

Measuring Financial Stress: The Case of Pakistan Economy

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Abstract:

The onslaught of 2008 financial crises that started in United States (U.S) strengthens the case of measuring financial stress to avoid the severity of such financial turmoil. This empirical study is aimed at developing a financial index for Pakistan economy during the period of 2000-2013. The study grasped different variables that are associated with the stress of financial system. Subsequently the paper used principal component analysis technique for the formation of single stress index. Empirical analysis disclosed that banking sector and stock market volatility are the leading contributors to financial stress in Pakistan. The developed financial stress index was successful for identification of three main crises that creates fluctuations in financial system. Moreover the analysis also reveals the individual contribution of various financial market components towards the proposed financial stress index for Pakistan's scenario. Further, the study draws comparison of high financial stress episodes with Gross Domestic Product (GDP) growth and suggested that excessive financial stress leads to decline in economic growth. And financial stress shocks to some certain level cannot effect the economy progression that is way financial stress must exceeds specific level to affects the economic progression.

Key words: Financial system, Stock market volatility, financial stress, Economic activity, Pakistan Economy

1. Introduction

The Global financial crisis (2008) is biggest promoter for the researchers to investigate the causes of crisis in economy. Literature presented evidence that elaborated the slump in financial markets due to financial downturn and also considered banking, foreign currency and securities markets as essential constitutes that act as foundation of any financial system of an economy. That is reason discrepancy in anyone market triggers financial stress in whole economy. Thus it is apparent financial stress is intervention created in routine functioning of financial markets. Different studies elaborated financial stress in different and inclusive way. Illing and Liu (2003) enlightened the financial stress as burden exercise on key drivers of economy, which creates doubt in financial market progression. Balakrishnan et al. (2009) clarified it as an episode of weak performance of markets. Hakkio and Keeton (2009) believed it as phase of ignorance of fundamental regulations of working for investors, asymmetry of information and low demand of risky assets. Due to advancement in trade, information and innovation leads towards the formation of an inter-reliant financial system which causes better progression of an economy. On other side modern era established linkage of financial and trade that causes some critical impact on economy that is biggest contributor of financial stress. Now these days, world considered financial markets foremost attribute for advancement in economic activities. Basically stress in financial markets causes the tightening of credit policy by cutting down the interest rate of loaning. That is way this contribution of interest rate prove the effect of financial market working on macroeconomic environment.

So, Pakistan's economy no doubt faced different challenges but still behaviour of financial stress revealed remarkable inference of Pakistan's financial market. Different studies elaborated that economy of Pakistan experienced financial stress from last few periods. In view of that it becomes the need

of an hour to investigate the factors of financial stress. And further examine the essential policy measures required for the lessen the severity of this stress. Prior studies used binary variables (0 and 1) for checking the existence of financial stress by capturing banking, currency and debt markets. Although these studies not proved beneficial for calculation of financial stress level. Balakrishnan et al. (2009) claimed all investigations that used binary variables inappropriate because these investigations just captured the fact of presence or absence but cannot explained the severity of the stress and its influence on economy. Few studies pay attention on construction of financial stress index for developing countries. So, major contribution of this paper is construct financial stress index for Pakistan. Formation of this financial Stress Index will prove fruitful for policymakers.

2. Review of Past Empirical Work

Previous studies focus on calculating financial stress occurs due to banking system, reason behind this is banking sector has been proved chief provider that leads towards systemic financial crisis. Kunt and Detragiache (1998) operate multivariate logit econometric model for evaluation of predictive ability for getting early warning systems for banking crises. The outcomes specify that feeble macroeconomic environment categorized by low growth and high inflation is an hint for banking crises. Furthermore, high interest rates are linked with systemic banking sectors crises. Hardy and Pazarbasioglu (1999) defined the financial stress in different periods of stress that are apparent during the period of vulnerability for identification of warning sign of crisis in banking system. After that Davis and Karim (2008) further explained the same phenomena in more detail and explained the negative influence of crisis on trade and GDP of economy. Laeven and Valencia (2008) recommend policies as solution for systemic banking crisis by taking data of 37 countries of period

1970-2007. Balakrishnan et al. (2009) explained that these studies are not properly authenticated due to usage of zero-one binary variables, which explained the presence or absence of any condition but cannot explain the severity of the condition. Babecký and Havránek (2012) explained that banking, debt, and currency crisis by using quarterly data of 40 developed countries from 1970 to 2010. Study exposed that banking crises were more frequent in developed countries by using vector autoregression model that linkage of currency and debt crises with banking crises. Koop and Korobilis (2013) nominated that three constitutes of financial stress index named: aggregated to shape a composite index, assigning weights to financial variables, and the interface between financial stress index of real economic activity.

