fact that borrowers have an incentive to take on greater amounts of risk than are in lenders’ interest, and lenders have limited means to restrict the amounts of risk that borrowers take on (BCBS).
tightening decreases money supply and money demand, which is the standard effect of monetary policy. On the asset side, however, contractionary policy entails a change in the asset composition, leading to a stronger decline in credit supply, which is the lending channel.

Structural changes and financial innovation have created a renewed interest in the assessment of financial vulnerabilities and the gate-keeping role of central banks. For example, Nwogugu (2007) has considered the interactions between capital reserve requirements and securitization and reached the conclusion that the new wave of securitization undermines the reserve requirements that are imposed by central banks to limit the expansion of credit by depository institutions. A fundamental assumption is that banks do not hold sufficient capital and that they are entirely funded by external liabilities under a neutral regulatory framework. However, some models have incorporated bank capital to investigate the bank capital channel (Stein (1998)).

Financial institutions, like households, can be equally subjected to tests for stress (vulnerabilities) and their ability to be creditworthy. “Since the external finance premium paid by banks is in turn reflected in the cost and availability of funds to bank-dependent borrowers a reduction in bank capital increases the cost of funds faced by banks and the cost of funds faced by borrowers and thereby constrains economic activity.” (BCBS, p. 9). The literature shows that any financial or real shock that adversely affects a bank’s capital will reduce the ability of the bank to extend credit, which in turn will restrain the volume of expenditures that can be associated with the banks’ borrowers. In effect, shocks to aggregate demand, as well as conditions in real estate [financial] markets, could impinge on loan losses and, if those losses are not augmented by profits, affect bank capital. Yet, the question has been raised whether macroeconomic conditions could significantly and generally influence the status of firms’ balance sheets (Jacobson et al. (2005)). Contending arguments suggest that banks vary in their scale and exposures to particular industries and regions. As a result, idiosyncratic performance and exposures to risk make it a challenging proposition to link macroeconomic performance and the health of balance sheets.

In their contribution to the post-crisis literature, Brunnermeier and Pedersen (2009) have made a distinction between two types of liquidity problems, broadly defined as funding and market liquidities; where funding liquidity refers to the liability side of a bank’s balance sheet (defined in terms of the promptness of an institution to get funding) and market liquidity refers to the asset side of a bank’s balance sheet (the liquidity of its assets). The adverse existence of both funding and market liquidities can result in the anticipation of funding liquidity shortages in which liquidity-surfeit banks could refrain from lending (Diamond and Rajan (2009)). The body of literature on unconventional monetary policy (UMP) has increased considerably.

The literature shows that the argument that central banks are incapable of influencing targeted policies with zero-bound interest rates is tenuous. Mishkin (1996) argued that the argument that central banks are incapable of influencing monetary policy at a zero-bound interest rate is “demonstrably false,” because central banks can influence prices and output even when short-term rates are near their zero floor by increasing liquidity, particularly by purchasing long-term assets. Following Mishkin, Fawley and Neely (2013) observe that occurrences have twice tested Mishkin’s claim:
first in the early 2000s in Japan and then after the 2007–09 financial crisis in the United States, United Kingdom, Japan, and the euro area.

Traditionally, central banks conduct monetary policy by targeting short-term nominal interest rates that can potentially affect the economy through a variety of channels.3

“With short rates approaching the zero lower bound in late 2008/early 2009, the Federal Reserve, the Bank of Japan (BOJ), the Bank of England (BOE), and the European Central Bank (ECB) began to pursue less conventional monetary policies—including forms of quantitative easing (QE)—to stimulate economic growth. QE policies are those that unusually increase the monetary base, including asset purchases and lending programs. Programs designed to improve credit conditions—that is, credit easing—are a special case of QE if they also increase the monetary base” (Fawley and Neely, p. 52).

But Taylor notes that just because monetary policy rules can be written down as a mechanical-looking mathematical equation does not imply that central banks should follow them mechanically. Most proposals for monetary policy rules suggest that the rules be used as guidelines or as general policy frameworks (Taylor, 2000, p. 443).

