

A FINANCIAL STRESS MEASURE FOR PAKISTAN ECONOMY: IMPLICATIONS FOR REAL ECONOMIC ACTIVITY

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ABSTRACT: *The onslaught of financial crises of 2008 signified the importance of a mechanism that can provide early warning signs of a stressed financial system. The present study is intended to design a monthly financial stress index for the Pakistan economy during the period 2000-2013. Components that constitute the index are banking sector stress, stock market stress, Exchange market pressure index, sovereign debt spreads between Pakistan and United States, and stock bond correlations. Principal component analysis is used to aggregate the components into a single index. Empirical analysis reveals that banking sector and stock market volatility are the leading contributors to financial stress in Pakistan. The developed financial stress index was successful in identifying three key instances of financial turmoil affecting the financial system including the global financial crisis of 2008. The study further observes the impact of our financial stress index on broad macroeconomic indicators using impulse response function and granger causality analysis. Both tests confirmed the negative impact of heightened financial stress on economic activity as high values of the financial stress index leads to decline in macroeconomic indicators. The paper is first of its kind that constructs a financial stress index for Pakistan and demonstrates its impact on real economic activity.*

Key words: Financial stress, Banking stress, Stock market volatility, Economic activity, Pakistan

1. INTRODUCTION

The US financial crisis and its impact on the real economy fueled the discussion of the possible causes of the crisis among practitioners and researchers alike. There is consensus in the literature that financial downturn stems from increased stress in the financial markets. Banking sector, foreign currency market, and securities market are the mainstays of the financial system in an economy. An imbalance in these major markets leads to an increase in financial stress and if the impact is too large it can lead to a financial crisis. Financial stress is interference in the normal working of the financial markets. Illing and Liu [1] describe financial stress as the pressure exerted on economic agents by increased uncertainty and varying expectations about risk of loss in financial markets. Balakrishnan *et al.* [2], defines an episode of financial stress as a period when the financial markets are under strain and their ability to intermediate is weakened.

Quantification of financial stress in an economy is very important so that policy measures shall be taken in advance to avoid a financial crisis or at least to reduce the severity of its impact. Various studies have been conducted that focus on banking, currency, and debt markets to gauge financial stress arising from these markets using binary variables. However, these studies are not appropriate to examine periods of financial stress because these binary variables show either crisis or no crisis and does not measure intensity of financial stress in a country [2]. Furthermore, less attention has been given to the stress arising from the securities market. In addition, only a few recent studies have focused on the construction of financial stress index to measure the overall financial stress in developing and emerging economies Cardarelli, *et al.*[3]; [2]; Cevik *et al.* [4].

Moreover, in today's world dependence of economic activities upon the financial markets has increased. Studies from developed countries suggest that stress in financial markets severely affects the economic activities and

ultimately leads to an economic downturn. If financial markets become more stressful, financial institutions will tighten their credit standards and increase the rate of interest at which they are willing to grant loans. Thus, individuals and firms will find it difficult to finance their economic endeavors. Consequently, decrease in individual's spending and decline in investments by firms will lead to an economic recession. Therefore, it is very important to examine the impact of financial stress on macroeconomic environment.

The main objective of this study is to construct a comprehensive financial stress index for Pakistan. The index proposed by Balakrishnan *et al.* [2], for developing countries and Cevik *et al.* [4], for Turkey is followed and possible modifications have been made with context to Pakistan economy. The index named as Financial Stress Index for Pakistan (FSIP) will provide valuable insights for policymakers as an increase in aggregate index will suggest special attention and policy response. The analysis is further extended to investigate the effect of FSIP on macroeconomic indicators. A significant relationship between these measures implies that heightened periods of financial stress negatively affected the real economy. The study is the first of its kind that is designed to construct a financial stress index in the context of Pakistan. The rest of the paper is organized as follows. Section 2 includes a review of past empirical work on financial stress and its link with economic activity. Section 3 discusses the components of financial stress used in this study to aggregate financial stress and construction of FSIP with the use of Principal Components Analysis (PCA) technique. Section 4 describes the results and analysis of financial stress index, section 5 empirically discusses the implication of financial stress on macro-economic situations and section 6 concludes the discussion.

