Pakistan Economic Review
5:1 (Summer 2022), PP. 1-25

Interconnection between Financial and Fiscal Stress: Block-wise Analysis for Developed and Emerging Countries

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Abstract

This study examines the interconnection between financial and fiscal stress within three blocks, namely BRICS, OE, and G5. We collect data on 14 countries covering the period 2000 to 2016. We utilize the theoretical model proposed by Acharya et al. (2014), which explains a two-way theoretical linkage between bank bailouts and sovereign risk.We employ a vector autoregressive model to analyze the interconnection between stress indices. The findings confirm the existence of a feedback loop from bank to sovereign in the case of BRICS, particularly for OE countries.However, the feedback loop from financial to fiscal stress does not exist for G5 countries as financial and fiscal stresses are self-explanatory phenomena for these economies. The study proposes building sufficient fiscal buffers to avoid banks to sovereign feedback loops. Further, it also calls for lowering fiscal deficits and debt to safeguard fiscal sustainability.

JEL Classification: E44, F41, G01

Keywords: Financial stress, Fiscal stress, interconnection, systemic risk, fiscal sustainability, Vectorautoregressive models

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1. Introduction

The interlinkages between the real and financial sides of the economy have been analyzed vastly in the economic literature. Such inter-linkages became more prominent when the global financial crisis acknowledged the co-existence of financial and business cycles.Banking industries failed to play their intermediary role. This enormously squeezed the supply of credit by the private sector, forcing the governments to intervene in the financial markets. Fiscal authorities not only designed the fiscal support programs at national levels but also went to the IMF for bailouts. Consequently, a heated debate surfaced in policy corridors regarding whether the financial cycles are related to business cycles (Tagkalakis, 2013). These incidences confirmed the existence of feedback loops between financial markets and government actions, with the possibility of creating adverse feedback in either direction(Berti et al., 2012).

The interconnection between the financial and fiscal crises is not a new phenomenon. However, the nature of fiscal crises and their linkages to financial crises modified vastly over time. Before 1933, banking crises were regarded as banking panics or liquidity crises where depositors converted their deposits into currency(Schwartz, 1987). Such banking panics lowered the quantity of money supply beside interfered with the process of financial intermediation. This resulted in fiscal distress through lower real income and squeezed the government revenues. Later, with the advent of deposit insurance, the nature of banking crises transformed from panic to crisis.A direct link between the banking sector and government finances established where banking crises were resolved through fiscal bailouts since the *Great Depression*. A series of events, such as the breakdown of the Bretton Wood system in the 1970s and financial liberalization in the 1990s made the fiscal resolution to financial crises a more pronounced phenomenon. Emerging countries have faced banking and debt crises more frequently than developed countries. However, the sovereign debt crises of 2011 in the European region raised the debt-to-GDP ratio unprecedently for the developed countries. A high degree of interconnectedness between financial and public sectors stirred up imbalances when banking crises surfaced in 2007. In extreme circumstances, financial crises may lead to sovereign defaults in the absence of resolution policies as guarantees involve moral hazard problems (Bordo & Meissner, 2016).

More recently, a relatively more devastating Eurozone crisis regained interest in studying a noteable connection between financial and fiscal crises(Sumner & Berti, 2017). European countries were engaged in bailout packages, either after the transmission of sub-prime mortgage crises from the US or after their house price booms driven by bank credits. Such bailouts increased the fiscal deficits and debt-to-GDP ratios.Reinhart and Rogoff (2009) explained that expansionary fiscal policy in the event of falling taxes escalated the deficits much more than debt-to-GDP ratios. Such vulnerabilities in the European region reflected a lack of confidence in the international bonds market. This further defined the limits of monetary union (hereafter MU) without fiscal unions and weaker banking unions.

