DYNAMICS OF FINANCIAL STRESS AND ECONOMIC PERFORMANCE

DYNAMICS OF FINANCIAL STRESS AND ECONOMIC PERFORMANCE: INSIGHTS AND ANALYSIS FROM THE WORLD ECONOMY

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Emerald Publishing Limited
Howard House, Wagon Lane, Bingley BD16 1WA, UK

First edition 2018

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-78754-783-4 (Print)
ISBN: 978-1-78754-782-7 (Online)
ISBN: 978-1-78754-784-1 (Epub)

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Certificate Number 1985
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Preface

This book attempts to understand the complex non-linear dynamics of the financial system stress (financial crisis or extreme events) and the economic performance as a whole. To some extent, the book is presented in a lucid style for the benefit of nontechnical readers; otherwise, the details of the analysis are very technical in nature. *Dynamics of Financial Stress and Economic Performance: Insights and Analysis from the World Economy* is predominantly an independent research study of Ramesh Babu Thimmaraya as part of the broader ongoing work on "Sovereign Country Profiles and Economic Partnerships." Section 2.2.10 (India – Financial System Analytics) and Section 4.2.9 (India – Causal Patterns and Multivariate Analysis) are co-authored with Prof M. Venkateshwarlu, and I am very thankful to him for his support.

Vocational readers who wish to understand the topic quickly may wish to read Chapter 5 (Interpretations and Global Outlook) in isolation. However, curious scholarly readers may prefer to read the entire book in detail. The reader can reach the corresponding author through an email (rameshbabu.thimmaraya@gmail.com) for further discussions or suggestions that may follow in response to the heavily technical nature of the book. The corresponding author teaches graduate courses such as Theory of Optimisation, Stochastic Calculus & Financial Engineering, Risk Management & Modelling and Quantitative Behavioural Finance. I am very thankful to Pankaj for helping me with the data. I also express my sincere thanks to Karthik for supporting me in writing this book.

I owe a very special thanks to my friends Shalu and HariGanesh for working with me; without their support, it would have been difficult to complete this book.

Executive Summary

The financial stress of 2008 has propelled the whole world into its most severe recession since the Great Depression. Despite the significant risk posed by the financial stress (virtual economy) to the real economy, the interaction dynamics between financial stress and economic performance is complex and not well understood. Financial stress has the potential to significantly change household spending behaviour, which becomes all the more complicated particularly during economic hardships, creating policy confusions for governments and regulators. However, important gaps remain in our general understanding of this critical relationship.

Until the recent global financial crisis of 2008, the majority of macroeconomic forecasting models did not include variables that signal the financial market movements such as stock market volatility, capital market spreads and indicators of other misalignments in the banking system. As a consequence, the traditional macroeconomic models significantly underestimated the scope of the global financial crisis, and this has focused recent attention on considering financial market variables in economic models.

The extreme conditions of high stress with low economic demand and low stress with high economic demand are observed in many countries. Likewise, there are many other such possible states for the economic system to attain and many such states are possible for the financial stress to interact with. This makes the entire process complicated and thus difficult to understand; a detailed analysis is, therefore, required to understand it more quantitatively.

The literature related to the understanding of the dynamics of financial market shocks on the whole economic system at a global level is rather scarce. To make it more generic, the present study analyses 12 major sovereign economies around the world: United States, China, Japan, Germany, India, United Kingdom, France, Canada, Italy, Russia, Brazil and Australia. This book is an attempt to understand the complex non-linear dynamics of the financial system stress (financial crisis) and the economic performance as a whole by developing a novel analytical framework.

The schematic of the book is presented in five parts:

(1) The first part deals with a brief introduction of the title, the importance of the study, relevance to the present global economic dynamics and a brief review of the literature.
(2) The second part deals with the construction and interpretation of global stress in stock markets, bond markets, Forex markets and the banking system which are the four major pillars of the financial system. Further, a single financial stress index has been computed for each country which serves as a proxy for financial system stability. The analytics computed from the

financial stress brings important insights about the magnitude of financial system shock and financial system recovery across the globe.

(3) The third part deals with credit expansion patterns in the government debt, stock market capitalisation, and bank lending. Analysis of the dynamics of credit expansion and their behavioural patterns bring key insights into the availability of liquidity and money supply vis-á-vis the financial shock and economic development in each country.

(4) The fourth part deals with the dynamic interaction of the financial system with the economic system. The study of this dynamic interaction helps in understanding the impact of financial system stability on the real economy and vice versa. Understanding the important connections and feedback mechanisms of the financial and economic systems will enormously infer the controllability (regulatory predictability) of these complex systems. Further, the discussions on modelling mysticism and analytics on economic model risk and shock penetration recovery are detailed in this part.

(5) The final part discusses the dynamics of financial system stress and multidimensional analysis of the global economic system with reference to the impact of the financial shocks. The multisystem dynamic analysis provides an overall understanding of the global economic extremities like financial bubble formations (stock market, bond market and banking system bubbles), economic demand and monetary analytics, price stability and money supply bubbles and so on. To conclude, this section discusses important insights from the present study and predicts major changes in the global economic fundamentals in the future.

Important observations and insights from the study are as follows:

- The competing 'capital' in the global financial markets flow mostly into 'fast'-growing economies which pressurises sovereign governments to adopt policies for 'faster' growth or quick recovery. These policies may create an artificial and unsustainable positive feedback to the financial system in the short term. Since the financial and economic systems are highly nonlinear and have a high probability of attaining a state of instability, understanding the nonlinear dynamics of these may help in attaining progressive limit cycle dynamics, thus indicating long-term stability.
- The real economic uncertainty is a continuous variable if the financial market hides it because of inertia (procyclical regulations, herd behaviour, top investors holding big sizes and so on), this uncertainty will eventually explode leading to a potential crisis. However, moderate bubbles in the financial markets are not a bad idea in the long run; the experience of dealing with this randomness by itself will help markets to operate more independently (leading to self-sustainability of markets in the long run) during severe economic hardships.
- It is observed that most of the economic system variables have low-frequency dynamics; thus, an abrupt change to the economic variable through a well-thought out policy or any random policy (due to pressure from other external factors) mostly creates disequilibrium in the system. Individual sovereigns

have to calibrate their economic frequency dynamics, and the calibration method should capture the sovereign financial system behaviour to decide the magnitude of perturbation to the regulatory and economic variables.

- The abrupt volatilities in Forex markets are largely nonmodelable, which, in turn, motivates sovereign economies to peg their currencies (or maintain large Forex reserves or maintain artificial trade surplus and so on). These actions will always create disequilibrium, thereby creating serious concerns particularly during economic hardships. The existing brute-force methods of global economic interaction are very rigid (the pattern of international capital flows) leading to a suboptimal state; on the other hand, the global economic interaction based on an individual country's "sovereign profile" is more optimal.
- More research is clearly required at an individual country and international level to develop innovative methods of capital flows since the existing methods are very rigid and volatile. Thus, new economic thoughts should devise methods to bring all the countries (including small countries) into the global economic space. Well-developed or large emerging countries should perform the role of local optimal (for capital/trade) to other compatible economies. This change will bring economic development to small countries and will eventually transform the mature/developed countries into self-sustaining and stable economies.
- Analysis from the present research indicates that most of the polices (including government spending) in the advanced economies are motivated to restore a low unemployment rate. Given the current population changes, technology dynamics (finding ways to reduce labor hours) and evolving global labor markets; sovereign governments should rethink about its policies of public welfare. Managing a real unemployment rate of 40% (non-robust estimate) may not be very far from today for most of the countries around the world.

Chapter 1

Introduction

1.1. Importance of the Study

A decade has elapsed since the troubles in the US subprime mortgage market erupted in the summer of 2007, which led to many complications in the US banking system. Further, it contributed to the failure of key businesses, decline in consumers' confidence, substantial financial commitments incurred by governments, and a significant decline in economic activity estimated to be trillions of US dollars.

The financial and economic crises are not infrequent. Recent years have been characterized by various episodes of significant financial crises; some important events are currency erosions during Asian crisis, long-term capital management crisis, the high-tech boom of the dot com bubble and the very recent 2008 global financial crisis. Many years have passed since the 1997 Asian crisis to the 2008 global financial crisis, yet our minds are still filled with fearful memories because of their sustained negative impact on the global financial and economic conditions.

Until the recent global financial crisis, the majority of macroeconomic forecasting models did not include variables which signal financial market movements such as stock market volatility, capital market spreads, and indicators of other misalignments in the banking system. As a consequence, the traditional macroeconomic models significantly underestimated the scope of the global financial crisis, and this has focused recent attention to consider financial market variables in economic models.

Due to a huge financial meltdown, the shock is transmitted across all the financial segments such as the stock market, bond market, forex market, and the banking system as a whole. The increase in the uncertainties around all the financial markets causes a stress-like situation. Stress is defined as the force exerted on economic agents by uncertainty and changing expectations of loss in financial markets and institutions.

The financial stress definition clearly defines that the crisis is nothing but the extreme values of the uncertainties or the expected loss in financial markets; these shocks transmit through the whole economic system and, in turn, disturb the financial system, which becomes a positive feedback system, causing substantial erosion of wealth and severe decline in the economic activity of the nation.

The financial stress of 2008 had pushed the whole world into its most severe recession since the Great Depression. Despite a significant risk posed by the financial stress (virtual economy) to the real economy, the interaction dynamics

between the financial stress and economic performance are complex and not well understood. The financial stress has a potential to change household spending behaviour, which becomes all the more complicated particularly during economic hardships, creating policy confusions for governments and regulators. However, important gaps remain in our general understanding of this critical relationship.

One potential complication in understanding the relationship is that the parameters of the system as a whole may change when financial stress is elevated and the economy is in a recession. The extreme states of high stress with low economic demand and low stress with high economic demand are observed in many countries. Likewise, there are many other such possible states for the economic system to attain, and many such states are possible for the financial stress to interact with. This makes the whole process complicated and thus difficult to understand; a lot of analyses is required to understand it more quantitatively.