2. MEASURING FINANCIAL STRESS

A much of the earlier empirical work focused upon measuring financial stress arising from the banking system because the banking sector has been a significant contributor towards systemic financial crisis. Cardarelli et al. [3] found that financial stress caused by the banking sector leads to more severe and prolonged financial crisis than periods of financial stress in securities and currency markets. Davis and Karim [5] argued that as several new economies are building their banking systems and banking innovations are taking place, the existence of a mechanism that intimate an early warning for the systemic banking crises is becoming more important. Kunt and Enrica [6] explored that crises began to emerge when a country is experiencing a weak macroeconomic environment, low growth and high rate of inflation. In addition, high real interest rates were associated with systemic crises in the banking sector.

Koop and Korobilis [7] postulated that construction of a financial stress index involves three concerns. Variables of the financial system to be aggregated to shape a composite index, assigning weights to these financial variables, and the interaction between financial stress index and measures of real economic activity. Kliesen et al. [8], conducted a survey of financial stress indexes constructed after global financial crisis. They found that there is a disagreement in the literature upon the variables to be used to measure financial stress.

Financial stress was more comprehensively measured after the U.S financial crisis of 2008. Hakkio and Keeton [9] examined episodes of financial stress by constructing a comprehensive index of financial stress for the U.S economy named as Kanas City Financial Stress Index (KCFSI). The index incorporates 11 variables of financial markets, including T-Bill spread, high yield bond spread, 5 year treasury spread, and volatility in the share prices. The index was successful in detecting widely known episodes of financial stress. Hubrich and Tetlow [10] evaluated the financial stress index used by Federal Reserve Board of U.S to monitor financial crisis of 2008. Study postulated that negative financial events severely affected the U.S economy and conventional monetary policy measures are not appropriate for such situations.

The events like global financial turmoil of 2008-2009 and the European debt crises strengthen the case of examining stress in the financial system and its impact on the real economic activity. From the context of European countries, Islami and Ryeol [11] constructed a financial stress indicator to predict the upcoming fluctuations in the real economies. They discovered that financial stress indicator has more predictive ability to capture the European banking crisis and sovereign debt crisis. Hollo et al. [12] argued that measuring financial stress through the consolidation into a single indicator only provides a rough, unnatural and highly imperfect view of the financial system. Gadanecz and Jayaram [13] conducted a review study to evaluate the performance of financial stability measures. They pointed out that financial stability is far more difficult to measure than measurement of price stability. Slingenbergh and Haan [14] claimed that complete magnitude of financial stress is hard to predict with a certain set of variables.

Less attention has been devoted in the literature upon constructing a financial stress index for developing and

emerging economies except few recent studies. The pioneer work in this regard was conducted by Balakrishnan et al. [2]. They designed an index of financial stress for developing countries. The study also examined the transmission channels of financial stress among developed and developing countries. Cevik, et al. [15] measured financial stress in economies of Russia, Poland, Hungary, Czech Republic, and Bulgaria by using a financial stress index for each economy. The index successfully captured the key periods of financial stress as high values of the financial stress index conforms to the known financial crises occurred in these countries. Subsequently, they analyzed the connection between financial stress and real economic activity. Impulse response function analysis found relationship between financial stress and measures of the aggregate economic activity. A more recent study was designed by Cevik et al. [4] in the developing economy of Turkey. They developed a financial stress index for Turkey by modifying the index constructed by Balakrishnan et al. [2] for developing countries. High values of index tend to correspond the heightened periods of financial imbalances. Furthermore, periods of higher financial stress were associated with economic recessions.

3. COMPONENTS OF FINANCIAL STRESS INDEX

Review of the aforementioned literature signifies that financial stress mainly emerges when there is problem in the four major financial markets, namely banking sector, stock market, currency market, and debt market. In addition, there are also some variables specific to the context of Pakistan like sovereign debt spreads and correlation between stocks and bonds that contributes towards financial stress. A brief description of Components that constitute the financial stress index for Pakistan is provided below.

3.1. Stress in the banking sector

Prolonged stress in the banking sector can lead toward a systemic banking crisis in the economy. Cardarelli *et al.* [3], used yield term spreads measured as the difference between short term and long run government issued securities as measure of banking sector stress. Similar to [2] and Roye [16] we have employed banking sector beta from the standard Capital Asset Pricing Model (CAPM) as a measure of banking sector vulnerability. A beta value greater than one will indicate that banking stocks were more volatile than the overall stock market, hence likelihood of a banking crisis will increase. During high stress periods this measure will reflect a sharp decline in the banking stock prices as compare to the overall stock market prices. Banking sector beta is defined as follows.

$$\beta_{i,t} = \frac{\text{cov}(r_{i,t}^M, r_{i,t}^B)}{\sigma_{i,M}^2} \quad (1)$$

Where r^M reflects excess return of the overall market and r^B reflects excess returns of the banking sector calculated on monthly basis.