The most recent empirical literature on the subject has highlighted an inevitable connectedness between financial and fiscal stress for developed countries(Chau & Deesomsak, 2014; Mody & Sandri, 2012; Tagkalakis, 2013). Nonetheless, the empirical literature on the interconnection between financial and fiscal stress is scant concerning modeling and country coverage. For example, Magkonis and Tsopanakis (2016)examined the international transmission between financial and fiscal stress for G5 countries. Our study aims to contribute to the existing empirical literature in multiple ways. First, we incorporate political risk as a vital control variable for the interconnection between financial and fiscal stress.Second, we employ impulse response functions and variance decomposition methodologies to explore the dynamic impact of financial and fiscal shocks. VAR analysis provides an assessment of feedback impacts to the policymakers. This assessment can help them better understand the interlinkages between the real and financial sides. On the other hand, it helps to formulate policies that curb adverse feedback loops. Third, we extend the interconnection analysis between financial and fiscal stress for three blocks of countries, namely BRICS, other emerging (hereafter OE), and a group of developed countries (hereafter G5) for panel data over the period 2000-2016.This can help to design regional policies to counter adverse implications. In this exploration, we try to provide satisfactory answers to several questions. For example, whether financial and fiscal stresses are interconnected in a dynamic setup within each block? Put it differently, either there exist any empirical interlinkages between financial and real sides of the economy within developed and emerging country blocks.

The rest of the study is organized in the following sections. Section 2 reviews theoretical and empirical literature on the interconnection between financial and fiscal stress. We build empirical model, propose an econometric methodology, and discuss data in Section 3. The next section analyzes the findings. The last section concludes the study and draw policy guidelines.

2. Literature Review

The literature on the subject is classified into two sub-sections. The first sub-section briefly documents theoretical developments on the interconnection between financial and fiscal stress, while the second sub-section provides empirical evidence on the interconnection between financial and fiscal stress.

2.1 Theoretical Literature

The Theoretical literature on interconnection is very extensive. Pioneering works, under The theoretical literature on interconnection is fairly extensive. Pioneering works, under traditional approaches, quantified the effects of banking crises separately from financial and fiscal crises. A fair degree of disagreement existed on the issue of whether banking panics reflected liquidity panics by causing monetary instability or over-indebtedness(Friedman & Schwartz, 1963; Minsky et al., 1977; Wyplosz, 2012).

By the mid-1980s, greater financial market integration and financial development led to refinements in theoretical modeling. Based on inherent banking instability,Escolano et al., (2011)emphasized the maturity mismatch phenomenon. The first-generation models attributed fundamental imbalances as a vital cause of crises(Krugman, 1979). Their seminal work explained how a less repressed financial system created a dynamic interaction between financial and fiscal crises.Thus, fiscal deficits and debt rose significantly. Over-borrowing and fiscal deficits, financed via inflation tax, raised asset prices. This caused systemic banking and currency crises. Similar results were documented by Fedelino et al., (2009) for the emerging countries.

The decade of the 1990s was marked by the development of second-generation models of currency crises. These models pinpointed the role of expectations and multiple equilibria. Besides that, macroeconomic models with an explicit role in financial frictions dominated the economic landscape (Bernanke et al., 1999; OECD, 2008). Later on, the third-generation

models focused on the notion of contagion, where a crisis beginning in a nation may transmit to other countries through liberalized global markets(Gorina & Maher, 2016).

Another theoretical model developed by Cruces and Trebesch (2013) described the interconnection between sovereign risk and the integrated banking sector. Financial integration was introduced in the model as a condition that government debt in a country serves as collateral in the financial system of all MU countries. Without fiscal integration, international financial integration carries a risk of financial contagion. Similarly, Acharya et al. (2014) mentioned a loop between the bank and sovereign credit risks. An increased sovereign risk lowers the government guarantees and created feedback into the financial sector.

2.2 Empirical Literature

Numerous studies were conducted to assess the linkages between financial and business cycles (Claessens et al., 2011, 2012). They concluded that financial and business cycles are related to each other. A few studies analyzed the characteristics of the financial cycles. They found that financial and business cycles are a related but different phenomenon in terms of their asymmetric responses in the contraction phase, with the former having a long contraction phase than the latter (Drehmann et al., 2012).