Many researchers have studied the complex economic phenomenon post the 2008 crisis on a standalone basis,[1] or the literature related to understanding the dynamics of financial market shocks on the whole economic system at a global level is rather scarce.

This book is an attempt to understand the complex non-linear dynamics of the financial system stress (financial crisis or financial shocks) and the economic performance as a whole. To make it more generic, the present study analyses 12 major sovereign economies around the world such as the United States, China, Japan, Germany, India, United Kingdom, France, Canada, Italy, Russia, Brazil and Australia.

Several insights about each economy and the world are presented in this book; however, it is constrained to explain only the macro-view or a bird's eye view of individual economies since more attention is given to understanding the global economic and financial system interaction dynamics in general. However, one can draw more insights specific to each country from this study by combining a few more country-specific variables (include micro-economic observations). Many technical discussions are presented in each chapter for a detailed study. However, important results, observations, and insights of this study (in a nutshell) are summarised in the last chapter, to make it easy for the readers to comprehend.

1.2. Brief Literature Review

A brief literature is presented in this section; most of the review is a reiteration of the findings and/or the conclusions of the original chapter partially because

[1]Standalone here means focusing on a specific important economic issues, and/or the study is limited to certain countries or the study uses longer historical data (more historical the data, better the model is not always right because of the averaging effect; the global financial markets are a new and recent phenomenon in the world when compared to the classical economic theories or even neoliberal theories).

most of these findings may have multiple interpretations at the policy level, and thus, this is not a literature review in research sense.

To gain insight into how financial stress influences real economic activity, this section discusses two prominent economic theories. The first theory comes from research on "real options," which incorporates uncertainty into the decision of whether to, for example, invest in a new manufacturing plant today, or postpone the decision for a while to see how the uncertainty is resolved.

The second theory shows how an increase in financial stress, that is, a worsening of financial conditions, affects the real economy by directly tying the cost of borrowing to the financial condition of firms. In this setting, a "financial accelerator" arises through which deterioration in the financial condition of firms raises their cost of borrowing funds, leading to less investment. In turn, a decrease in investment will lower profits and further impair the financial condition of firms. Both theories, the real option and financial accelerator, indicate that high financial stress, as reflected primarily through heightened uncertainty, is associated with lower economic activity.

The central element of the real option theory is that it incorporates the value of waiting, allowing uncertainty to be resolved before making a new, irreversible investment. For example, a new manufacturing plant may be profitable in the future if the price of its output rises, but it may lose money if prices fall. By waiting, the firm has more information about its economic prospects and can make a more informed choice about whether to proceed with an investment. Thus, the term real option pertains to the option, a firm has, of waiting to make a real investment. Importantly, this option has value that firms should consider when undertaking a new investment.

A key result from the real option framework is that, when uncertainty rises, waiting to make a new investment is often optimal. Low uncertainty generally means there is a small probability of an extreme outcome, including the one so bad that the investment would prove unprofitable. As a result, there is not much to be gained from waiting for additional information before making the investment. In this case, firms are likely to invest today, given the investment is deemed to be profitable on average.

However, when uncertainty is high, that is when the probability of an extreme outcome is high, the firm will often find it optimal not to invest today but to wait until the uncertainty is resolved. Then, in the future, if the bad outcome appears certain, the firm will forego the investment. Alternatively, if it appears certain that the bad outcome will not occur, the firm will go ahead with the investment. In other words, high levels of uncertainty will lead to reduced investment today and, depending on how the uncertainty is resolved, may lead to increased investment in the future.

Focusing on the effect of uncertainty, the real option theory suggests that financial stress will lead to less investment spending. This occurs because financial stress often reflects heightened financial market volatility and greater uncertainty about the future performance of the economy. Thus, firms may interpret a sudden jump in financial market volatility as a reflection of more uncertain economic conditions in the future and will pull back on new investment.

The financial accelerator theory states that, when financial stress is low, financial markets operate smoothly. Thus, low financial stress can be viewed as "greasing the wheels" of economic transactions and facilitating economic growth by efficiently transferring funds from savers to borrowers. Savers are willing to extend credit to firms in exchange for an expected positive return on their savings. Risk is always present, but during normal times, savers may perceive they have a firm grasp on the risks they face. In this case, financial markets provide a valuable function by efficiently pricing such risks and appropriately compensating savers. Funds then flow to borrowers, and riskier borrowers pay a higher interest rate, or risk premium, on what they borrow.

However, if financial markets become significantly impaired and financial conditions become stressful, obtaining funds from savers becomes more difficult and costly for firms and consumers. The premium that riskier borrowers have to pay increases, and the riskiest borrowers may be unable to obtain credit on any terms. If firms or consumers are unable to obtain funds to finance investment spending or purchase consumer durables, then both the types of spending will fall. Such a response was particularly evident during the recent financial crisis when many financial markets simply stopped operating.

The workhorse model often used to address the impact of financial conditions on the real economy is the financial accelerator framework developed by Bernanke, Gertler, and Gilchrist (1999). In this setting, firms that need to borrow from external sources or obtain external financing pay a premium to borrow that depends on their financial position. For example, firms with high debt levels must pay a higher interest rate on the funds they borrow to undertake an investment compared to an identical investment by a firm with less debt. This premium is referred to as the "external finance premium." It represents the cost difference of financing a new investment by raising funds externally, such as by borrowing from a bank, versus using internal funds, such as the opportunity cost of using cash on hand.

The term financial accelerator arises from a feedback mechanism in the model. When the economy is booming, firms post higher profits and have stronger balance sheets. As a consequence, they appear to be less risky, so banks charge them a lower external finance premium. In turn, the lower external finance premium induces firms to make more new investments, which further contributes to economic growth. This mechanism works during good times when the economy is growing rapidly, but also works in reverse, generating an "adverse feedback loop." In this case, weakening economic conditions cause profits to decline and balance sheets to weaken. In response, banks charge a higher external finance premium, which causes firms to invest less.

If uncertainty increases, banks respond by raising the average external finance premium because they expect more firms to go bankrupt. If a firm files for bankruptcy, the bank will have to incur a cost to verify that the firm has insufficient assets to repay its loan and claim the firm's remaining assets. In response, banks charge a higher average premium on firms that borrow funds as compensation for the higher rate of expected bankruptcies. As a consequence, the higher average external finance premium causes the average level of investment to decline.

In the financial accelerator model, various shocks to the economy can cause further fluctuations in the external finance premium and, in turn, investment. For example, a sudden shift in investor sentiment may cause asset prices to fall for reasons unrelated to economic fundamentals, leading to a decrease in the net worth of firms. Such an unexpected drop in the net wealth of firms will sharply increase the external finance premium and generate what is typically thought of as financial stress. The decline in net worth weakens firms' balance sheets, so banks charge them a higher external finance premium to borrow. In response, firms invest less, causing economic activity to fall. Over time, the impact of the shock wears off and the economy recovers.

An important aspect of the financial accelerator model is that the strength of the relationship between a firm's net worth and the premium it must pay to borrow depends on the uncertainty of its profitability. Under heightened uncertainty, the premium becomes more sensitive to a firm's financial condition. During such times, credit spreads become more sensitive to changes in the financial conditions of firms, causing firms to make larger adjustments to their investment plans.

The theories discussed in Davig and Hakkio (2010) suggest a strong relationship between financial stress and economic activity; hence, understanding the dynamics of the financial and economic shock transmissions and interactions is the key to break the positive feedback stress system or to control the financial stress within acceptable limits. However, policymakers have a very limited understanding of the impact of these episodes on the economic activity and on the transmission mechanism of monetary policy. Assessing this impact is, thus, a very important topic (Li and St-Amant, 2010).

Claessens, Dell, Deniz and Laeven (2010) investigate the question of how small shocks can lead to relatively large fluctuations in aggregate economic activity. For the last two decades, much of the research and policy focus has been on the links between the real and financial variables. It has been found that initially small, real (or financial) sector shocks can be amplified through changes in financial markets, a phenomenon that has often been called "financial accelerator."

Financial accelerator theories have provided various ways of explaining this pattern, and empirical research has documented some of the channels through which real and financial markets interact. For example, financial and macroeconomic variables closely interact through wealth and substitution effects and through the impact on the balance sheets of firms and households. Asset (house and equity) prices exert a direct influence on the real economy by affecting the net worth of their owners. Households who hold assets become richer during an asset-price boom and normally increase their consumption spending because of wealth effects. In addition, higher net worth releases (to varying degrees) some households' financing constraints and allow them to increase spending through more borrowing.

Similarly, asset prices also affect corporate balance sheets, with effects on firms' access to external financing. Rising prices for assets and generally increased prospects in the upswing of a business cycle raise the net worth of companies. The value of the assets that a borrower owns, especially property,

plants, and equipment, is an important determinant of his or her creditworthiness. Collateral that carries a higher value provides the lender with a high recovery rate in the event of a default and foreclosure on a secured debt, which makes lending less risky and more generously available.

Moreover, in the context of information asymmetries and principal agent issues, a higher net worth reduces moral hazard concerns, allowing lenders to provide more financing. These effects can operate at the individual firm (and household) level, but because of firms' (and households') interactions in real and financial markets, they can also create economy-wide effects that can take on dynamic, pro-cyclical patterns.

Important models with these general equilibrium dynamics include Kiyotaki and Moore (1997) and Bernanke and Gertler (1989), followed by many others that also have dynamics that resemble Fisher's (1933) debt-deflation idea. In a nutshell, the idea can be summarized as follows: during an asset-price boom, the creditworthiness of borrower's rises, banks and other financial intermediaries become more willing to lend, and the interest rates at which borrowers can borrow decline because of lower risk spreads and moderation in the extent of principal agent problems. Business investment increases as firms take advantage of the relatively lower interest rates they face and the relaxation of their financing constraints. Moreover, as asset prices rise, households may increase their spending.