3.2. Securities market stress

The imbalances in securities market is an important source of financial stress especially in the developing countries. Only a few studies have included this measure in constructing the financial stress index. [3] ; Bollerslev et al. [17] measured stock market related stress by computing

yearly changes in the country’s stock index and multiplying it by minus one . In this way a decline in the securities prices indicate increased stress in the securities market. Following Balakrishnan *et al.* [2] we used country beta from the CAPM to capture the stress arising from securities market. For this purpose MSCI-Barra World Index (WI) was used as the benchmark index of the world stock market and Karachi Stock Exchange 100 index (KSE 100) as representative of Pakistan’s securities market.

$$\beta_c = \frac{\text{cov}(r_t^w, r_t^c)}{\text{var}(r_t^w)} \tag{2}$$

Where r^w is the excess returns on the world index and r^c is the excess return on the index of a country’s stock market that is KSE 100 index.

3.3. Currency market stress

Stress arising from the foreign exchange market is a very important component of overall financial stress, especially in the context of developing and emerging economies. The majority of the studies in this regard follows the work of Girton and Roper [18]. They developed Exchange Market Pressure Index (EMPI) to track the degree of pressure on the exchange rate. Many studies in the literature used alternative models to measure pressure on the exchange rate. But these alternatives of EMPI fail to identify currency crises successfully. Bussiere and Fratzscher [19] argue in favor of the EMPI because of its ability to identify both successful and unsuccessful speculative attacks. Following the literature we construct EMPI using movements in exchange rates and changes in international reserves as under.

$$\text{EMPI}_t = \frac{\Delta e_t - \mu \Delta e}{\sigma \Delta e} - \frac{\Delta \text{RES}_t - \mu \Delta \text{RES}}{\sigma \Delta \text{RES}} \tag{3}$$

Where Δe_t and ΔRES_t reflects 12-month changes in exchange rate and changes in total reserves minus gold. μ and σ are measures of mean and standard deviation of exchange rate and foreign exchange reserves respectively.

3.4. Sovereign debt spreads

Changes in investor’s risk perceptions are signaled by a shift in sovereign debt spreads and it is an important indicator of financial stress in the developing countries. Cevik *et al.* [4] incorporated this variable in the construction of financial stress index for developing countries. The interest rate spread between Pakistan and United States (U.S) can indicate the sentiments of investors about risk in Pakistan. So we take the difference between yield on Pakistan investment bonds and 10-year U.S Treasury yield to measure this variable.

3.5. Correlation between stocks return and bonds return

During financial stability returns on stocks and bonds are either unrelated or tend to move together. However during periods of financial stress investors may perceive stocks as

more risky than government bonds. As a result they will shift their investment from stocks to bonds so the returns on the two securities will move in opposite directions. Baur and Brian [20] confirm that correlation between returns on stocks and government bonds becomes negative during financial crisis. Similar to the work of Hakkio and Keeton [9] the stock-bond correlation will be calculated between the returns on KSE-100 index and the return on government bonds.

3.6. Construction of FSIP

We construct FSIP on a monthly basis to measure the degree of financial stress in Pakistan from January 2000 to August 2013. Data was collected from websites of State Bank of Pakistan (SBP), Karachi Stock Exchange (KSE) and MSCI-Barra world indices. Data related to T-bill rates, foreign exchange rates, international reserves, and claims on the private sector was obtained from SBP. The stock market index and banking sector index were collected from KSE’s official website. Data on the world index and sovereign bond spread was obtained from World Bank Global Economic Monitor and MSCI-Barra’s official website respectively. Before combining the components, all the variables were standardized by deducting their means and dividing by their standard deviations so that they are not influenced by the measurement units or by magnitude of individual series [21]. Various methods are used in the literature in combining the stress variables into a single index. Illing and Liu [1] applied different weighting techniques in constructing an index of financial stress like factor analysis, economic weights, variance equal weights and cumulative distribution function. [2 &3] used variance equal weighting scheme. Similar to Hakkio and Keeton [9] we apply principal component analysis in aggregating the components into a single index. The idea of making principal components arises from the fact that number of variables may be highly correlated with each other and they may almost reflect the same fundamentals. So, PCA generates primary drivers of a set of data that are more easily interpretable and convenient to manage [21]. To construct the financial stress index chosen principal components will first be multiplied by the share of total variability explained by them and then will be summed up to form a single index [22].