Developed and under-developed countries were affected by the financial crisis alike. These stresses always show negative influence on economic growth (Cevik et al., 2013). Thus, it becomes need of an hour to calculate the level of financial stress by quantifying all relevant variables. Financial stress index is essential for better evaluation of any financial system and also proved beneficial for planning the monetary and fiscal policy measures. Few important institutions regularly calculate and report the financial index named Bank of America Global Financial Stress Index (GFSI), Kansas City Fed's Financial Stress Index (KSFCI), and St. Louis Fed's Financial Stress Index (STLFSI).

For investigation of sound banking sector in Pakistan, State Bank of Pakistan (SBP) organized stress analysis of 12 large banks in 2005. The stress indicators incorporated interest rate risk, exchange rate risk, equity price volatility and liquidity risk measure. These stress state were planned to calculate the influence of each measure on progression the banks. So, the motivation behind this investigation is to fill the gap by calculation the stress index in case of Pakistan. There are few studies that considered making of financial stress index for developing and emerging economies. The initial study

conducted by Balakrishnan et al. (2009) related to index construction. Further Cevik et al. (2012) calculate financial stress influence on economy of Russia, Poland, Hungary, Czech Republic, and Bulgaria with help of index formation by taking banking sector volatility, stock market volatility, exchange market pressure index and trade credit as constitutes of index. and study concluded the presence of stress that showed negative influence on economic progress with help of bi-variate vector autoregression and impulse response function analysis. Cevik et al. (2013) prepared index for Turkey by manipulating the index constructed by Balakrishnan et al. (2009). Variables used in the investigation are securities market risk, foreign exchange risk, external debt, sovereign risk, money market spreads trade finance and credit stress. All the variables were accumulated with help of principal component analysis. The index captured financial crises that happened in Turkish economy during 1997-2010.

3. Components of financial stress index

Financial stress occurred when there is obstacle for appropriate working of following: banking sector, stock market, currency market, and debt market. Further debt spreads and correlation between stocks and bonds are also considered as an essential source for the crisis measurement. Details of all components are discussed below.

3.1. Stress in the Banking Sector

Systemic functioning of banking sector always verified better progression of an economy. So, obstacle in proper functioning of this sector causes obstruction in whole economy. Basically this snag arises due to inability of corporate and financial sector to reimburse the contract on the dot. Further due to non performing loans sharp decline occurred on prices of equity and interest rates increases, on other hand flow of capital show decrease. Basically countries faced crisis when there is country

is suffering from weak macroeconomic environment, low growth and high rate of inflation. And high real interest rates was linked with crisis in banking sector. Banking sector beta is calculated by correlating banking sector index with index of overall stock market. Value of $\beta > 1$ showed more volatility of banking stocks, which indicates high chances of crisis.

3.2. Stress in the Securities Market

Three security markets perform the responsibility of providing funds that deals with equity market in Pakistan named: Karachi Stock Exchange (KSE), Lahore stock exchange, and Islamabad stock exchange. Main among all three is KSE due to largest share in terms of trading volume and liquidity. In 2002 KSE was declared as best performing equity market of the world. Its main index on basis of market capitalization is KSE-100 index that was introduced in 1991. The stress in securities market is calculated with help of country beta from CAPM. Here MSCI-Barra World Index (WI) is used as benchmark index of the world and Karachi Stock Exchange 100 index (KSE 100) as representative of Pakistan's securities market.

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

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

3.3. Currency Market Stress

Bussiere and Fratzscher (2006) 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 rate and changes in international reserves as under.

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

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:

The interest rate spread between Pakistan and United States (U.S) can indicate the sentiments of investors about risk in Pakistan. So, study takes the difference between yield on Pakistan investment bonds (PIB) and 10-year U.S Treasury yield to measure this variable.

3.5. Correlation between Stocks Return and Bonds Return

It is considered that stocks are more risky than government bonds that are way preference for investment shifted from stocks to bonds. Baur and Brian (2008) confirm that correlation between returns on stocks and government bonds becomes negative during financial crisis. Hakkio and Keeton (2009) the stock-bond correlation calculated between the returns on KSE-100 index and the return on government bonds.

3.6. Credit Stress

Rey (2009) emphasized that credit stress shall be included for the construction of financial stress index. Cevik et al. (2013) calculated by growth rate in claims of private sector for credit stress.