The models have also shown that this process in turn can create further increases in asset values, triggering another round of economy-wide relaxation of financing constraints and increased (investment) spending. It, thereby, creates a cycle of repeated increases in asset prices, investment, and output, i.e., the expansion phase of a business cycle. Conversely, as asset prices fall due to a (small) shock, financial or real, these general equilibrium interactions trigger rounds of reduced lending, less investment and spending, lower assets prices, and thereby depressing output, i.e., the contraction phase of the business cycle.

There is also a large empirical literature analysing the dynamics of business cycles, asset price fluctuations, and credit cycles. Studies using micro-data (banks or corporations) include Bernanke, Gertler, and Gilchrist (1996) and Kashyap and Stein (2000). Other such studies include Borio and McGuire (2004) and Pagan and Sossounov (2003).

Kose, Prasad, and Terrones (2004) studies the synchronization of house prices and the interaction between housing markets and the real economy using dynamic factor models. Few studies to date, however, have investigated the empirical patterns in business cycles, asset price fluctuations, and credit cycles across a large sample of countries and over a long period.

Financial markets often go through a period of stress around recessions as economic activity contracts. Both house and equity prices typically decline before and during a recession reflecting the pro-cyclical nature of asset prices. The decline in equity prices is more than twice that of house prices during these periods, showing volatile behaviour of equity markets. Although credit continues to expand typically, its growth rate is usually much lower, especially during the onset of recessions. Recessions have been becoming shorter and milder over time, especially after the mid-1980s. In particular, the amplitude of a

typical recession fell by roughly half from 1973–1985 to 1986–2007. These patterns are in line with recent empirical work documenting a trend decline in output volatility in industrial countries, the so-called Great Moderation phenomenon.

The credit contractions and declines in asset prices are classified according to their severity by Kose et al. (2004). In particular, they define a credit crunch as a peak-to-trough contraction in credit that is in the top quartile of all credit contractions. Likewise, an equity (or house) price bust is a peak-to-trough decline that falls into the top quartile of all equity (or house) price declines. With these definitions, the study identified 112 contractions (28 crunches) in credit, 114 declines (28 busts) in house prices, and 234 declines (58 busts) in equity prices. The episodes of credit crunches and housing busts are often long and deep.

Kose et al. (2004) states that a credit contraction episode lasts around six quarters on an average, while a credit crunch typically lasts a year longer. Credit contractions usually mean some 4 per cent decrease in credit from peak to trough while, in case of crunches, the fall is typically more than four times larger than that of a credit decline. Housing busts tend to last even longer than credit crunches. The typical episode of decline in house prices is around nine quarters long, whereas a housing bust usually persists twice as long. A typical house price decline is only 6 per cent, but prices tend to fall down by five times as much during a house price bust.

Kose et al. (2004) argues that the episodes of crunches and busts are not necessarily associated with declines in output. In fact, although output growth slows down especially during the early stages of credit crunches and house price busts, output often expands at the end of these episodes. The eventual increase in output during crunches and busts is not surprising since these episodes do not always fully overlap with recessions and last twice as long as recessions do. Still, the average growth rate of output in such episodes is much lower than that observed during more tranquil periods in credit and housing markets.

Recessions tend to remain highly synchronized across countries. Recessions can be quite contagious, as shown by the fact that those recessions in the OECD countries bunch in four periods during 1960–2007. This coincidence is because the episodes of synchronized recessions often coincide with common shocks. A large fraction of countries went into a recession in the mid-1970s, shortly after the first oil price shock.

The proportion of countries in recession also rose during the second oil price shock and the period of highly synchronized contractionary monetary policies across major industrial economies in the early 1980s. In the early 1990s, recessions were again highly synchronized around the world and to some degree in the early 2000s, following the burst of the global dot-com bubble. Not surprisingly, the episodes of highly synchronized recessions mostly overlap with the recessionary periods in the United States.

Kose et al. (2004) states that, during recessions, coinciding with the episodes of crunches and busts, consumption and investment usually display sharper downturns leading to a more pronounced decline in output. For example, the decline in consumption during recessions associated with house price busts is

typically two times larger than that in recessions without busts. The large fall in consumption likely reflects the substantial wealth effects stemming from housing busts. Moreover, the rate of unemployment typically registers a larger increase during recessions accompanied with crunches and busts. Although recessions associated with equity price busts tend to be longer and deeper than those without busts, these differences are not statistically significant. This could reflect that equity price busts have a less tight relationship with developments in the real economy compared to how credit crunches and house price busts do.

If financial stress is systemic, economic behaviour can be altered sufficiently to have adverse effects on the real economy. Therefore, financial stress is a continuous variable with a spectrum of values, where extreme values are called a crisis. Stress increases with expected financial loss or with risk (a widening in the distribution of probable loss) or with uncertainty (lower confidence about the shape of the distribution of probable loss).

The Financial Stress Index (FSI) addresses the weakness inherent in models that use single indicator approaches by improving the reference variables. In particular, the FSI is continuous, of high frequency (daily), and covers the equity markets, bond markets, foreign exchange markets, and the banking sector. Therefore, it is far better suited to analysing financial stability in general with numerous systemically important financial markets and institutions by Illing and Liu (2006) due to its lucidness; a similar method for FSI construction is adopted in the present study.

The global financial crisis of 2008−2009 showed that strong increase in financial stress has dramatic effects on the economy. The collapse of Lehman Brothers led to a full-blown systemic crisis in the financial system that triggered the sharpest and severest downturn in economic activity since the Great Depression. In the Euro area, this crisis was exacerbated by a sovereign debt crisis, which was associated with a systemic crisis in the Euro area banking system.

In addition to the very recent evidence from the worldwide financial crisis and the Euro area sovereign debt crisis, there is also empirical and theoretical evidence that financial stress leads to widespread financial strains and financial instability, which may cause severe financial crises and recessions in general (Borio and Lowe, 2002; Borio and Drehmann, 2009; and Bloom 2009).

Borio and Lowe (2002) argue that financial imbalances can build up in a low inflation environment, and that in some circumstances, it is appropriate for the policy to respond to contain these imbalances. While identifying financial imbalances ex-ante can be difficult, they presented the empirical evidence that it is not impossible. In particular, sustained rapid credit growth combined with large increases in asset prices appears to increase the probability of an episode of financial instability.

They also argue that, while low and stable inflation promotes financial stability, it also increases the likelihood that excess demand pressures show up first in credit aggregates and asset prices, rather than in goods and services prices. Accordingly, in some situations, a monetary response to credit and asset markets may be appropriate to preserve both financial and monetary stability.

Borio and Drehmann (2009) states that, historically, unusually strong increases in credit and asset prices have tended to precede banking crises. Could the current crisis have been anticipated by exploiting this relationship? They explored this question by assessing the out-of-sample performance of leading indicators of banking system distress, and also extended to incorporate explicitly property prices. They found that they are fairly successful in providing a signal for several banking systems currently in distress, including that of the United States. They also considered the complications that arise in calibrating the indicators as a result of cross-border exposures so prominent in the current episode.

Bloom (2009) states that uncertainty appears to jump up after major shocks like the Cuban Missile crisis, the assassination of JFK, the OPEC I oil-price shock, and the 9/11 terrorist attacks. He offers a structural framework to analyse the impact of these uncertainty shocks. He has built a model with a time-varying second moment, which is numerically solved and estimated using firm-level data. The parameterized model is then used to simulate a macro uncertainty shock, which produces a rapid drop and rebound in aggregate output and employment. This occurs because higher uncertainty causes firms to temporarily pause their investment and hiring. Productivity growth also falls because this pause in activity freezes reallocation across units.

In the medium term, the increased volatility from the shock induces an overshoot in output, employment and productivity. Thus, uncertainty shocks generate short sharp recessions and recoveries. This simulated impact of an uncertainty shock is compared to vector autoregression estimations on actual data, showing a good match in both magnitude and timing. He also jointly estimated labour and capital adjustment costs (both convex and nonconvex). Ignoring capital adjustment costs is shown to lead to substantial bias while ignoring labour adjustment costs does not.

Despite the fact that the financial stress has huge implications on the performance of the economy, the policymakers have minimal understanding about the inter-relationship among the financial stress and economic activity. To cater to this, theoretical literature has emphasized the nonlinearities involved in the stress and economic relationship, for example, Bernanke and Gertler (1989) constructed a model which exhibited that balance sheet conditions can amplify output fluctuations and negative shocks are likely to have a greater impact than positive shocks.

They developed a simple neoclassical model of the business cycle in which the condition of borrower's balance sheets is a source of output dynamics. The mechanism is that higher borrower net worth reduces the agency costs of financing real capital investments. Business upturns improve net worth, lower agency costs, and increase in investment, which amplifies the upturn; vice versa, for downturns. Shocks that affect net worth (as in a debt-deflation) can initiate fluctuations.

Azariadis and Smith (1998) developed a model in which the economy may switch between financially constrained regimes that has worse financial conditions such as higher interest rate, deterioration of balance sheets of firms, and weaker bank lending, and a financially unconstrained regime with reduced

financial stress conditions. Interestingly, even though these theoretical models differ in various dimensions, they all imply non-linear dynamics, such as regime switching associated with fluctuations in output, and found asymmetries in responses to shocks.

It has been argued by Azariadis and Smith (1998) that the effect of a change in the monetary policy interest rate on aggregate demand may be larger at higher levels of indebtedness through its impact on cash flows. However, the extent of credit constraints may be at least as important, if not more so. In particular, monetary policy could have a larger impact on aggregate demand when credit constraints are pervasive (which could be the case at low or high levels of indebtedness, or both).

They examined the extent of the strength of credit growth, which can be seen as a proxy for credit constraints and may affect the transmission of monetary policy in a way that cannot be captured in linear models. The results reveal that GDP growth is more responsive to interest rate shocks when credit growth is low. Separate models for household and business credit growth confirm this finding: consumption and business investment are more responsive to interest rate shocks when credit is growing slowly for the household and business sectors, respectively.