Fawley and Neely have shown that monetary policy can affect long-term rates in three ways: (i) expected inflation can increase, (ii) the expected policy rate path can fall, and (iii) the term premium can fall. Their central argument is that since inflation expectations do not immediately react one for one to changes in nominal interest rates, central banks can also control real interest rates, at least over the short to medium term. If monetary policy can change real (inflation-adjusted) short-term rates, then monetary policy will change asset prices in such a way as to change the willingness of banks to lend, firms to invest, or individuals to consume or invest in housing. In effect, a change in short-term real interest rates potentially influences the level of output and employment. This argument critically relates monetary policy to asset prices and employment. Assuming that people can always hold currency instead of depositing it in a bank, short-term nominal interest rates cannot go (much) below zero. The effectiveness of conventional monetary policy becomes limited.

The literature provides no precise mechanism for converting wealth from the financial markets into real consumption. Case et al. (2005) find that it is hardly safe to extrapolate the wealth effect for the stock market to the real estate market. They identify multiple reasons why consumption may be differently affected by the form in which wealth is held; for example, households may have a bequest motive, households may view wealth as temporary or uncertain, wealth may be held as an end in itself, and wealth can be immeasurable (see also Sinai and Souleles (2003)).

The literature on UMP also shows studies that are event-based (event studies) (see Bernanke, Reinhart, and Sack (2004), D’Amico and King (2011), Gagnon et al.

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3 The Taylor Rule, which has morphed into several variations, is traditionally used as a benchmark against which a policy rule is evaluated. The rule essentially tracks the deviation of unemployment and output from their “natural rate” in order to set targeted nominal rates \(i\) that are responsive to changes in inflation \((\pi)\) and unemployment. The traditional form is presented here: \(i = \pi + 2.0 + 0.5(\pi - 2.0) - 0.5(GDP \text{ gap})\).
Gagnon et al.’s (2011a,b) announcement study finds that large-scale asset purchase (LSAP) announcements reduced US long-term yields. Joyce et al. (2011) find that the BOE’s QE program had bond-yield effects that were quantitatively similar to those reported by Gagnon et al. (2011a,b) for the US program. Neely (2012) evaluates the effect of the Fed’s 2008–09 QE on international long-bond yields and exchange rates to show that the effects are consistent with a simple portfolio balance model and long-run purchasing power parity.

The event studies have some desirable and undesirable properties. One advantage of an event study, according to Jarrow and Li (2012), is that it does not require the specification of a particular equilibrium or arbitrage-free model. Hence, the results are robust to model misspecification. However, the key disadvantage of an event study is that it measures only the impact of an asset purchase over the event window considered. Additionally, the validity of event studies is contingent on imperfect information (no premature leakage of announcement or information) and the instantaneous effect of any price impact (no leading effect). They contend that the reliability of these assumptions in US Treasury markets is uncertain.

Are the monetary policy channels clear? Krishnamurthy and Vissing–Jorgensen (2011) provide mixed results. They find evidence for a signaling channel, a unique demand for long-term safe assets, and an inflation channel for both QE1 and QE2. They find evidence for a mortgage-backed securities (MBS) prepayment channel and a corporate bond default risk channel only for QE1. They note that the effects on particular assets depend critically on which assets are purchased. The event study suggests that MBS purchases in QE1 were crucial for lowering MBS yields as well as corporate credit risk and thus corporate yields for QE1. Treasury only purchases in QE2 had a disproportionate effect on Treasuries and agency bonds relative to MBSs and corporate bonds, with yields on the latter falling primarily through the market’s anticipation of lower future federal funds rates. Gagnon and others (2010) present an event study of QE1 that documents large reductions in interest rates on dates associated with positive QE announcements. Swanson (2011) presents confirming event-study evidence from the 1961 Operation Twist, where the Federal Reserve purchased a substantial quantity of long-term Treasuries.

Yet, by purchasing short-term securities, expanding the monetary base, and lowering short-term real interest rates, central banks can affect a variety of asset prices, including exchange rates and stock prices. Changes in asset prices can affect economic decisions because higher stock prices can directly stimulate consumption and business investment by increasing consumer wealth and making the issuance of new stock more lucrative, and lower interest rates encourage borrowing for consumption and investment (Fawley and Neely).