4. RESULTS OF ANALYSIS

Table 5.1 presents the contribution of each component to explain variation in the FSIP. The amount of variation explained by some of the variables is quite low and the reason is attributed to several factors. Basic problems witnessed by the Pakistan economy in the recent decade was political instability, poor formulation and implementation of policies, poor law and order situation, and energy crisis. So these structural and governance issues were the main contributing factors for economy rather than external issues or financial imbalances [23].

Table 1: Results of Principal Component Analysis

Variable	Weight
Banking Beta	0.24
Country Beta	0.214
EMPI	0.209
Stock& Bond Correlation	0.178
Sovereign Spreads	0.156

Source: Author calculations

Banking sector Beta explained the large variation in the final FSIP. The reason is when the economy is witnessing financial strain it will also be signaled through the banking system. Normally in such a scenario, investors will believe that the banking securities are more risky than the other corporate stocks. Consequently, the banking sector beta will be higher than the stock market beta. During the sampled period banking beta has been quite higher than the stock market beta in most instances. As a result it has highest contribution towards financial stress in FSIP.

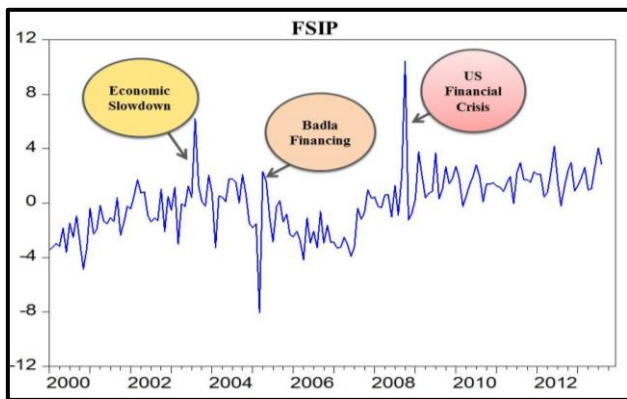


Fig. 1 Financial stress index for Pakistan

Country beta is the next significant contributor towards FSIP. During the period of study Karachi Stock Exchange witnessed many ups and downs. At some points it just crashed and investors lost all their money. At other times it crossed the previous psychological barriers and reached to its peak. This volatility was gauged by the country beta. A beta value greater than one at numerous periods depicted that KSE 100 index has been more volatile in its behavior than the benchmark world index. During the period of study there was a continuous depreciation in the value of Pak rupee mainly due to balance of trade deficit, economic slowdown, deficit financing, and an unstable economy. So EMPI explains about 21% of the variation in the FSIP. Similarly, stock and bond correlations caused 17.8% variation in financial stress in Pakistan. Sovereign spreads explains the least amount of variation in the FSIP that's why it carries the lowest weight of 15.6% in the PCA.

The above figure presents the yearly behavior of FSIP. Major episodes of financial stress that transformed to a full fledged financial crisis are highlighted. The main factors leading to financial crisis in a particular year are also presented. The financial imbalance of 2003 was caused by a weak macroeconomic environment that led to slump in country's major financial markets. The financial downturn of 2005 was attributed to manipulation in the stock market and introduction of badla financing facility by KSE. Consequently, investors were of the view that stock market is not working on fundamentals so they withdrew investment from market. Increased risk and lack of investor

confidence transformed the financial distress into a financial turmoil. As it is commonly believed that U.S financial crisis of 2008 affected the whole world, it is apparent in the graph that Pakistan witnessed the biggest episode of financial stress in this year which in turn converted into a financial crisis.