Another line of research empirically examined the existence of feedback loops between financial and fiscal instability. For instance,Tagkalakis (2013)considered a sample of 20 OECD countries and concluded that financial instability requires fiscal bailouts. It stimulated fiscal imbalances and caused a subsequent sharp surge in debt. They found that countries with large financial sectors experienced a more substantial increase in debt followed by the financial crisis. In a subsequent study, Magkonis and Tsopanakis (2014)investigated the dependence of financial cycles on the fiscal position of G7 countries. Their findings reveal that shocks to financial and fiscal stress generate a negative response of real GDP, inflation, and interest rate, whereas the response of the nominal exchange rate is mixed. The response of fiscal stress to shocks in financial stress is unequivocally positive for all economies, whereas the reverse is not always true.

Following a relatively novel methodology of network diagrams, Diebold and Yilmaz (2014)examined the connectedness of stock returns of 13 major US financial institutions before and during global financial crises. They found a very high degree of total

connectedness (that is, 78.3 percent) for the whole sample.Volatility connectedness reached its maximum value of 89.2 percent in September 2008 before it subsided to 70 percent by October 2009. The network diagram suggested a substantial increase in net pairwise directional connectedness during global financial crises. Similarly, Fernandez-Rodriguez et al. (2016) measured the connectedness of bond market volatility for the European MU. They observed an increase in sovereign risk premium in Euro Area after the sovereign debt crisis. Likewise, Magkonis and Tsopanakis (2016)examined the interconnection between financial and fiscal crises in G5 countries. They used quarterly data to analyze total, directional, and net spillover effects within and across sample countries. The positive net spillover index for Canada and Japan revealed the predominance of financial stress, whereas the negative net spillover for Germany indicated that fiscal stress determines financial stress. Their work further employed the dynamic causality index proposed by Billio et al., (2012) to assess the interdependence of stress indices for pre and post-global financial crisis periods. They concluded that international transmissions got intensified following the global financial crises.

Thus, a review of existing literature highlights that empirical studies on dynamic spillovers between financial and fiscal stress are limited to developed countries. The only study that empirically tested the interconnection between financial and fiscal stress is for G5 countries (Magkonis & Tsopanakis, 2016). Investigating these spillovers within emerging and developed countries is not done yet. We take up this issue for the blocks of emerging and developed countries.

3. Methodology

This section explains the theoretical framework, econometric procedure, and data used in exploring the interconnection between financial and fiscal stress for each block.

3.1 Theoretical Framework

Recent theoretical models of crises have emphasized the interconnection between financial and fiscal crises. This study relies upon the theoretical model proposed by Acharya et al. (2014). It explains a two-way interconnection between bank bailouts and sovereign risk. A loop exists between the financial sector and sovereign credit risk. To alleviate the debt overhang in the financial sector, the government makes large transfers either by bailouts or by diluting the current level of debt. Bailouts are costly when the cost of under-investments

is high and, hence, raising taxes to finance bailouts is inefficient. In that scenario, the government raises the insolvency ratio and dilutes the existing debt by accepting a positive probability of default. This will establish a positive relationship between sovereign debt and financial sector credit risk. Credit risk of the financial sector spillover and becomes a credit risk of the sovereign. Likewise, exposure of the sovereign to the rollover risks feedback into the financial sector and vice versa.

3.2 Econometric Procedure

To study the dynamic response of financial and fiscal stress to shocks in financial stress index (herafter FinSI) and fiscal stress index (hereafter FisSI), we estimate a model where financial and both stress indices are endogenous variables. The appropriate methodology is Vector Autoregressive models (hereafter VAR) as we are keen to study the generalized responses. We prefer **VAR over Structural VAR because the latter model takes parametric values as fixed. It makes SVAR an inappropriate technique for studying the interconnection between FinSI and FisSI.**VAR models are proposed by Sims (1980). These models were developed as the byproduct of the critique of simultaneous equation models. They explore the dynamic impact of random shocks on the system of variables. Simultaneous equation models are flawed because they rely on the ad-hoc classification of the exogenous and endogenous variables. While simultaneity proposes that we should treat each variable as endogenous in the model. In this regard, we analyze the systematic impacts of shocks in stress indices on financial and fiscal stress through the unrestricted VAR Model. In the present context, the VAR model is as follows;