There is widespread awareness of the sources of vulnerabilities in the financial and real sectors and responses that are made to financial and macroeconomic shocks. We find the assessment of UMP and its stabilizing or destabilizing effects to be particularly probative. We consider a range of data during periods of instability and relative calm in order to investigate the response of unemployment and investment (asset prices) to a monetary policy shock and vice versa. Our contribution to the literature is to report our findings on the interaction of key variables in the real and financial sectors after a distress in the financial sector and the use of monetary policy to mitigate risk and open
the investment channel for economic growth. Implicitly, we reevaluate the fundamental argument of Tobin.

This study confronts some apparent but surmountable challenges; namely, the measurement of the market value of firms and the replacement cost of capital. We deal with these issues by relying on stock (equity) prices of large capitalized firms and the cost of borrowing money in anticipation of return or risk. More explicitly, as stock prices rise, we expect the market value of firms to increase. Analogously, as borrowing cost and risk increases, we expect replacement cost to increase. The next section discusses the methodology of the paper.

3. Methodology: Variables and Models
We examine the interaction of three variables—stock prices, unemployment, and the three-year Treasury-swap rate spreads (swap spread)—in the United States, based on data that have been obtained from the Federal Reserve Bank of St. Louis. We adopt the view that monthly data are more useful for the analysis of volatility (risk) rather than low frequency processed data that lose valuable information about volatility. As a result, for econometric and theoretical reasons, this work shows a preference for high frequency data to evaluate the interaction of monetary policy and the financial sector.

The monthly data, which span November 2004 to October 2014, have been configured to control for two years (2008–2009) of noisy and unstable data. We use the noisy component as an out-of-sample benchmark against which macroeconomic performance can be evaluated after simulating financial and macroeconomic shocks. That is, responses of macroeconomic variables to shocks are compared against the actual data in order to evaluate our hypotheses and models.

The S&P 500 Index is used as a broader measure of financial market performance. The variable is important not only because of its sample size and the capitalization of firms that are included in the sample but also because it tracks optimism or pessimism in the financial sector ex post. Economic theory suggests that there is a relationship between monetary policy and asset prices. Additionally, perceptions about asset prices influence investment decisions and employment. We find the link between the financial and real sectors in terms of asset prices to be probative. The S&P 500 Index is regarded as a gauge of the large capitalized ($5 billion or more in outstanding market value) US equities market. The index includes 500 leading companies in leading industries of the US economy, which are publicly held on either the NYSE or NASDAQ, and covers 75 percent of US equities. The relationship among asset prices, perception of risk, monetary policy, and unemployment are important for assessing the competing channels of monetary and financial policies. Ideally, though we would have preferred data on national output, the data on national output is not of high frequency. As an alternative, we use the relatively high frequency unemployment data as a sound theoretical proxy (instrument).

It is noteworthy that with a correlation coefficient of -0.177, the quarterly data from 2000 to 2014 (third quarter) for unemployment and output are not positively correlated. Therefore, the data show no evidence of jobless recovery. As a result, the unemployment rate is used as a proxy (instrument) of national income. The decision to proxy national income is consistent with macroeconomic theory and has been made without any loss of generality. The unemployment data capture economic performance
and the sensitivity of monetary policy (rule and discretion) to the dual mandate (economic growth and stable prices). The Federal Reserve prevented a total meltdown that was associated with collateral impacts on the US and the global economy. The US economy fell by 5 percent while eight and a half million people lost their jobs, an increase in unemployment to 10 percent (Bernanke, 2013, p. 87). Data for the civilian work force are operationalized in terms of seasonally adjusted monthly percentages.

The three-year swap spread is used as a barometer of monetary policy and financial risk. The swap incorporates the risk-sensitive rate of borrowing, while the Treasury rate, with a low probability of default, is a risk-free rate. The swap rate is a fixed rate that settles against the future three-month London Interbank Offered Rate (LIBOR). LIBOR is a floating (flexible) rate based on the borrowing rates quoted by contributor banks identified by the British Bankers Association.\(^4\) The borrowing rates of these banks reflect default and liquidity risks above the relatively riskless (Treasury) rates. Positive spreads provide opportunity for arbitrage and higher financial risks.