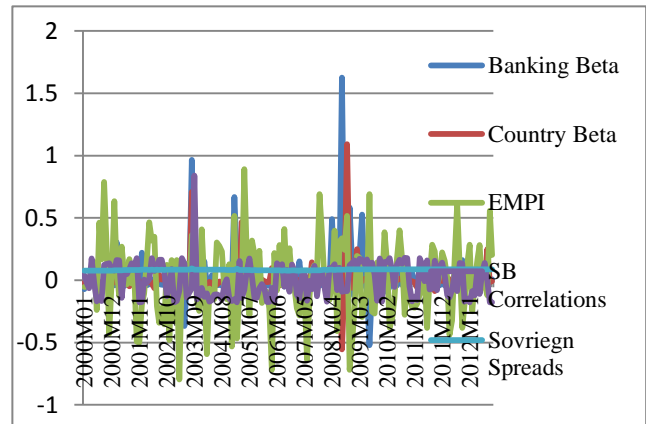


Fig.2 Aggregate monthly behavior of FSIP

It is important to study the behavior of financial stress index over the business cycle to identify the periods of financial stress traced by the FSIP. Fig.2 presents the aggregate monthly behavior of FSIP. It indicates that Pakistan economy witnessed three major stress periods during the period of study. The time period from the beginning of year 2000 up till middle of the year 2003 can be characterized by financial stability and smooth performance of economy system as indicated by the graph. However, in the mid of year 2003, FSIP is showing symptoms of financial stress as highlighted by a sharp upward movement in the index that mainly stemmed from economic imbalances. This led to a decrease in the assets class performance of the KSE from 112% in the year 2002 to 66% in the year 2003. The returns in the bond market were also facing downward trend as returns on Pakistan investment bonds fell from 10% in the year 2002 to 6% in the year 2003. The same slump was witnessed by the money market as the return on the T-bills declined from 6% in year 2002 to merely 2% in the year 2003 [24]. The year 2004 can be considered as a financially stable period because financial stress was quite low and it further decreased by the end of the year. Yet, the first month of 2005 was marked by a sudden increase in financial stress as indicated by a rapid increase in financial stress indicator. This financial hype is attributed to irregularities and manipulations in the country's leading stock market. Majority of the small investors in Pakistan take decisions based on intuitive factors forces rather than rational analysis of market fundamentals [25]. At that time most of the investors perceived that stock prices has moved away from their fundamentals and are working only on the basis of speculations and manipulations. Thus, prevailing uncertainty and suspicion led to decrease in trading activity and a decline in the financial markets [26].

Financial system responded to the worldwide financial crisis that started from the U.S. in 2008. Crisis initiated in Pakistan by problems with the balance of payment account resulting from high oil prices and increase in the commodity prices. Inflation during this period reached to 24%. This balance of payment crisis hit Pakistan at a time