$$\alpha y_{it} = \beta_0 + \beta_1 y_{it-1} + C x_{it} + \varepsilon_{i,t} \quad (1)$$

where y_{it} and x_{it} are vectors of endogenous and exogenous variables respectively. While $\varepsilon_{i,t}$ denotes the vector of shocks in financial and fiscal stress indices. Model (1) in matrix notation is as under:

$$\begin{bmatrix}\alpha_{11} & \alpha_{12}\\ \alpha_{21} & \alpha_{22}\end{bmatrix}\begin{bmatrix}FinSI_{it}\\ FisSI_{it}\end{bmatrix} = \begin{bmatrix}\beta_{10}\\ \beta_{20}\end{bmatrix} + \begin{bmatrix}\beta_{11} & \beta_{12}\\ \beta_{21} & \beta_{22}\end{bmatrix}\begin{bmatrix}FinSI_{it-j}\\ FisSI_{it-j}\end{bmatrix} + \begin{bmatrix}\delta_{11} & \delta_{12}\\ \delta_{21} & \delta_{22}\end{bmatrix}\begin{bmatrix}X_{it-j}\\ X_{it-j}\end{bmatrix} + \begin{bmatrix}\varepsilon_{1t}\\ \varepsilon_{2t}\end{bmatrix} \quad (2)$$

where $FinSI$ and $FisSI$ denote the financial and fiscal stress indices respectively.

We include level and lag of the growth in global commodity prices (gcpg), political risk index (pri), and gross debt (gd) as the exogenous variables in both the VAR equations. The estimated VAR model is generally interpreted through impulse response functions and variance decomposition. An impulse response function traces the impact of a one-time exogenous shock in a variable on the current and future values of the endogenous variables through the dynamic structure of VAR. Variance decomposition indicates the contribution of shocks in various variables of the model to forecast the variance of any one variable in the model. An important aspect of VAR models is the selection of optimal lag length through various model selection criteria. We applied the general procedure of fitting a VAR model of higher order and then made a choice using model selection criteria. The optimal lag length in the VAR model is one that optimizes the model selection criteria. We further test for lag exclusion for endogenous variables in the VAR model to supplement the lag selection criteria. We estimate the VAR model with a higher lag length of stress indices and control variables as a system for deciding the optimal lag selection of exogenous variables. Then, we apply the Wald test to finalize the optimal lag length. Exogenous variables are included in the chosen VAR with the optimal lag length.

3.3 Data

This study explores the interconnection between financial and fiscal stress indices within three blocks, namely BRICS, OE, and G5 panel data ranging from 2000 to 2016. Our analysis includes 14 countries that are subdivided into three blocks**.** We followSadia et al., (2019)to include seven monthly components for developing monthly FinSI for all the blocks. **We initially choose sample until 2020, but data limitations on few components of FinSI confined us to conduct the interconnection analysis for the periods 2000-2016.** FisSIcombine 12 annual components to construct a composite annual index for BRICS and OE blocks. These components are interest-rate-growth difference, gross debt by the general government, cyclically adjusted primary balance, fertility rate, age dependency ratio, population aging, gross financing needs, short-run debt as a ratio of total debt, debt held by non-residents, weighted-average maturity of total government debt, short-term external debt as a ratio of reserves, and political risk for emerging countries. To construct FisSI

for G5, we consider all the above components except short-term external debt as a ratio of reserves as it is not relevant for developed countries.