After the financial crisis, some longer-maturity swap rates became lower than Treasury rates (negative spreads). Let us say that long positions in Treasuries financed by overnight repo agreements in return for floating LIBOR is indicative of the fact that the spread trade is a reasonable metric for compensation that is required for refinancing risk or replacement capital.\(^5\) Figures 1(a) and (b) show that the swap spreads and Treasury maturity move towards convergence before and after the financial crisis, a reasonable indicator that monetary policy is capable of mitigating (refinancing) risk in the financial markets. Convergence trades typically move prices toward fundamental levels and stabilize markets (Kambhu, 2006).

The swap market is sensitive to monetary policy and it is a forum that links the financial and real sectors.

“The interest rate swap market is one of the most important fixed income markets for the trading and hedging of interest rate risk. It is used by nonfinancial firms in the management of the interest rate risk of their corporate debt.... The liquidity of the swap market also underpins the residential mortgage market in the United States, providing real benefits to the household sector. If the swap market was less liquid, lenders in the mortgage market would find it more difficult and expensive to manage the interest rate risk in fixed-rate mortgages; consequently, they would demand higher mortgage interest rates as compensation.” (Khambu, p. 2).

\(^4\) LIBOR is the average of the middle eight of the quoted short-term borrowing rates of sixteen contributor banks identified by the British Bankers Association: Bank of America, Bank of Tokyo-Mitsubishi UFJ, Barclays, Citibank, Credit Suisse, Deutsch Bank, HBOS, HSBC, JPM Chase, Lloyds, Rabobank, Royal Bank of Canada, Norinchukin, Royal Bank of Scotland, UBS AG, and WestLB.

\(^5\) One aspect of a convergence trade on the swap spread is a position in Treasury securities that would normally involve a transaction in the repo market. For instance, Kambhu observes that when the spread is above its fundamental level, convergence traders will establish a position that would gain from a falling spread. Unwinding the position prematurely, however, will cause the spread to rise further above its fundamental level rather than converge to it. Such a trading shock, he maintains, will destabilize the swap spread in the sense that the spread will diverge from its fundamental level instead of converge to it; see Kambhu for further discussion.
We argue that low interest rates and converging swap spreads (see Figures 1(a) and (b)) have extended effects on financial risk, asset prices, and the level of unemployment. This argument is akin to Tobin’s marginal $q$. Kobor et al. (2005) find that US dollar swap spreads and the supply of US Treasury bonds are cointegrated, suggesting that the Treasury supply is a key determinant [of swap arrangements] on a long-term horizon. In our view, we consider the three-year swap spread to be a sufficient intertemporal time dimension for investment risk decisions. It is not too long or too short for forecasting investment decisions.

Kobor et al. observe that swaps constitute the most common instrument in asset-liability management and portfolio and debt management. They are essential for hedging, investing, and borrowing, and are customarily used by banks, industrial firms, institutional investors, and sovereign debt managers. The Euro and US dollar swap curves represent a primary source of information in developed markets and swaps are also noted to be a nonredundant financial instrument. Further, as unique derivatives, they broaden the choices available to economic agents when borrowing money while preserving and transferring value over time and accepting or avoiding risk (see also Haubrich (2004)). Invariably, the interest rate is one of the most important macroeconomic variables that is directly related to economic growth.
The variances for all spread categories, with the exception of the initial three-month LIBOR (or do you mean 1Y swap spread?) (see Table 1), suggest that excessive risk was taken out of the financial market with the practical effect of shoring up asset prices; that is, monetary policy was used to increase the level of optimism in financial markets and by the end of 2008, the risk that was associated with the three-month LIBOR had virtually dissipated (see the standard deviations in Table 1).