The empirical evidence of the asymmetries in the effects of monetary policy on the economy is mixed. Cover (1992) found (using US data) that a contractionary monetary policy shock causes output to decline, whereas an expansionary monetary policy shock has no effect on output. These results are confirmed by DeLong and Summers (1988), Morgan (1993), Rhee and Rich (1995), Thoma (1994), Kandil (1995), and Karras (1996).

Using threshold vector autoregression models in which the threshold variables are credit conditions, McCallum (2001) and Balke (2000) found that US output responds more to a tightening monetary policy in a credit-rationed regime. Balke (2000) also found that contractionary Fed funds shocks have a larger effect on output growth than expansionary shocks. However, Atanasova (2003) and Weise (1999) provided empirical evidence, respectively, based on UK and US data, that the contractionary and expansionary monetary shocks have almost symmetric effects. The size of monetary shocks appears to matter only when the economy's initial state is in the high-risk premium regime.

Cover (1992) examined whether positive and negative money-supply shocks have symmetric effects on output. The results are consistent with the hypothesis that positive money-supply shocks do not have an effect on output, whereas negative money-supply shocks do have an effect on output. This finding is independent of whether or not expected money is assumed to affect output. The results reported in their study imply that the Fed could increase the growth rate of real output by reducing the standard deviation of unexpected changes in the money supply.

DeLong and Summers (1988) states that the natural rate hypothesis, with its corollary that demand management policies cannot affect an economy's long-run average level of unemployment or output, has come to be widely accepted even by Keynesian economists.

In their study, they raise questions about the validity of the natural rate hypothesis and argue that demand management policies can and do affect not just the variance, but also the mean of output and unemployment. As a way of comparing the effectiveness of different demand management policies in stabilizing national economies, they returned to the much discussed comparison of macroeconomic performance in the US and other industrial nations before and after World War II. Previous explorations of macroeconomic performance in historical perspective have focused either on the volatility of output about trends or on the volatility of changes in output. But volatility is not the relevant measure if, as Keynes and the early Keynesians believed, successful macroeconomic policies fill in troughs without shaving off peaks.

Morgan (1993) states that a number of stabilizers are thought to mute the business cycle. One key stabilizer is federal fiscal policy. The federal budget surplus tends to rise during economic booms and fall during downturns, helping to stabilize consumers' disposable income, and thereby mitigate economic fluctuations. During booms, for example, the budget surplus typically rises because tax revenues rise more than expenditures. Another stabilizer that has traditionally received less attention is the state fiscal policy. Like the federal budget surplus, state government surpluses tend to rise during economic expansions and decline during downturns. According to Morgan (1993), Nebraska's budget surplus rose from $91 per capita in the recession year 1990 to $326 (in 1990 prices) per capita in 1998, when the economy was booming.

Morgan (1993) also states that the federal budget and state budgets represent large shares of the economy. For example, in 1998, state government expenditure was 10 per cent of the gross state product in Kansas and 9 per cent in Missouri. The stabilizing influence of state fiscal policy, however, may differ across business cycle expansions and downturns, making state fiscal policy asymmetric. For example, state budgets could be more effective at mitigating economic slumps than at muting booms, if taxes fall more sharply during a slump than they rise in an expansion of equal magnitude. Asymmetry in fiscal policy could be caused by a number of factors, such as balanced budget rules, which are constitutionally imposed restrictions on a state government's ability to incur debt.

Their article examined the business cycle behaviour of state fiscal policy to determine whether policy is asymmetric and, if so, to identify the causes. They conclude that state revenue and expenditure display significant asymmetry over the business cycle, with nearly offsetting effects on the budget surplus. As a result, state fiscal policy tends to mute economic booms to roughly the same degree it mitigates slowdowns. The asymmetries in revenue and expenditure appear to be associated with balanced budget rules, although their fundamental causes cannot be clearly identified.

Rhee and Rich (1995), benefiting from annual data from 1973 to 2008 in the economy of Iran, have studied unexpected asymmetric effects of money on production and inflation. Respective concerns of monetary policymaking deals with how unexpected changes alter production and level prices. In their study, unexpected monetary shocks were analysed using the rest of function of money

supply. According to applicable results obtained in this respect, unexpected monetary decrease influenced economic growth to a great extent (compared with unexpected monetary increase) and unexpected monetary increase largely influenced inflation (compared with unexpected monetary decrease).

Consequently, they conclude that, although a policymaker is able to increase economic growth through unexpected increase of monetary volume, this policy shall bring about more inflation, on the one hand. On the other hand, if the policymaker decreases monetary growth supply unexpectedly to decrease inflation, this shall bring about more effects towards decrease in economic growth.

Kandil (1995) uses quarterly data for the United States, demand contraction exceeds expansion in the face of monetary and government spending shocks. Demand contraction in the face of government spending shocks is absorbed in nominal wage and price deflation. The variability of government spending shocks decreases average wage and price inflation. In contrast, the upward flexibility of price appears in sharp contrast to its downward rigidity in the face of monetary shocks. Furthermore, he argues that the output contraction is notably larger relative to expansion in the face of monetary shocks. He concludes that monetary variability accelerates average price inflation and decreases average output and real wage growth.

Karras (1996) has examined whether the effects of monetary policy on output in Europe are asymmetric. Data from the 1953–1990 periods are used to identify money-supply shocks and their effects on output for a panel of 18 European countries. Many different specifications and estimation methods strongly support asymmetry: negative money-supply shocks are shown to have a statistically significant effect on output, whereas the effect of positive shocks is statistically insignificant.

A similar asymmetry governs the output effects of interest rate changes. The sources of these asymmetries are traced to similar behaviour for consumption and investment. These findings imply that positive money-supply shocks may be an ineffective anti-recession policy, and more generally, that the monetary component of the optimal stabilization policy should be less activist than generally thought.

Balke (2000) examined empirically whether credit plays a role as a nonlinear propagator of shocks. This propagation takes the form of a threshold vector autoregression in which a regime change occurs if credit conditions cross a critical threshold. Using nonlinear impulse response functions, the study evaluates the dynamics implied by the threshold model. These suggest that shocks have a larger effect on output in the "tight" credit regime than is normally the case and that contractionary monetary shocks typically have a larger effect than expansionary shocks. Finally, using a nonlinear version of historical decompositions, they attempted to determine the relative contribution to output growth of shocks and the nonlinear structure.

Atanasova (2003) states that a linear vector autoregression (VAR) model provides a useful starting point for analysing multivariate relationships between economic variables. They are frequently used for empirical macroeconomic modeling, policy analysis and forecasting. However, linear VAR systems fail to

capture nonlinear dynamics such as regime switching and asymmetric responses to shocks, suggested by the recent theoretical developments in macroeconomic research. In addition, an increasing body of empirical evidence suggests that the linear conditional expectations implied by standard VAR models do not always accord with the observed facts. For example, a significant number of empirical studies document asymmetries in the effects of monetary policy on output growth.

His study employs a more general non-linear VAR methodology to re-examine previous findings that credit market conditions contribute to economic fluctuations as a propagator of shocks. Unlike linear projections, it allows for nonlinear dynamics and asymmetric effects of shocks. He estimated a threshold vector autoregression (TVAR), in which the system's dynamics change back and forth between credit constrained and unconstrained regimes. Using generalized impulse response functions (GIRF) generated from the estimated nonlinear model, they examined the real effects of monetary policy. The study concludes that evidence of asymmetry in the effects of monetary policy in the credit constrained and unconstrained regimes as well as different output effects of monetary contractions and expansions.

Weise (1999) tested non-linearity in a standard VAR, including output, prices and money supply using an estimation strategy that is consistent with a wide range of structural macro-economic models. Shocks to the money supply are found to have stronger output effects and weaker price effects when output growth is initially low. Positive and negative monetary shocks are found to have nearly symmetric effects. In addition, he states that there is some evidence that shocks of different magnitudes have asymmetric effects. These results are consistent with the view that the aggregate supply curve is convex

It is, therefore, a crucial challenge to monitor and detect potential signs of financial stress for the conduct of economic policy. Hence, the monitoring of financial stability has also become an increasingly important task for central banks. One major challenge is that monetary and financial factors are too peripheral in the standard macro-economic models. Real-time indicators for the build-up of financial imbalances play a critical role in improving these models. These indicators may be able to guide decision makers to tighten or loosen monetary and macro-prudential policies even if inflation remains subdued as reported by Borio (2011a), Borio (2011b), and Goodhart (2011)).

Borio (2011a) states that the global financial crisis has shaken the foundations of the deceptively comfortable pre-crisis central banking world. Central banks face a threefold challenge: economic, intellectual and institutional. His essay proposes a compass to help central banks sail in the largely uncharted waters ahead. The compass is based on tighter integration of the monetary and financial stability functions, keener awareness of the global dimensions of those tasks, and stronger safeguards for an increasingly vulnerable central bank operational independence.

Borio (2011b) states that the recent financial crisis has triggered a major rethink of analytical approaches and policy towards financial stability. The crisis has encouraged a sharper focus on systemic risk, the inclusion of a financial

sector in macro-economic models, a shift from a micro-prudential to a macro-prudential orientation in regulation and supervision and questions about whether price stability is a sufficient criterion to guide monetary policy. In the process, it has led to a rediscovery of the macro-economic roots of financial instability. He argues that this development is welcome but has not gone far enough. To substantiate this conclusion, his study documents an analytical and policy journey before suggesting a way forward.

Goodhart (2011) argues that, although Central Banks have pursued the same objectives throughout their existence, primarily price, and financial stability, the interpretation of their role in doing so has varied. He identified three stable epochs, when such interpretations had stabilized, i.e.:

(1) the Victorian era, 1840s to 1914;
(2) the decades of government control, 1930s to 1960s; and
(3) the triumph of the markets, 1980s to 2007.