3.7. 3-months KIBOR/ T-Bill Spread

3-months KIBOR is the rate at which banks lends to each other for shorter period of time. It is measured by capturing three different aspects of financial stress, flight to liquidity, flight to asset quality, and asymmetry of information (Hakkio & Keeton, 2009).

3.8. Corporate Bond Spreads

This measure account for the difference between corporate bond yield and long-term government bond returns. In case of evasion uncertainty on corporate bonds publisher is high as with respect to treasury bonds of similar maturity. Reason behind is these treasury bonds are reversed by the government form any uncertainty. Hakkio and Keeton (2009) elaborated that use of corporate bond spreads in constructing financial stress index for U.S economy is of main consideration. This study make comparison between bonds carrying different ratings assigned by the bond rating agencies. But unfortunately in context of Pakistan, bond market is not much developed. There are only few private corporations that issued bonds to raise funds and data for these transactions is not available on reliable information databases.

4. Construction of financial stress index

The investigation created index on monthly basis for calculation of level of financial stress in Pakistan from January 2000 to August 2013. Data related to all the constitutes of index were collected from websites of State Bank of Pakistan (SBP), Karachi Stock Exchange (KSE) and MSCI-Barra world indices. Information regarding T-bill, foreign exchange rate, international reserves and claims on private sector collected from SBP. Statistics of stock market index and banking sector index was taken from KSE's official website. Data of world index and sovereign bond spread were taken from World Bank Global Economic Monitor (WBGEM) 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.

Formation of index done by combining all components of stress after grasps all information regarding their nature. This index named as financial stress index. Principal component analysis uses the linear combinations of variables to model the

variance structure of a set of variables. This method helps for identification of pattern in data to separate the similarities and differences. This method is considered as variable reduction process and useful for huge data sets. But in this case usage of this principal is that all variables are highly correlated and posses same nature of rudiments (Angelopoulou et al., 2013).

5. Results of Principal Component Analysis

Table 5.31 depict the PCA of seven variables for investigating variation toward the constructed index. The investigation checked the influence of KIBOR ratio and credit stress into the index. KIBOR ratio is used to calculate stress existing in money market. T-bill hypothetically considered risk free securities for calculating variability in returns during times of financial distress but KIBOR higher ratio is due to higher lending risks that the banks are exposed to. Results concluded that banking beta described highest degree of variability in our index. KIBOR ratio and credit stress explains low variation in index that is way these two components does not justify their place into final index.

Table 5.1: Results of Principal Components Analysis

Variable	Weight
Banking Beta	0.289
Country Beta	0.1850
Exchange Market Pressure Index (EMPI)	0.154
Stock Bond Correlations	0.124
Sovereign Spreads	0.115
KIBOR to T-bills ratio	0.094
Credit Stress	0.038

Beta is a measure of systematic risk. Banking sector beta was higher than stock market beta showed highest contribution towards financial stress. Study explained few variables that showed low variation due problems witnessed by Pakistan economy in the recent decade. And major problem are political instability, poor formulation and implementation of policies,

poor law and order situation, energy crisis and the like (Draz, 2011). Country beta is the next significant contributor towards financial stress. This country beta is used to make a comparison of stability of a country's stock market with the benchmark world index. The world index is considered constant chiefly for evaluation of developing country's index. During the period of study Karachi Stock Exchange witnessed volatility that is represented by country beta. Investigation period shows consistent devaluation of Pak rupee due to trade deficit, economic slowdown, deficit financing, and an unstable economy. So, study explains the variation of 21% through these variables. Stock and bond returns are not significantly correlated but during periods of higher stock market volatility, investors make portfolio by making investment in bond market rather than stocks that depicts negative association between them. Sovereign spreads explains the least amount of variance in the index that's why it carries the lowest weight of 15.6% in the PCA. This factor is used for comparison of risk spreads between Pakistan and the U.S for getting better indication about investor's risk perception.

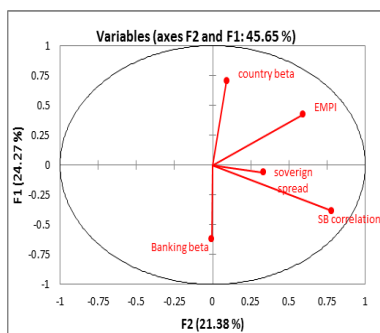


Fig.5.1 Wheel Diagram

Wheel chart is a representation of all change in each variable of financial stress index. Banking sector beta and Country beta captured major part of variance. They combine showed 45.65% of change in index. And the smallest change is shown by sovereign spreads because the sovereign spreads among

Pakistan and the U.S has not been sufficient volatile to cause variability.