Table 1: Variations and Spreads Among the Monetary Instruments*

<table>
<thead>
<tr>
<th>July 2000–07</th>
<th>1 Year Swap-1 Treasury</th>
<th>2 Year Swap-2 Treasury</th>
<th>3 Year Swap-3 Treasury</th>
<th>LIBOR (3 month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spread (monthly avg.)</td>
<td>0.33</td>
<td>0.41</td>
<td>0.50</td>
<td>4.73</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>0.17</td>
<td>0.13</td>
<td>0.14</td>
<td>0.73</td>
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<tr>
<td>Spread (monthly avg.)</td>
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<td>Std. Deviation</td>
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<th>Jan, 2009–Oct 2014</th>
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<tr>
<td>Spread (monthly avg.)</td>
</tr>
<tr>
<td>Std. Deviation</td>
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</tbody>
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* All spreads are in monthly averages from July 2000–07 and from August 2007–October 2014. Variations are operationalized in terms of standard deviation (SD) for the aforementioned periods. Data Source: The Federal Reserve Bank of St. Louis. The authors assume responsibility for all computations.

As an empirical matter, this paper investigates the responses of the selected variables to shocks when the data are ascertained to be stationary. As a result, the impulse response and variance decomposition graphs (see Figures 2 and 3) are derived from stationary data. To attain brevity or parsimony, the Argand diagram is not reported here but Table 2 indicates that the modulus of the data lie within the unit circle (Eviews reports the inverse roots).

Table 2: Stability Diagnosis for Impulse Response Analysis*

<table>
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<tr>
<th>Roots</th>
<th>Modulus</th>
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<tbody>
<tr>
<td>0.997792</td>
<td>0.997792</td>
</tr>
<tr>
<td>0.925366</td>
<td>0.925366</td>
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<tr>
<td>0.851078</td>
<td>0.851078</td>
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<tr>
<td>0.351351 - 0.496408i</td>
<td>0.608168</td>
</tr>
<tr>
<td>0.351351 + 0.496408i</td>
<td>0.608168</td>
</tr>
<tr>
<td>-0.266167 - 0.504413i</td>
<td>0.570331</td>
</tr>
<tr>
<td>-0.266167 + 0.504413i</td>
<td>0.570331</td>
</tr>
<tr>
<td>0.302158</td>
<td>0.302158</td>
</tr>
<tr>
<td>-0.204714</td>
<td>0.204714</td>
</tr>
</tbody>
</table>

*The VAR satisfies a stability condition

The impulse function provides empirical information about the endogenous variables when they become individually susceptible to disturbances, and the responses are tracked over a twelve-month period. The impulse response function takes a stationary moving average representation:
The matrix, $\psi_j$, has the usual interpretation that is given to dynamic or impact multipliers:

$$\psi_j = \frac{\partial y_{t+p}}{\partial \epsilon_i} ,$$

(2)

A one-period perturbation in the innovation $\epsilon$ generates an effect (response) on the $j$th endogenous variables in the $\psi$ matrix (see Hamilton, 1994, pp. 318). We note that theoretical arguments against causal ordering (Cholesky factorization) or the identification problem is considered very well. Apart from the theoretical sensitivity to the causal ordering (the Cholesky proposition), the responses indicate no significant differences. However, we show a preference for the generalized system proposed by Pesaran and Shin (1998):

$$\sum_j = n \sigma_j^2 B^n \sum_j \delta_j ;$$

(3)

where $\sigma_j^2$ is the variance of the $j$th innovation, sigma is a symmetric matrix of standard errors, $\delta_j$ is for the $j$th innovation and $B^n$ is a row vector of variables.

The shocks (innovations) are generally indicative of theoretical and unexpected perturbation or deviations of events from practical policy rules or expected outcomes. Ideally, it would have been interesting to visualize the propagation of responses after the 2007/8 perturbation. Unfortunately, available data for our reference period are too noisy and not conducive to successful stability tests for impulse response analysis. As a result, for strong empirical and theoretical reasons, this study is a simulation of the responses of the selected endogenous variables to shocks, based on available and less noisy data. We are particularly interested in the propagation of probable responses to shocks without the known noisy preconditions of 2008 and 2009 if and when the variables are subjected to contemporaneous perturbation. The probable responses are evaluated over a twelve-month period. Since unemployment and swap spreads are denominated in percentages, we have estimated the regressions in log-linear and linear-log combinations.