a) **Response of economic activity to shocks of financial stress**

b) **Response of FSIP to economic activity**

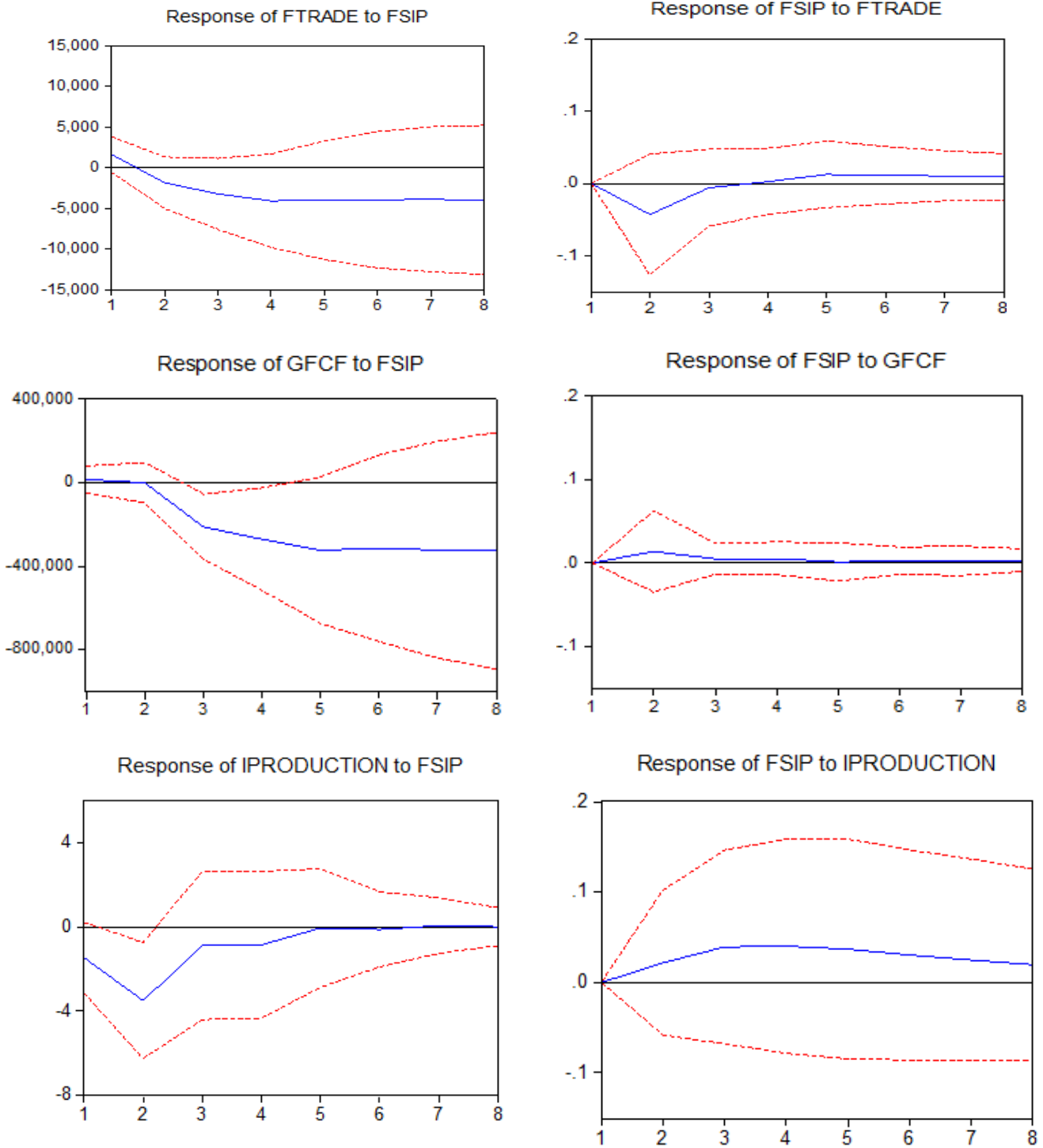


Fig. 3 Impulse response function from unrestricted VAR model

¹In Fig. 3 FSIP is a financial stress index for Pakistan, FTRADE is foreign trade, GFCF is gross fixed capital formation and IRODUCTION denote industrial production

Table 2: Granger Causality between FSIP and Economic Activity

<i>Null Hypothesis</i>	<i>F-statistic</i>	<i>Probability</i>
FSIP does not Granger Cause Foreign Trade	8.553	0.013
Foreign Trade does not Granger Cause FSIP	1.617	0.265
FSIP does not Granger Cause Gross Fixed Capital formation	15.419	0.003
Gross Fixed Capital Formation does not Granger Cause FSIP	7.381	0.019
FSIP does not Granger Cause Industrial Production	3.394	0.093
Industrial Production does not Granger Cause FSIP	0.273	0.769

Source: Author calculations

when the donor countries, including U.S and European Union were facing subprime disasters. Pakistan tried for a bailout package from U.S, Saudi Arabia and China but could not get any financial assistance to come out of this situation. Hence excessive financial stress transformed into financial crisis.

5. CONNECTION BETWEEN FINANCIAL STRESS AND MACRO-ECONOMIC ACTIVITY

There are several studies from developed countries on analyzing the relationship between financial variables and the real economic activity. Gertler [27] discussed paradigm shift in the perception about behavior of financial markets and real macro-economic environment. The belief that economic recessions stems from a slowdown in the real economic transactions and not from the financial performance was criticized during this period. And the policy makers and economists were of the belief that financial system shall be critically observed and regulated because it can significantly affect growth and output in the real economy. Information asymmetry in financial markets can lead to inefficiencies which can have serious implications for macroeconomic environment.

Problems in the financial system have a ripple effect on the real sector of the economy. Several sources of links have been discussed in the previous studies. The results of Hakkio and Keeton [9] show that increase in financial stress leads to more tightening of credit terms at the part of bank and increase the cost of obtaining funds for firms which in turn reduces economic activity in the U.S. Cardarelli *et al.* [3] found that more often financial stress causes an economic slowdown in 17 developed economies. Davig and Hakkio [28] concluded that increase in financial stress have a much more severe impact on the economic activity when the economy is already in a state of distress. When stress in the financial system crosses a certain threshold level, the real economic activity is significantly affected [29].