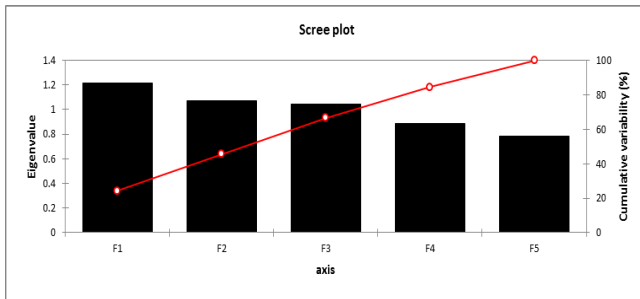


Fig.5.2 Scree Plot

Scree plot represents the individual and cumulative variability explained by each factor along with their respective eigenvalues. An eigenvalue basically reflects the change in length of a vector. Study explained that higher the variability higher will be the eigenvalue score of a specific factor as indicated by each rectangle on the Scree plot. The first factor contributes 24.27% into the overall variability as indicated by the dotted line on Scree plot, due to this reason highest eigenvalue is assigned to this factor.

Figure 5.3 represents aggregate attitude of financial constitutes of the index. The whole scenario elaborated the financial stress episode of 2003 was mainly caused by the interactions of problems in the banking system, bond market and a negative correlation between the stocks and bonds. On other hand the highest peak of financial stress was observed in 2008.

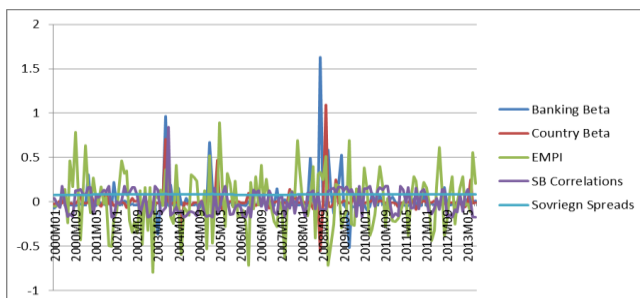


Fig.5.3 Combined Graph

6. Linkage between Financial Stress and Real Economy

GDP is considered as most essential leading indicator of economic activity. GDP growth statistics for 2003 revealed that problems in the financial system during that period did not affect the economic growth. But rather there is a marked increase in the value as compare to the preceding year. For year 2005 however financial turmoil transmitted its affects to the economy and GDP growth declined by 3% as compare to 2004. This substantial decrease suggests a significant contraction in economic activity. The financial crisis of 2008 also led to an economic downtrun as GDP growth declined from 3.68% in 2007 to 1.21% in the year 2008. These statistics revealed that in most cases high episodes of financial stress leads to an economic recession but it's not true for all recessions.

Year	Growth %	Year	Growth %
2000	1.96	2007	3.68
2001	3.11	2008	1.21
2002	4.73	2009	4.09
2003	7.48	2010	4.8
2004	8.96	2011	2.4
2005	5.82	2012	3.2
2006	6.81	2013	3.59

Source: Federal Bureau of Statistic

7. Conclusion and policy implication

Recent financial crises started in U.S and first affect the developed economies then it flowed towards emerging economies. Developing countries like Pakistan were also affected by these financial crises but severity of influence is different. The study used banking sector volatility, stock market volatility, EMPI, stock & bond correlations, and sovereign debt spreads between Pakistan and U.S for index formation of period 2000-2013. The result indicates that

financial stress was a meager problem for Pakistan's monetary and financial system rather poor formulation and implementation of policies, political instability, and terrorist attacks that causes weak financial and macroeconomic environment. Empirical analysis shows that index was quite successful in capturing three major periods of financial crisis that hit the Pakistan's financial system during the period of study. Our financial stress index successfully captured the affects of global financial crisis of 2008-09. The financial stress index rose to its highest level by the end of 2008 that is representation of extreme stress in the financial system. At that time Pakistan economy experienced higher level of inflation and deficit balance of payment. At that time IMF controlled the situation by a stand arrangement.

Due to negative relation of financial stress and real economic activity causes flow of capital from providers of funds and to users of funds. The results suggest that financial stress exceeding from a certain threshold level cause an economic slowdown in the context of Pakistan. Moreover, except 2003 high episodes of financial stress leads to a decline in the GDP growth.

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