The Granger Causality test is used to examine the interdependence of the endogenous variables on their current and past values. The general assumption is that the current values of the variables can be explained in terms of their past values and the past values of other endogenous variables. In the absence of the ability to obtain direct causal evidence, the Granger test evaluates the explanatory power of the variables of interest. We are particularly interested in stock prices (an indicator of investor optimism), three-year treasury-swap spread (an indicator of risk tolerance and mitigation), and the level of civilian unemployment (an instrument for the level of economic performance and consumption). The Granger test can therefore be represented as:

$$Y_t = \sum_{i=1}^n \alpha_i X_{t-i} + \sum_{j=1}^n \beta_j Y_{t-j} + u_{1t} , \quad \text{for all } i \text{ and } j = 3;$$

(4)
where $Y_t$ is a vector of contemporaneous endogenous variables, $X$ is a matrix of lagged exogenous variables, $Y_{t,j}$ is a matrix of lagged endogenous variables, alpha and beta are Chi Square parameters to be estimated, and $u$ is a vector of uncorrelated white noises.

The quarterly lag structure has been selected for good econometric reasons. It reduces the amount of parameters to be estimated and it provides a theoretical foundation for evaluating the variables on a quarterly basis without violating the Schwarz or Akaike information criteria (AIC).

4. Empirical Findings

The findings of the models actually mimic the known trajectory of variable responses after the 2007/8 crisis, at least for up to a year. Recall the arguments in favor of the correlation of the performance of financial markets with the real economy.

Tobin’s $q$ suggests causality from stock prices to newly issued stocks, meaning that higher stock prices will induce firms to issue larger amounts of new stock. Purchasing longer-term government securities is aimed at reducing long-term private borrowing rates. This mechanism may be employed when short-term policy rates are near their lower bound and (explicit or implicit) commitment to keep policy rates low does not effectively translate into lower long-term interest rates (IMF, p. 8).

The response of stock prices to a liquidity shock (in Figure 2) is revealing. On the impact of a shock, stock prices gradually fall for about two quarters, stabilize at a lower level, and actually recover after a year and two quarters. It is noteworthy that the responses have been empirically tracked for four quarters but that the actual data are indicative of such a trajectory (see Table 1).

The response of unemployment to a monetary policy shock indicates that monetary policy has a stabilizing effect. Unemployment gradually increases, but stabilizes at a higher level after two quarters. The unemployment rate reflects such a pattern in 2008 (see Table 3). In response to the stock price disturbance (financial market shock), expansionary monetary policy eliminates the positive Treasury-swap spread (see the bottom left panel of Figure 2, in the Annex. There are strong theoretical reasons to believe that the top right panel of Figure 2 is related to the bottom left panel of the same Figure. Expansionary monetary policy is necessary to prevent the free fall of asset prices (fire sales and depression). In response to the unemployment (output) shock, monetary policy can prevent large positive swap spreads that promote destabilizing arbitrage (see the bottom right panel of Figure 1 (also recall the swap spreads of Table 1).

When AR, MA, or ARMA models are fitted to a given time series, it is prudent to check if the models provide an adequate characterization of the data. The Akaike and Schwarz criteria are prevalently used. For further reading, see Maddala and Kim, p. 19. For ease of reference and without any loss of generality, the quarterly proposition has been evaluated by the AIC criteria. The AIC is constructed as $AIC(p) = n \log \hat{\sigma}^2 + 2p$; where $n$ is for the sample size (modified to include 92 observations), $p$ is for the number of parameters to be estimated, and the estimated variance is the residual sum of squares (RSS) divided by $(n-p)$. The AIC is estimated to be -3.66 (for the stock price regression), -2.31 (for the interest rate regression), and 1.34 (for the unemployment regression); see Table 3. The low estimates are generally desirable.
Table 3: S&P Index, Swap Spread, and US Civilian Unemployment Rate (2008–2009)