Each epoch was followed by a confused inter-regnum, searching for a new consensual blueprint. The final epoch concluded with a crisis, when it became apparent that macro-economic stability, the Great Moderation, plus (efficient) markets could not guarantee financial stability. So, the search is now on for additional macro-prudential (counter-cyclical) instruments. The use of such instruments will need to be associated with controlled variations in systemic liquidity and in the balance sheet of the Central Bank. Such control over its own balance sheet is the core, central function of any Central Bank, even more so than its role in setting short-term interest rates, which later could be delegated. He concludes by surveying how relationships between Central Banks and governments may change over the next period.

Baumeister and Benati (2012) have explored the macro-economic effects of a compression in the long-term bond yield spread within the context of the Great Recession of 2007–2009 via a time-varying parameter structural VAR model. They identified a "pure" spread shock defined as a shock that leaves the policy rate unchanged, which allows us to characterize the macro-economic consequences of a decline in the yield spread induced by central banks' asset purchases within an environment in which the policy rate is constrained by the effective zero lower bound.

Baumeister and Benati (2012) have identified a pure spread shock as a disturbance that leaves the policy rate unchanged on impact, which allowed us to characterize the macro-economic consequences of a compression in the yield spread induced by central banks asset purchases within an environment in which the short-term rate cannot move because it is constrained by the zero lower bound.

Two main findings emerged from Baumeister and Benati (2012) empirical analysis. First, a compression in the long-term yield spread exerts a powerful effect on both output growth and inflation in the US and the UK when the zero lower bound is binding. Second, conditional on consensus estimates of the

impact of the Federal Reserve's and the Bank of England's asset purchase programs on long-term government bond yield spreads, our counterfactual simulations have indicated that both in the US and the UK unconventional monetary policy actions have been successful at mitigating significant risks both of deflation and of further output collapses comparable to those that took place during the Great Depression.

Baumeister and Benati (2012) model simulations suggest that in the absence of policy interventions, the US economy would have been in deflation until 2009 Q3 with annualized inflation rates as low as −1%. Real GDP would have been 0.9 per cent lower and unemployment would have been 0.75 percentage points higher reaching a level of about 10.6% in 2009 Q4. Similarly, in the UK, without quantitative easing annualized inflation would have fallen to −4 per cent and output growth would have reached a trough of −12 per cent at an annual rate in the first quarter of 2009 based on the median of our counterfactual estimates.

Based on these results, they conclude that large-scale purchases of Treasury securities constitute a viable policy option to provide additional monetary policy accommodation in a zero lower bound environment that enable Central Banks to achieve their mandate of promoting price stability and, in the case of the Federal Reserve, fostering full employment, and should therefore be added to the toolkit of monetary authorities.

It cannot be excluded, however, that there were additional forces at play that are not captured in the empirical model, which have the potential to reinforce the macro-economic stimulus induced by the large open-market purchases of domestic government debt. First, unconventional fiscal policy operations in the wake of the crisis complement monetary policy efforts when the economy is stuck at the zero lower bound. Second, the announcement and implementation of nonstandard policy measures should also have stabilizing effects on agents expectations and contribute to a rebound of confidence that enhance the effectiveness of policy interventions.

Based on cross-country experiences during the crisis, present evidence shows that both unconventional monetary and fiscal actions positively affected the evolution of inflation and growth expectations. Exploring these and other additional channels of nonstandard policy interventions is an important task for future research to provide a comprehensive assessment of the beneficial macroeconomic effects of such policies.

In practice, the European Central Bank (ECB) and the Federal Reserve have developed indicators that are aimed to "measure the current state of instability, i.e., the current level of frictions, stresses, and strains in the financial system" (Davig and Hakkio, 2010 and Kliesen and Smith, 2010). The Federal Reserve Bank of Kansas City and the Federal Reserve Bank of St. Louis established the so-called KCFSI and STLFSI Indices to have a single and comprehensive index measuring financial stress for the conduct of monetary policy "further down the road."

Davig and Hakkio (2010) state that, despite the apparent risk that financial stress poses to the real economy, the relationship between financial stress and

economic activity is complex and not well understood. The experience of the United States and other countries has shown that businesses and households often pull back on new investments and purchases in response to the tighter credit conditions and greater uncertainty caused by financial stress. Yet, important gaps remain in their understanding of this critical relationship.

One potential complication is that the relationship may change when financial stress is elevated and the economy is in a recession. Over the last 20 years, the US economy has shown a tendency to switch between two very distinct states: a normal state in which economic activity is high and financial stress is low and a distressed state in which economic activity is low and financial stress is high. Does the impact of financial stress on economic activity depend on which of these two states currently prevails? And how do changes in financial stress and economic activity affect the likelihood of switching from one state to the other? They have also examined these questions.

A key finding of Davig and Hakkio (2010) is that, over the last two decades, increases in financial stress have had a much stronger effect on the real economy when the economy is in a distressed state. In addition, rising financial stress plays a role in eventually tipping a strong economy into a distressed state. As a result, policymakers should monitor financial conditions closely, both in good as well as bad times.

Kliesen and Smith (2010) state that the recent public debate over financial regulatory reform has been heated and some have argued that we need an agency charged with monitoring financial market developments that are deemed to pose a risk to the entire financial system or to firms deemed systemically important. Presumably, one of the requirements of such a systemic risk regulator would be to measure financial market "stress." There are many ways to measure financial market stress. One is to look at an interest rate spread designed to measure default risk, such as the difference between yields on a "risky" asset (e.g., corporate bonds) and a "risk-free" asset (e.g., US Treasury securities).

However, financial stress can also arise in other dimensions. One type of risk prominent in the recent financial crisis was the inability of many financial institutions to secure funding to finance their short-term liabilities, such as repurchase agreements (repos). This type of risk is known as "liquidity risk." To overcome a potential problem of focusing solely on one indicator at the expense of others, some economists have combined several indicators designed to measure financial market stress into one summary variable, like an index number.

A recent example of such an index is the KCFSI, which is a measure constructed by the Federal Reserve Bank of Kansas City that uses 11 financial market variables. However, one potential limitation of the KCFSI is its use of monthly data. Significant developments in the financial markets often occur much more frequently (e.g., the difficulties associated with Bear Stearns and Lehman Brothers), so a more "real time" index might be better. The trade-off for a higher frequency index, of course, is greater volatility, and thus, perhaps, noise.

To gauge whether the STLFSI can be used to measure the degree of financial stress in the market at three key events over the past several years have been

observed as follows: (1) the Russian debt moratorium in August 1998 that helped to precipitate the Asian financial crisis and the associated collapse in the US hedge fund Long-Term Capital Management; (2) the decision by the Paris-based BNP Paribas banking group in August 2007 to suspend redemptions from three of its mutual funds with significant holdings of US asset-backed securities; and (3) the bankruptcy of the investment bank Lehman Brothers in September 2008.

In each instance, the STLFSI seemed to accurately capture the subsequent turmoil and financial stress. In one sense, the STLFSI and the KCFSI can be thought of as coincident indexes rather than as leading indexes; that is, they are designed to measure developments as they occur. In another sense, however, they have leading indicator properties because rising levels of financial stress, as recently seen, can portend economic turmoil and disruption. Although the STLFSI suggests the level of financial stress in the markets has declined significantly since September 2008, the stress level still remains modestly higher than average.

International institutions and private financial institutions, such as the International Monetary Fund (IMF), the Organization of Economic Co-operation and Development (OECD), the Bank for International Settlements (BIS), Goldman Sachs, Bloomberg, and Citigroup have all developed financial stress indicators to detect early signs for increases in financial stress.

Until the global financial crisis, the majority of macro-economic forecasting models did not include variables signaling financial market movements, i.e., variables such as stock market volatility, capital market spreads, or indicators of misalignments in the interbank market were not considered in these models. As a consequence, the traditional macro-economic models significantly underestimated the scope of the global financial crisis, and this has focused the recent attention on including financial market variables in these models.

A whole new strand of literature has sprung up that uses financial stress indicators to capture the rupture of the financial system after the default of Lehman Brothers. The financial stress indicators are generally calculated using various financial variables, such as stock and bond market developments and risk spreads. In the new strand of the literature, these financial variables have been summarized in one indicator using either principal components analysis or a weighted-sum approach.

Illing and Liu (2006) were among the first to use a principal component analysis calculating a financial stress indicator. They use a static factor model for Canada and show that their indicator provides an ordinal measures for financial stress in the financial system. Davig and Hakkio (2010) and Kliesen and Smith (2010) used this approach to calculate the so-called KCFSI and STLFSI Indices for the US economy, which were established by The Federal Reserve Bank of Kansas City and the Federal Reserve Bank of St. Louis. In a subsequent article, Davig and Hakkio (2010) analysed the effects of financial stress on real economic activity using the KCFSI. They found that the US economy fluctuates between a normal regime, in which financial stress is low and economic activity

is high, and a distressed regime, in which financial stress is high and economic activity is low.

Hatzius, Hooper, Mishkin, Schoenholtz, and Watson (2010) calculated an alternative financial stress indicator using 45 variables to explore the link between financial conditions and economic activity in the United States and showed that during most of the past two decades, including the last five years, the indicator indicated future economic activity better than existing indicators. Their major innovation is that they estimate an unbalanced panel, which makes it possible to calculate the indicator back to 1970.

Hatzius et al. (2010) explores the link between financial conditions and economic activity. It first reviewed existing measures, including both single indicators and composite financial conditions indexes (FCIs). They then built a new FCI that features three key innovations. First, besides interest rates and asset prices, it includes a broad range of quantitative and survey-based indicators. Second, the use of unbalanced panel estimation techniques results in a longer time series (back to 1970) than available for other indexes. Third, we control for past GDP growth and inflation and thus focus on the predictive power of financial conditions for future economic activity.