F inSIs and FisSIs are computed for each block using Principal Component Analysis. Since FinSIs are constructed on a monthly frequency, we take period averages to annualize these indices. On the other hand, annual FisSIs are computed as monthly public accounts that are not readily available. Several control variables are considered in the VAR model besides block-wise FinSIs and FisSIs in order to avoid misspecification. We include political risk and global commodity prices as potential drivers of financial stress, whereas political risk and debt-to-GDP ratio play a vital role in determining fiscal stress. Thus, we consider the past and current value of the political risk index, global commodity prices, and debt-to-GDP ratio as the control variables within each block.

It is desirable to normalize the various indicators that might differ in terms of the unit of measurement. A detailed survey for the normalization method is provided by OECD (2008). We choose min-max normalization, which is defined as:

$$I_{norm} = \frac{I_t - I_{min,t}}{I_{max,t} - I_{min,t}} \quad (3)$$

where $\boldsymbol{I_t}$ = value of stress index at time t

$\boldsymbol{I_{min,t}}$ = Minimum value of stress index over the sampled period t

$\boldsymbol{I_{max,t}}$ = Maximum value of stress indicator over the sampled period t

The sample for the FinSI covers 4800 and 6624 monthly observations for emerging and developed countries respectively. For FisSI, the sample consists of 289 and 306 annual observations for both country groupings respectively. To evaluate the interconnection between financial and fiscal stress, we first test the stationarity of the stress indices. We apply four stationarity tests, namely Levin, Lin, and Chu Test, Im, Pesaran, and Shin Test, Fisher ADF, and PP Tests.

4. Empirical Analysis

In this section, we explore the interconnection between financial and fiscal stress within three blocks, namely BRICS, OE, and G5 through graphic and econometric analysis. The first sub-section presents the graphic analysis to examine whether there exists a relationship between FinSI and FisSI for each block. The second sub-section

estimates a VAR model to analyze the dynamic responses to shocks in FinSI and FisSI.

4.1 Block-Specific Graphic Analysis

We plot the financial and fiscal stress over the sampled period for BRICS in Figure 4.1 (a). The most notable impact on financial stress appeared in 2008 with the inception of the global financial crisis. More recently, the economic recession in China during 2015 halted the trends in financial stress, but economic fundamentals worsened as fiscal surplus in China and other leading economies turned into a deficit. Overall, fiscal stressstayed low as compared to financial stress throughout the analysis. However, fiscal stress has escalated since 2010 in almost all the countries in the block. The second block, OE countries, followed a manageable trajectory of fiscal stress as most of the sampled countries characterize healthy fundamentals and low deficits. Most of these economies coped well with the financial crises as they made

Figure 4.1 Block-Specific Financial and Fiscal Stress Indices

The figure plotsthe country-specific financial and fiscal stress indices for each block. The horizontal axis measures years of analysis and the vertical axis mentions FinSI and FisSI for each country within each block.