<table>
<thead>
<tr>
<th>Date</th>
<th>Stock Price</th>
<th>Swap Spread (%)</th>
<th>Unemployment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-01-01</td>
<td>1378.76</td>
<td>0.8</td>
<td>5</td>
</tr>
<tr>
<td>2008-02-01</td>
<td>1354.87</td>
<td>0.87</td>
<td>4.9</td>
</tr>
<tr>
<td>2008-03-01</td>
<td>1316.94</td>
<td>1.02</td>
<td>5.1</td>
</tr>
<tr>
<td>2008-04-01</td>
<td>1370.47</td>
<td>0.95</td>
<td>5</td>
</tr>
<tr>
<td>2008-05-01</td>
<td>1403.22</td>
<td>0.84</td>
<td>5.4</td>
</tr>
<tr>
<td>2008-06-01</td>
<td>1341.25</td>
<td>0.92</td>
<td>5.6</td>
</tr>
<tr>
<td>2008-07-01</td>
<td>1257.33</td>
<td>0.99</td>
<td>5.8</td>
</tr>
<tr>
<td>2008-08-01</td>
<td>1281.47</td>
<td>1.04</td>
<td>6.1</td>
</tr>
<tr>
<td>2008-09-01</td>
<td>1217.01</td>
<td>1.2</td>
<td>6.1</td>
</tr>
<tr>
<td>2008-10-01</td>
<td>968.80</td>
<td>1.42</td>
<td>6.5</td>
</tr>
<tr>
<td>2008-11-01</td>
<td>883.04</td>
<td>1.18</td>
<td>6.8</td>
</tr>
<tr>
<td>2008-12-01</td>
<td>877.56</td>
<td>0.93</td>
<td>7.3</td>
</tr>
<tr>
<td>2009-01-01</td>
<td>865.58</td>
<td>0.62</td>
<td>7.8</td>
</tr>
<tr>
<td>2009-02-01</td>
<td>805.23</td>
<td>0.61</td>
<td>8.3</td>
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<tr>
<td>2009-03-01</td>
<td>757.13</td>
<td>0.62</td>
<td>8.7</td>
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<td>2009-04-01</td>
<td>848.15</td>
<td>0.54</td>
<td>9</td>
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<tr>
<td>2009-05-01</td>
<td>902.41</td>
<td>0.46</td>
<td>9.4</td>
</tr>
<tr>
<td>2009-06-01</td>
<td>926.12</td>
<td>0.5</td>
<td>9.5</td>
</tr>
<tr>
<td>2009-07-01</td>
<td>935.82</td>
<td>0.48</td>
<td>9.5</td>
</tr>
<tr>
<td>2009-08-01</td>
<td>1009.72</td>
<td>0.5</td>
<td>9.6</td>
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<tr>
<td>2009-09-01</td>
<td>1044.55</td>
<td>0.43</td>
<td>9.8</td>
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<td>2009-10-01</td>
<td>1067.66</td>
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<td>10</td>
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<tr>
<td>2009-11-01</td>
<td>1088.07</td>
<td>0.4</td>
<td>9.9</td>
</tr>
<tr>
<td>2009-12-01</td>
<td>1110.38</td>
<td>0.42</td>
<td>9.9</td>
</tr>
</tbody>
</table>

Source: Federal Reserve Bank of St. Louis.

The variance decomposition (see Figure 3 in the Annex) provides information about the relative significance of each shock on the endogenous variables, with all percentages adding up to 100 percent. By so doing, it accounts for the decomposition of innovations (innovation accounting). The data show that monetary policy is capable of accounting for about 40 percent of the variation in stock prices, more than the amount of variation that can be attributed to employment (output). After a shock impact, it is not unreasonable for monetary policy and unemployment to account for about 46 percent of the variation of stock prices within three quarters. Analogously, in the aftermath of a severe macroeconomic shock, stock prices and unemployment could account for about 63 percent in the variation of monetary policy after three quarters.