During most of the past two decades for which comparisons are possible, including the last five years, their FCI shows a tighter link with future economic activity than existing indexes, although some of this undoubtedly reflects the fact that they selected the variables partly based on our observation of the recent financial crisis. As of the end of 2009, FCI showed financial conditions at somewhat worse-than-normal levels. The main reason is that various quantitative credit measures (especially issuance of asset backed securities) remained unusually weak for an economy that had resumed expanding.

Beaton, Rene and Corinne (2009) argue that the financial crisis of 2007−2009 highlighted the importance of developments in financial conditions for real economic activity. They estimate the effect of current and past shocks to financial variables on US GDP growth by constructing two growth-based financial conditions indexes (FCIs) that measure the contribution to quarterly (annualized) GDP growth from financial conditions. One FCI is constructed using a structural vector-error correction model and the other is constructed using a large-scale macro-economic model. Their results suggest that financial factors subtracted around 5 percentage points from quarterly annualized real GDP growth in the United States in 2008 Q4 and 2009 Q1 and should subtract another 5 percentage points from growth in 2009 Q2.

Moreover, to assess the effect of financial shocks in terms of policy interest rate equivalent units, they convert the effect of financial developments on growth into the number of basis points by which the federal funds rate has been tightened. They showed that the tightening of financial conditions since mid-2007 is equivalent to about 300 basis points of tightening in terms of the federal funds rate. Thus, the aggressive monetary easing undertaken by the Federal Reserve over the financial crisis has not been sufficient to offset the tightening of financial conditions. Finally, in a key contribution to the literature, they assess the

relationship between financial shocks and real activity in the context of the zero lower bound.

They found that the effect of the tightening of financial conditions on GDP growth in the current crisis may have been amplified by as much as 40 per cent due to the fact that policy interest rates reached the zero lower bound. They have developed two growth-based FCIs in an attempt to quantity the effect of financial shocks on real activity, and have shown that tightening financial conditions have significantly dampened growth in the current cycle.

According to Beaton et al. (2009), Macro-Financial Conditions Index (MFCI) adjusted for the binding lower bound suggests that financial factors subtracted around 5 percentage points from quarterly annualized growth in 2008 Q4 and 2009 Q1. Moreover, to assess the effect of financial shocks in terms of policy interest rate equivalent units, they have converted the effect of financial developments on growth into the number of basis points by which the federal funds rate has been tightened. The results suggest that the net tightening of financial conditions since mid-2007 is equivalent to about 300 basis points of tightening in terms of the federal funds rate, despite the actual 500 basis point decline in the policy rate.

Given the ongoing disruptions in financial markets, the degree of tightening of price and non-price credit conditions and the substantial losses in wealth over 2008, and the long transmission lags between a shock to financial conditions and its impact on the real economy, these financial conditions are expected to continue to dampen growth going forward. Finally, a key contribution is to address the effect of financial shocks on real activity in the context of the zero lower bound on policy rates, as in the current crisis.

Beaton et al. (2009) results suggest that the impact of financial shocks on the real economy may be amplified in the face of higher real interest rates, since policy interest rates are currently at the zero lower bound and credit and quantitative easing policies may not be as efficient in stimulating demand as traditional interest rate policies. Going forward, actions implemented by the Federal Reserve and the Treasury should help to improve the functioning of distressed market, thereby removing a source of downward pressure on growth.

Li and St-Amant (2010) state that previous research has emphasized the role that financial sector developments could play in the transmission mechanism of monetary policy. Both theoretical models and empirical findings point to the possibility that there are nonlinear relationships between monetary policy, the business cycle, and developments in the financial sector. Using Canadian data and a TVAR model that allows for such nonlinear relationships, they also obtain results that are generally consistent with the previous literature.

That is, when the economy can move into different financial-stress regimes, monetary policy actions can influence the likelihood of moving into these regimes, and monetary policy tightening appears to have more powerful effects, in general, than monetary policy easing. Moreover, the effects of tighter monetary policy are particularly large in regimes of high financial stress.

Li and St-Amant (2010) results point to the need for policy-makers to take into account the impact that their actions might have on financial conditions.

They also point to the need to be aware of the possibility that conditions in the financial sector influence the effects of policy actions. These transmission mechanisms must be factored into the models used to guide monetary policy decisions. While progress has been made in developing such models, much remains to be done. Also, Canada has experienced only a few episodes of very high financial stress, and these could be driving our results. More research is needed before strong policy conclusions can be reached.

In addition, they stated that the results should not be seen to imply that monetary policy should remain easy to avoid situations of high financial stress. Another observation shows that excessive growth in credit and asset prices, associated with a monetary policy that is kept too easy for too long, can be a source of disequilibrium that may eventually result in high financial stress. Easy monetary policy could produce such developments. More generally, a monetary policy stance that is kept too easy for too long would cause inflation and instability.

Ng (2011) examines the predictive power of the indicators developed by Hatzius et al. (2010), the Basel Committee's Indicator (Bank for International Settlements (2010)), and Domanski and Ng (2011). He concludes that using financial stress indicators as additional predictors improves forecasting U.S. GDP growth performance at horizons of two to four quarters.

Domanski and Ng (2011) argues that the financial cycle refers to fluctuations in perceptions and attitudes about financial risk over time. It is often marked by swings in credit growth, asset prices, terms of access to external funding, and other financial developments. A single measure that summarized such indicators would simplify analysis of the financial cycle, with benefits for both systemic risk assessment and stabilization policy.

It is not obvious, however, how best to select and combine the many potentially relevant indicators or how the usefulness of the resulting measure might be assessed. One criterion is predictive power. This special feature reviews the power of three differently composed measures to predict output fluctuations up to two years ahead. One of the measures is found to have substantial predictive content for output forecasting at short horizons. However, this result seems to arise mainly from the inclusion of indicators strongly related to actual financial system stress, rather than from swings in more generalized perceptions and attitudes about financial risk.

Blinder and Avner (1988) study presents two macro models in which central bank policy has real effects on the supply side of the economy due to credit rationing. In each model, there are two possible regimes, depending on whether credit is or is not rationed. Starting from an unrationed equilibrium, either a large enough contraction of bank reserves or a large enough rise in aggregate demand can lead to rationing. Monetary (fiscal) policy is shown to be more (less) powerful when there is rationing than when there is not.

In the first model, credit rationing reduces working capital. There is a failure of effective supply in that credit-starved firms must reduce production below national supply. The resulting excess demand in the goods market may in turn drive prices up and reduce the real supply of credit further, leading to further reductions in supply and a stag-flationary spiral.

In the second model, credit rationing reduces investment, which cuts into both aggregate demand and supply. Their study finally concludes that despite the effect on demand, stag-flationary instability is still possible. A rise in government spending crowds out investment in the rationed regime but crowds in investment in the unrationed regime.

Li and St-Amant (2010), using a threshold VAR to capture nonlinear relationships in the data, found evidence that a regime change occurs if financial stress conditions cross a critical threshold. The empirical findings of their study show that regardless of the initial level of the financial stress conditions, output growth and inflation respond more strongly to contractionary monetary policy shocks than to expansionary monetary policy shocks, while the responses of the overnight rate and FSI to contractionary monetary policy shocks are not significantly different from the responses to expansionary monetary shocks.

The asymmetric response of output to monetary policy shocks is consistent with the results of:

Cover (1992) who found that negative monetary shocks have stronger effects than positive monetary shocks. However, he did not find evidence that responses to large shocks are disproportionate compared with responses to small shocks. Responses to monetary policy shocks seem proportional to the size of the shock in both high-stress and low-stress regimes.

He also found that monetary policy shocks have a larger impact on output, inflation (after two quarters) and financial stress when the economy begins in a low financial stress regime than in a high financial stress regime. An explanation for this is that the shock raises the likelihood that the economy will move to the high stress regime. This contradicts Blinder's and Avner (1988) conclusion that a tightening of monetary policy may have stronger effects on the real sector when credit is already tight.

Finally, he found that large contractionary monetary policy shocks can substantially increase the likelihood of switching to the high financial stress regime, while large expansionary monetary policy shocks substantially decrease the likelihood. In particular, successive increases in the interest rates are associated with an increase of the transition probability from a low regime to a high regime. These results states that monetary policy shocks have substantial effects on the transition probability from the given regime to another indicate that monetary policy shocks feedback into Canadian financial stress conditions and play an important role in the evolution of financial stress regimes.

One potential concern arises from the fact that the FSI contains information related to international financial markets (Canada/US exchange rate volatility, and US 90-day Treasury Bill spread, and so on). The TVAR methodology used does not easily allow them to include international variables as exogenous factors that might explain movements in the FSI. Thus, the estimated model presented may overstate the impact of monetary policy on the transition probability between regimes.

Bloom (2009) took a somewhat different approach to explore the link between financial stress and economic activity in the US by analysing the impact of uncertainty shocks, measured by the volatility index (VIX) of the S&P500, on

industrial production. He uses a VAR and found that the stock market volatility affects industrial production significantly.

Hollo, Kremer, and Lo Duca (2011) develop a composite indicator of systemic stress (CISS), which is thought to measure the current state of financial instability of the financial system in the euro area. They employ a threshold bivariate VAR model including the CISS and industrial production. They show that impact of stress in financial markets depends on the regime, i.e., while the impact of financial stress on economic activity in low-stress regimes is insignificant; the impact in high-stress regimes significantly dampens economic activity considerably in the months after the shock.

Hubrich and Tetlow (2012) argue that the recent financial crisis and the associated decline in economic activity have raised some important questions about economic activity and its links to the financial sector. Their study introduces an index of financial stress, an index that was used in real time by the state of the Federal Reserve Board to monitor the crisis and shows how stress interacts with real activity, inflation, and monetary policy. They define a stress event as a period affected by stress in both shock variances and model coefficients and describe how financial stress affects macroeconomic dynamics.