Figure 4.1 a) Block I: BRICS

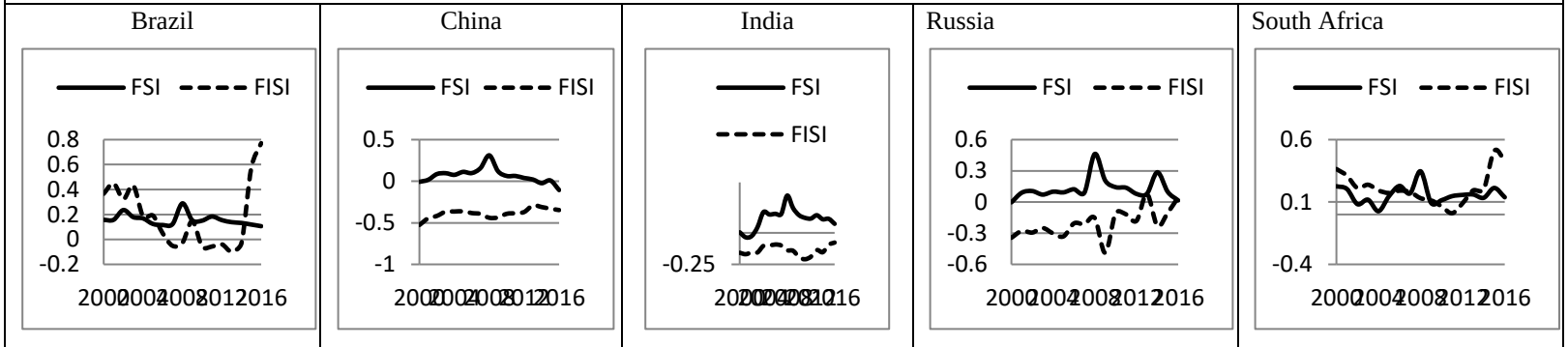


Figure 4.1 b) Block II: Other Emerging (OE) Economies

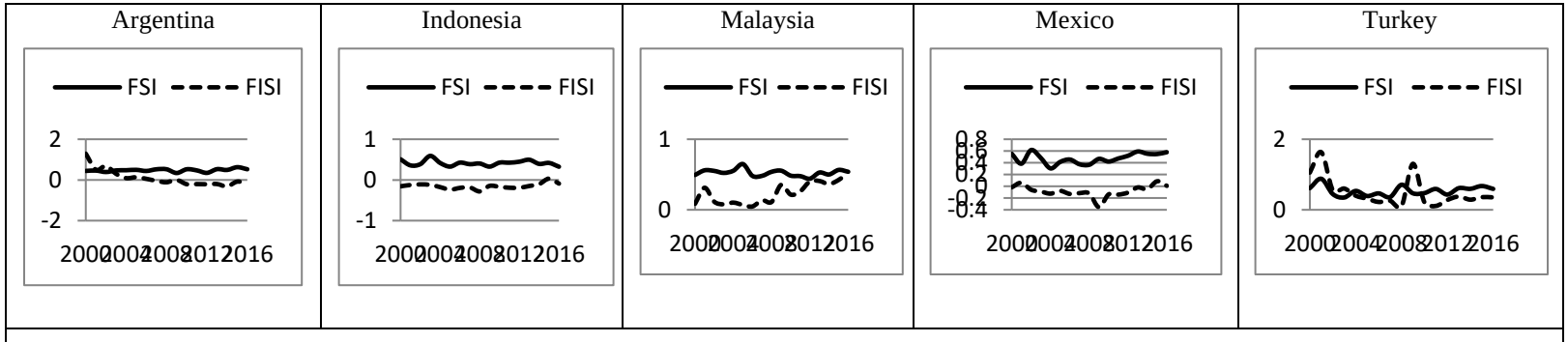
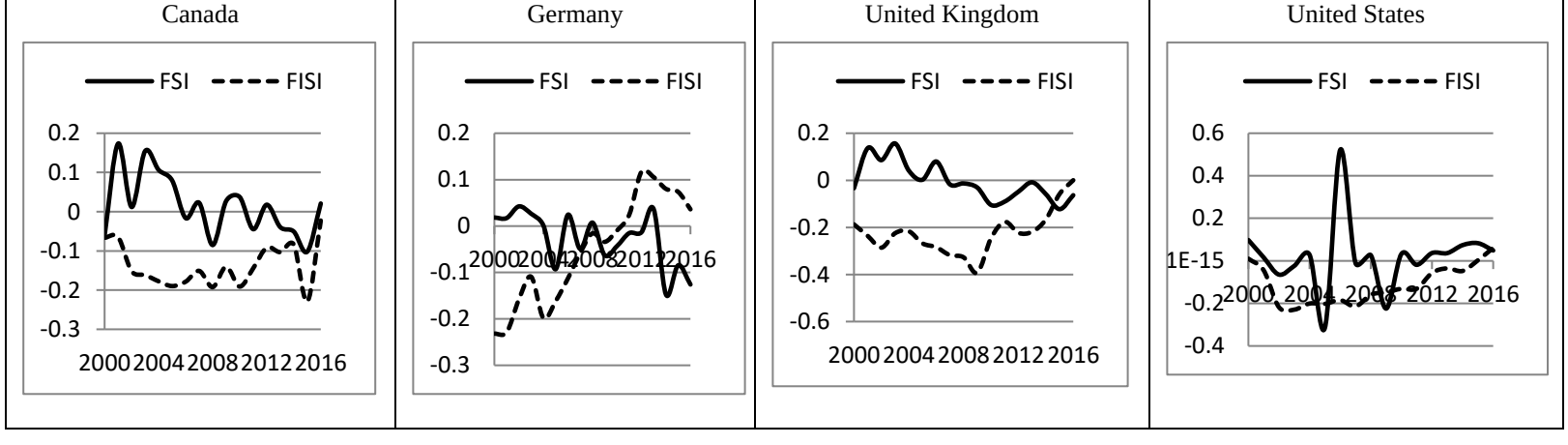