In this section, we tested the relationship between FSIP and measures of real economic activity by impulse response function from Unrestricted Vector Autoregressive (VAR) model and Granger causality analysis. Measures of economic activity used in this study includes yearly growth rate in industrial production, annual growth rate in foreign trade measured as the sum of imports and exports and year wise growth rate of gross fixed capital formation. Most of the countries experiencing high economic growth have a

large volume of foreign trade so taking growth rate in foreign trade as indicator of economic activity is essential. The data regarding these variables was obtained from State Bank of Pakistan and Pakistan Bureau of Statistics.

The most relevant phenomenon that we want to observe in the above testing is response of economic activity to financial stress shocks. The impulse response function basically depicts that if one standard deviation shock is given to one economic or financial variable, then how it affects the other related variable. The graphical representation of the impulse response function demonstrated that financial stress shocks lead to a significant reduction in real economic indicators. First figure clearly shows a decline in foreign trade as a result of an increase in financial stress shocks. Black line representing the behavior of foreign trade reflects a downward trend as the number of financial stress shocks increases. Similarly, the gross fixed capital formation also present a downward trend in response to increased financial stress shocks. The response of industrial production to increase in financial shocks is quite volatile, but the line stays in the negative region. The impulse response function presents a strong case of decline in economic activity as a result of increased financial stress in the context of Pakistan.

Evidence regarding Granger causality between FSIP and the indicators of economic activity is presented in the above table. The economic series was found to be stationary as it is an important condition for Granger causality analysis. The hypothesis of whether FSIP Granger causes economic activity provides promising results. First null hypothesis shows that there exist a Granger causality relationship between FSIP and foreign trade and the results are robust at 5% level of significance as evident by the probability value of 0.013. Our second hypothesis strongly recommends Granger causality between FSIP and gross fixed capital formation and the null of no Granger causality is strongly rejected as indicated by the F-statistic and corresponding significance level. Similarly, null of FSIP does Granger cause industrial production is rejected at 10% a significance level. These findings suggest a significant connection between financial stress and economic activity. And high values of FSIP negatively affected the real economy. However, most of these economic series does not granger causes FSIP and the results are consistent to that of Cevik *et al.* [15]

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6. CONCLUSION AND POLICY IMPLICATIONS

Since independence, Pakistan's economy has experienced several episodes of financial imbalances. This study examines periods of financial stress in Pakistan during 2000-2013. Those variables are used that capture some unique aspects of financial markets to construct a financial stress index. PCA aggregate banking sector volatility, stock market volatility, EMPI, stock & bond correlations, and sovereign debt spreads between Pakistan and U.S to construct the financial stress index for Pakistan. The results of analysis disclose that the components individually explained smaller proportion of variation than expected. It indicates that financial stress was a meager problem for Pakistan's monetary and financial system rather poor formulation and implementation of policies, political instability, energy crisis, and terrorist attacks were some of the key factors responsible for a weak financial and macro-economic environment [30]. Moreover, the banking sector and stock market volatility were the leading variables that contributed towards financial stress in Pakistan. For the reason that during the period of this study, these two sectors experienced several instances of volatilities and financial imbalances. Mainly, Karachi stock market has been exposed to several political and economic tremors. Empirical analysis shows that along with smaller financial shocks, FSIP was quite successful in capturing three major periods of financial vulnerability that hit the Pakistan's financial system during this period.

It is a well-researched phenomenon in developed world that high financial stress can negatively affect real economic activity mainly because the flow of capital from providers of funds and users of funds will be contracted due to increased uncertainty in financial markets. Pictorial demonstration of impulse response function confirms that high financial stress shocks are associated with contraction in real economic indicators. In addition, FSIP has significant Granger causality relationship with foreign trade, the index strongly Granger cause gross fixed capital formation and a moderately strong Granger causality exists between FSIP and industrial production. Results suggest that excessive financial stress caused an economic slowdown in the context of Pakistan.

The developing countries shall design policies to avoid the negative consequences of high periods of financial stress. These corrective policy measures depend on the underlying factors causing financial stress. If the financial stress arises due to problems in the securities market, policy actions shall focus to strengthen this market and remove underlying inefficiencies. Nonetheless, if financial stress is caused by some external source such as transformation of stress from other countries, then coordination in international policies becomes inevitable in managing financial stress. Our FSIP provides a benchmark for measuring the intensity of financial stress. It also signals the contribution of each financial component to overall financial stress index and therefore can provide considerable insights to policymakers

in formulation of suitable financial and macro-economic policies.

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