They also examined what constitutes a useful and credible measure of stress and the role of monetary policy. They addressed these questions using a richly parameterized Markov-switching VAR model, estimated using Bayesian methods. Their results show that allowing for time variation is important: the constant-parameter, constant-shock-variance model is a poor characterization of the data. They found that periods of high stress coefficients, in general, and stress events, in particular, line up well with financial events in recent US history.

They found that a shift to a stress event is highly detrimental to the outlook for the real economy and that conventional monetary policy is relatively weak during such periods. Finally, they argue that their findings have implications for DSGE modeling of financial events insofar as researchers wish to capture phenomena more consequential than garden-variety business cycle fluctuations, pointing away from linearized DSGE models toward either MS-DSGE models or fully nonlinear models solved with global methods.

Their objective was to uncover whether shifts in the state of the economy have been an important feature of the real financial linkage in the US economy, and if so, whether the transmission of financial stress differs in some states of the world than others.

They also examined whether monetary policy in the high-stress state differs from what it is in low stress states. They also assessed whether the Board staffs Financial Stress Index is up to the task of providing real-time insight on financial stress and its relation to macroeconomic outcomes. Their analysis shows substantial evidence that a single-regime model of the macro-economy and financial stress is inadequate to capture the dynamics of the economy. Moreover, the data showed that there have been periodic shifts in the dynamics of the economy as well as in stochastic shocks.

They further found that these shifts are best described as having occurred in all of the model equations, rather than being restricted to subsets of equations. In particular, there is no evidence that the interest rate reaction function has constant parameters. These finding implies that inference regarding the conduct of monetary policy that is gleaned from a constant-parameter Gaussian model may be inappropriate for periods when the policy is conditioned on movements in financial stress.

Quantitatively, they found that output reacts differently to financial shocks in times of high financial stress than in normal times, with macro-economic dynamics being highly conditional on the financial stress regime: Stress is of negligible importance in "normal" times, but of critical importance when the economy is in a high-stress coefficient state. They also found that an important precursor to adverse economic events is a switch to what we call a stress event: a period in which the shock variance is at a relatively high-stress level and the coefficient state is also at a high-stress level. It is often the case that stress events occur when shock volatility begins to rise and is followed by the change in coefficient state. The fact that such switches in state can be reliably inferred in real time leads one towards optimism regarding the efficacy of now casting stress events.

Lastly, they showed that the Federal Reserve Board staffs use of the financial stress index described in their study appears to have been an efficacious choice. The joint findings of the prevalence of Markov switching in model coefficients together with the observation that conventional monetary policy is not very powerful in high-stress coefficient states speaks to the issue of whether there are conflicts in central banks mandates for price stability and maximum employment, on the one hand, and financial stability, on the other.

The issue is whether there exists merely an assignment problem in which financial instruments need only be assigned to financial goals and monetary instruments to monetary goal or whether there are times when monetary policy needs to be concerned with the goal of financial stability, regardless of financial stability instruments. Markov switching is exogenous in their study, but their findings suggest that unless alternative mechanisms can be found to rule out switching to the high-stress coefficient state, it is possible that monetary policy might at times need to contribute to maintaining financial stability.

They have noted that it is the components of the financial stress index that are associated with market perceptions of default risk that are instrumental in driving their results. This suggests that non-linear structural models aimed at explaining the same sort of quantitative phenomena as their study would be well advised to assign a prominent role to considerations of default risk.

Evidently, in high-stress situations, agents regard conventional policy actions that would normally be beneficial as confirmation of incipient financial difficulties. The resulting higher levels of stress choke off the salutary effects of easy monetary policy. They emphasize that this result is germane to stress events: in low-stress states, a surprise reduction in the federal funds rate reduces financial stress rather than increasing it.

They concluded that conventional monetary policy actions, in the absence of actions to alleviate the fundamental causes of the stress event or actions to arrest increases in financial stress, will only be modestly helpful for economic performance. At one level, this should not be surprising: it is received wisdom in economics that would-be policy cures should be tailored to the ultimate causes of the problem as opposed to the symptoms that those causes engender. Finally, they turn to our second class of experiments, a conditional forecast that illustrates the importance of initial conditions for economic outcomes.

Hollo et al. (2011) introduced a new indicator of contemporaneous stress in the financial system named Composite Indicator of Systemic Stress (CISS). Its specific statistical design is shaped according to the standard definitions of systemic risk. The main methodological innovation of the CISS is the application of the basic portfolio theory to the aggregation of five market-specific subindices created from a total of 15 individual financial stress measures. The aggregation accordingly takes into account the time-varying cross-correlations between the subindices.

As a result, the CISS puts relatively more weight on situations in which stress prevails in several market segments at the same time, capturing the idea that financial stress is more systemic and thus more dangerous for the economy as a whole if financial instability spreads more widely across the whole financial system. Applied to euro area data, they determine within a threshold VAR model a systemic crisis-level of the CISS at which financial stress tends to depress real economic activity.

Mallick and Sousa (2013) use a financial stress indicator in a Bayesian VAR (BVAR) model and a sign-restriction VAR model to examine the real effects of financial stress. They found that unexpected variation in financial stress leads to significant variations in output. Grimaldi (2010) derives a financial stress indicator for the euro area and studies its ability to detect periods of financial stress. She found that the indicator is able to extract information from an otherwise noisy signal and that it can provide richer information than simple measures of volatility.

Mallick and Sousa (2013) in his study examines the real effects of financial stress in the Euro-zone using two identification strategies based on a Bayesian Structural VAR and a Sign-Restriction VAR. As expansionary monetary policy has been blamed to have fuelled asset price bubble, it is important to assess the macro-economic impact of both a financial stress shock and a monetary policy shock. They found that unexpected variation in financial stress conditions plays an important role in explaining output fluctuations and, therefore, demands an aggressive response by the monetary authority to stabilize output. This, in turn, indicates a preference shift from inflation targeting.

They also show that a monetary policy contraction strongly deteriorates financial stress conditions. As a result, rapid credit growth due to a long period of low interest rates possibly contributed to an increase in asset prices and encouraged unsustainable demand growth as observed in the recent financial crisis.

There are also several articles in the recent literature that deal with various comparable financial stress indicators that can be used across countries. These indicators have been used recently by the IMF to improve the assessment of economic activity in the World Economic Outlook (International Monetary Fund (2011)). Matheson (2011), for example, developed the indicators for the United States and the euro area and Unsal, Osorio, and Pongsaparn (2011) developed indicators for several Asian countries and Australia. Cardarelli, Elekdag, and Lall (2011) use an augmented indicator including more variables from the banking sector and examine why some financial stress periods lead to a downswing in economic activity in 17 advanced economies over 30 years. They found that financial stress often but not always precede a recession.

Claessens et al. (2010) argue that the difficulties in financial markets can prolong and deepen recessions through variety of theoretical channels. For example, sharp declines in asset prices can reduce firms and households net worth, limiting their capacities to borrow, invest, and spend. This process can in turn lead to further drops in asset prices amplifying the adverse effects of financial stress on economic activity. Banks and other financial institutions might be forced to restrict their lending activities as their capital base diminishes during the episodes of credit crunches leading to protracted and deeper recessions.

They also questioned, are recessions associated with crunches and busts indeed worse than other recessions? To answer this question, they first use a simple "dating" rule to determine whether a specific recession is associated with a credit crunch or asset price bust. In particular, if a recession episode starts at the same time or after the beginning of an ongoing credit crunch or asset price bust, we consider the recession to be associated with the respective credit crunch or asset price bust.

This rule, by definition, basically describes a "timing" association, or simply a coincidence between the two events but does not imply a causal link one or the other way. Among the episodes of recessions, crunches, and busts, there is a considerable overlap, since there is 18, 34 and 45 recession episodes associated with credit crunches, house price busts and equity price busts, respectively. In other words, in about one out of six recessions, there is also a credit crunch underway and in about one out of four recessions also a house price bust. Equity price busts overlap for about one-third of recession episodes.

They also investigated that why recessions associated with crunches and busts longer and deeper? During recessions coinciding with the episodes of crunches and busts, consumption and investment usually display sharper downturns leading to a more pronounced decline in output.

Claessens et al. (2010) also states that, the rate of unemployment typically registers a larger increase during recessions accompanied with crunches and busts. Although recessions associated with equity price busts tend to be longer and deeper than those without busts, these differences are not statistically significant. This could reflect that equity price busts have a less tight relationship with developments in the real economy compared to how credit crunches and house price busts do.

They also investigated the question, how long after a period of financial stress does a recession start? Of course, not all episodes of financial stress end in a recession, but when this happens, it typically takes four to five quarters for a recession to begin after the onset of a credit crunch or a housing bust. Although they start later, recessions often end two to nine quarters before credit or house prices bottom out, respectively. These findings suggest that the phenomenon of "creditless recoveries" can be a feature of business cycles in industrial countries, similar to the recoveries from sudden stop episodes observed in emerging markets.

Unsal et al. (2011) proposed a new Financial Condition Index (FCI) for Asian economies based on two different methodologies: a VAR model and a Dynamic Factor Model. They showed that this index has predictive power in forecasting GDP growth and may be used as a leading indicator. Based on the FCI, financial conditions in Asia tightened substantially earlier in the global crisis, reflecting losses in stock markets and tighter credit conditions. In early 2010, financial conditions in Asia recovered rapidly and reached pre-crisis levels due to accommodative monetary policies and a rapid rebound in regional equity markets.

Cardarelli et al. (2011) examined why some financial stress episodes lead to economic downturns. The study identifies episodes of financial turmoil in advanced economies using a financial stress index (FSI), and proposes an analytical framework to assess the impact of financial stress in particular banking distress on the real economy. It concludes that financial turmoil characterized by banking distress is more likely to be associated with deeper and longer downturns than stress mainly in securities or foreign exchange markets. Economies with more arm's-length financial systems seem to be more exposed to contractions in activity following financial stress, due to the greater procyclicality of leverage in their banking systems.