Approximately 79 percent of the variation in unemployment is accounted for by monetary policy and stock prices after three quarters, and within a year, they account for about 84 percent of the variation in unemployment. Figure 1 and Table 1 mirror the theoretical underpinnings of this paper. The impulse response of unemployment to a stock price shock shows that the unemployment rate could rise for over two quarters. After the 2007/8 macroeconomic shocks, unemployment increased for a period of over twelve months. Beyond the responses of the variables to shocks, which are contingent on stability diagnosis presented in Table 2, we further subject our predictive hypotheses to a Granger-causality test (Table 4).
Table 4: The Granger-Causality Test (Chi Square in parenthesis)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Stock Prices (I)</th>
<th>3-Year Treasury-Swap Spread (II)</th>
<th>Unemployment (III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Prices</td>
<td>NA</td>
<td>0.005**</td>
<td>0.04**</td>
</tr>
<tr>
<td>3-Year Treasury-Swap Spread</td>
<td>0.03**</td>
<td>NA</td>
<td>0.02**</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.23</td>
<td>0.12*</td>
<td>NA</td>
</tr>
<tr>
<td>Chi Square</td>
<td>(12.03)</td>
<td>(21.44)</td>
<td>(13.90)</td>
</tr>
<tr>
<td>p-value</td>
<td>0.06*</td>
<td>0.002**</td>
<td>0.03**</td>
</tr>
<tr>
<td>Observations</td>
<td>92</td>
<td>92</td>
<td>92</td>
</tr>
</tbody>
</table>

Although monetary policy, as measured by a three-year swap spread and the unemployment rate collectively have strong predictive power over stock prices (Regression 1), monetary policy helps to significantly predict the trajectory of stock prices more than changes in the unemployment rate. However, stock prices and monetary policy significantly have individual and joint predictive power over the level of unemployment, suggesting that equity prices have implications for the level of unemployment (Regression III). Evidently, it is worth noting that though monetary policy and changes in the level of unemployment are collinearly related, the relationship provides no diminutive effect on the forecasting model. The relationship is theoretically sound, lawful, and continuous. As expected, Regression II shows that monetary policy significantly responds to the lagged values of both stock prices and the level of unemployment.

5. Conclusion

Although the literature shows that the effects of unconventional monetary policy are conflictive and imprecise, this study finds that the past values of stock prices and monetary policy have significant and predictive power over the level of unemployment, just as past monetary policy and unemployment have collective predictive power over stock prices. Within a year, about 79 to 84 percent of the variation in unemployment can be accounted for by disturbances to monetary policy and stock prices.

Actual data show that monetary policy in its conventional and unconventional forms leads to the reduction of financial risk as assorted categories of swap spread converge in response to monetary policy. The reduction in risk and cost of borrowing increases asset prices, optimism, and employment when borrowing (credit) channels become clogged up. The empirical evidence further suggests that stock prices will fall in response to a monetary policy shock, and that unemployment increases in response to shocks that are associated with stock prices and monetary policy. The empirical evidence shows that monetary policy is sensitive to disturbances in financial markets or perturbations that impinge on stock price. The literature and theoretical arguments

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7 See the Federal Reserve Act of 1913 and its emergency clause, 13(3), which permits the Fed to provide liquidity for nondepository institutions under exigent circumstances; see also Bernanke (2013), p. 78. For further discussion of multicollinearity and forecasting, see Gujarati and Porter, pp. 258–259.
reflect that the response is generally intended to shore up asset prices and economic growth.

Having subjected our predictive hypothesis to tests and simulated the effects of macroeconomic shocks, we conclude that beyond the channels that directly impinge on the real sector, Tobin’s \( q \) is important for understanding how and why monetary policy is relevant to financial risk mitigation and the level of unemployment.

References


Annex on line at the journal Website: http://www.usc.es/economet/eaat.htm
Figure 2: The Impulse-Response of Stock Prices, Spreads, and Unemployment*
Response of Unemployment to Interest Rate Innovation

* 96 observations with +/- 2 standard deviations for all reported innovations (5 percent tolerance of error).

Figure 3: Decomposing the Variances in Stock Prices and Unemployment

Variance Decomposition of Stock Prices

Variance Decomposition of Unemployment