Casarin, Tronzano, and Sartore (2013) analysed the impact of financial stress on the real economy of a representative Euro area through the use of a Bayesian VAR model with informative prior. The combination of the lagged effects (i.e., the regression coefficients) together with the simultaneous (i.e., the co-variances) highlighted a strong influence of a financial shock in the economic activity, not only directly but also triggering a chain reaction in the system's variables which leads to strong dampening in the EMU economies. They observed 15 per cent to 40 per cent of the variations in the IPI growth are directly accountable to the financial stress, with also an influence of the 10−30 per cent on the annual inflation rate and a 50 per cent on the short-term interest rates.

Their analysis also allowed deriving a general evaluation on the resistance of the single countries to the financial stress, demonstrating that Germany and France suffer much less troubles with respect to both the strength of the crisis peak and to the recovery rate. On the other hand, Spain and Greece are the most influenced states, in particular, the first exhibits the highest sensitivity to the direct effects, while the second suffers the longest recession.

A specific analysis of the coefficients also revealed that while on the front of the inflation rate the system has reached a high level of integration, on the side

of the IPI Greece is still outside from an integrated European trend. Finally, the comparison with a noninformative model allowed for an evaluation of the IMF projections. The most relevant considerations regard the Greece, which is much more influenced by its past history in the informative model, and so exhibits a much worse outlook in the recession periods.

As a last consideration, the long-term projections, even if based on a strict data sample, leaves open important questions about the European integration, in particular showing how the crisis in the long-run quickly involve the most integrated countries.

As future developments, the analysis could be replied for the dollar-area and the yen-area, and subsequently extended putting in relation results in order to evaluate the transmission of the effects to a global scale.

Matheson (2011) developed financial conditions indexes for the United States and Euro area using a wide range of financial indicators and a dynamic factor model. The financial conditions indexes are shown to be useful for forecasting economic activity and have good revision properties.

Davig and Hakkio (2010) argue that the recent financial and economic crisis illustrated the sharp relationship between financial stress and economic activity. However, such a tight connection is not always so obvious as the economy also passes through several years where financial conditions appear to play a tangential role in driving economic activity. To assess how the effects of financial conditions vary over time, their article considers whether the influence of financial stress on economic activity depends on broader economic and financial conditions.

The article finds that the US economy fluctuates between a normal regime, in which financial stress is low and economic activity is high, and a distressed regime, in which financial stress is high and economic activity is low. In the distressed regime, the effect of financial stress on economic activity can be quite large compared to the normal regime. Thus, when financial stress becomes elevated, policymakers should pursue policies to alleviate it since the economy appears to be particularly susceptible to further increases in financial stress.

During less stressful times, policymakers also need to monitor financial stress closely, but for a slightly different reason. An event that triggers higher financial stress, even if the overall level is generally low, will raise the probability the economy will enter a distressed state. Thus, even when financial conditions are normal, policymakers should closely monitor financial conditions.

Bjorn (2012) estimated a financial market stress indicator (FMSI) for Germany using a dynamic approximate factor model and has used TVAR measure to understand the impact of financial stress on the economic activity for Germany. He has found that if the indicator exceeds a certain threshold, an increase in financial stress causes economic activity to decelerate significantly, whereas if it is below this threshold financial stress does not significantly matter for economic activity.

Bjorn (2012) concludes that the disruptive events in financial markets over the past three years increased the necessity in taking into account financial misalignments for forecasting and analysing economic activity in macroeconomic

models. The aim of his study is to establish a financial market stress indicators that should be taken into account when analysing business cycles in Germany.

The indicator is developed using a panel of various financial market variables that are available in real time by applying a dynamic factor model. An increase in this indicator can be considered as additional early warning variables for a deceleration of economic activity. In particular, it can be shown that an increase in financial stress, if it is above a certain threshold indicates economic activity to dampen. Subsequently, he showed forecasting accuracy of industrial production can be improved when he include the indicator into a small scale threshold VAR model.

In particular, he compared the root-mean-squared-errors of two estimation samples and diverse time horizons including and excluding financial stress. The analysis shows that the indicator significantly reduces the root-mean-squared error and can improve forecasting accuracy in the short to medium term.

Li and St-Amant (2010) uses the FSI developed by Illing and Liu (2006), they then use a threshold VAR model to capture asymmetries and regime switching implied by theoretical models. The econometric specification for the threshold VAR model allows the economy to switch between two regimes. The economy is in the high financial stress regime if the financial stress conditions are higher than a threshold value; otherwise, it is in the low financial stress regime.

The empirical findings of Li and St-Amant (2010) reveals that: (1) contractionary monetary shocks typically have a larger effect on output than expansionary monetary shocks; (2) the effects of large and small shocks are approximately proportional; (3) expansionary monetary shocks have larger effects on output in the high financial stress regime than in the low financial stress regime; (4) large expansionary monetary shocks increase the likelihood of moving to, or remaining in, the low financial stress regime; (5) typically, high financial stress regime has been characterized by weaker output growth, higher inflation, and higher interest rates.

One of the early warning studies which discussed the growing risk in the financial system by Rajan (2006) rightly mentions that more study is required to estimate the magnitude of the concerns raised.

Important articles related to the topic are presented in the references section for further reading.

1.3. Methodology

The present study is based on the financial market data of the four major pillars of the financial system such as stock market (stock market returns volatility as the stock market stress), bond market (interest rate volatility as bond market stress), banking system (banking stock returns volatility as banking system stress), and Forex market (exchange rate volatilities as forex market stress).

To understand the interaction between the economic system and financial market stress, the following macro-economic variables are considered as economic system in the present study: GDP growth, inflation growth, money supply

growth, and interest rates (long-term 10-year rates and short-term 3-month rates).

The macro-economic variables data considered in the present study are available from 1990 onwards with annual frequency (more than 25 years). However, the financial markets are a more recent phenomenon for many countries, especially emerging economies. Thus, the data period considered for each country is outlined as follows: Australia (from 2000 onwards), Brazil (2006 onwards), Canada (1990 onwards), China (2006 onwards), France (from 1995 onwards), Germany (from 1995 onwards), India (2000 onwards), Italy (from 1995 onwards), Japan (from 1990 onwards), Russia (from 1995 onwards), the United Kingdom (from 1990 onwards), and the United States (from 1990 onwards).

These data variables are collected for 12 major economies considered in the study. Important data sources referred are CIA, World Bank, IMF, OEC, BIS, CEIC, Trading Economics, OECD, and major financial market exchanges.

A pictorial overview of the proposed framework is presented in Figure 1.1. Each of the financial market stress variable can interact with each other and can interact as a whole (combined into financial stress index) dynamically with the economic system. The financial market stress can provide a positive or negative feedback to the economic system and vice versa.

The economic system can be very complex with many dimensions, hence, modeling its interaction with the financial system will be nearly impossible using routine/pure mathematical or statistical methods. Thus, to study the dynamic interaction between the financial and economic systems, the economic activity is

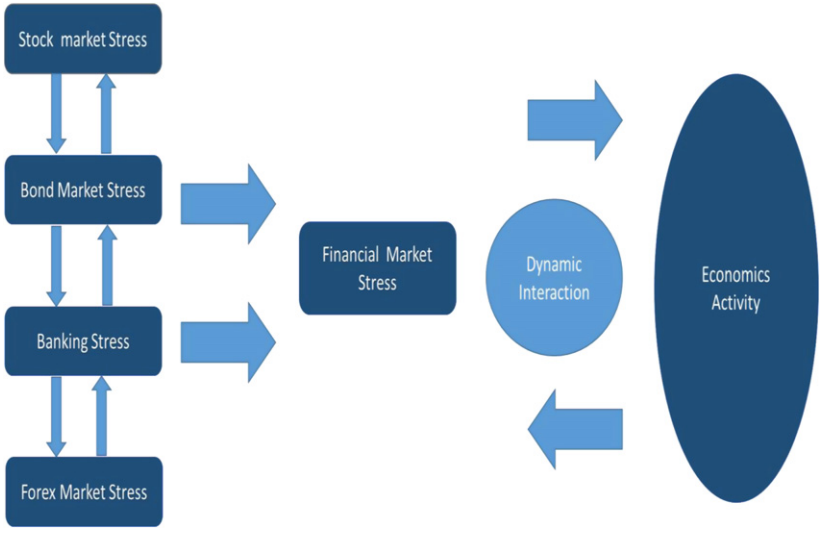

Figure 1.1: Framework for the Dynamics of Financial and Economic Systems. *Source*: Framework from author's research.

confined to four important variables; GDP growth, inflation growth, money supply growth, and interest rates.

However, the impact of financial system stress on other important economic variables such as stock market capitalization, government debt, external debt, domestic credit expansion of banking sector, bank capital to assets ratio, current account balance, FDI, fiscal balance, Forex reserves, gross fixed capital formation, household debt, household expenditure, banks nonperforming assets, annual budget revenue, welfare spending, unemployment rate, and interest on debt are studied using analytical/quantitative methods in the last chapter.

The primary objective of the study is to understand the important and pressing economic issues around the world via the financial market behavior and its feedback mechanism to the economic system and vice versa.

1.4. Flow of the Book

- *Chapter 2: Financial System Stress Analysis*. In this chapter, a detailed introduction to the financial stress, its interpretations, and computations have been presented. The construction of financial stress index along with financial stress analytical are also discussed.
- *Chapter 3: Financial System Credit Analysis*. This chapter details the analysis of the credit expansion patterns of the individual financial markets. The credit dynamics and its analytics are discussed in detail.
- *Chapter 4: Dynamics of Financial and Economic System*. This chapter discusses the economic model risk and causality patterns between economic and financial system variables. The multivariate analysis and the dynamic interactions are discussed in detail.
- *Chapter 5: Interpretations and Global Outlook*. This chapter discusses the impact of financial system shocks on a multidimensional economic system and vice versa. It also discusses many important observations and insights drawn from the present study.