Figure 4.1 c) Block III: Advanced Economies (G5)



fiscalresolutions to disturbances in the financial system. Contrary to OE, the third block (G5) experienced higher financial and fiscal stress throughout the sampled period. Most of these countries faced problems of fiscal indiscipline. Thus, the impact of financial stress halted, but the bailout costs raised fiscal stress in this block. Their debt-to-GDP ratios rose, and ultimately sovereign debt crises hit the European countries in 2011. Strong trade ties between European developed countries (Germany and UK) and the US intensified the stress transmission.

4.2 Econometric Analysis for the Interconnection between FinSI and FisSI

We apply impulse function and variance decomposition analysis to interpret the estimated VAR model. For estimating a VAR model, the first step is to test the stationarity of both indices. The results are reported in Table 4.1. Test results unanimously confirm that FinSI and FisSI are stationary at the level for all the countries in each block. The test statistics are significant either at 1 or 5 percent level in all the cases except the PP fisher test for FisSI that reports non-stationarity.

Table 4.1 Panel Unit Root Tests

Blocks/	**BRICS**		**OE**		**G5**	
Test Stats	***FinSI***	***FisSI***	***FinSI***	***FisSI***	***FinSI***	***FisSI***
Levin, Lin & Chu Test	-3.002*** (0.001)	-1.988** (0.023)	-4.989*** (0.000)	-4.4820*** (0.000)	-2.9716*** (0.003)	-5.1193*** (0.000)
IPS Test	-2.925*** (0.002)	-2.106** (0.018)	-3.876*** (0.000)	-2.5107*** (0.006)	-4.186*** (0.000)	-3.762*** (0.000)
ADF Fisher Test	26.411*** (0.003)	20.678** (0.024)	36.26*** (0.000)	26.962*** (0.003)	31.373*** (0.000)	28.781*** (0.000)
PP Fisher Test	26.251*** (0.003)	14.598 (0.147)	41.569*** (0.000)	27.172*** (0.002)	36.037*** (0.000)	34.8217*** (0.000)
Note: The level of significance for the unit root tests at 1, and 5 percent are denoted by *** and ** respectively.						

Overall, we confirm with a fair degree of agreement that both the stress indices are stationary at level. Next, we probe the systematic relation between FinSI and FisSI through the VAR model. We subdivide the VAR analysis into three subsections, one for each country block.

4.2.1 Interconnection between FinSI and FisSI for BRICS

We estimate the VAR model for a panel of BRICS countries from 2000-2016. The selection of lag length for the VAR model relies on various lag selection criteria. Most selection criteria confirm the optimal lag length for the VAR model is one. Next, we determine the lag length for the exogenous variables through the Wald test on system OLS estimates. We find that the optimal lag length is one for exogenous variables.

Figure 4.2 reports the impulse response function for the one standard deviation shocks in FinSI and FisSI on the current and future values of the FinSI and FisS for BRICS. Panel 4.2 (a) indicates the dynamic response of FinSI to one standard deviation innovation in FinSI. The impulse response is positive and statistically significant instantaneously for the first year before it weakens for the next two years and then fades away by the end of the third year. Thus, we infer that the dynamic response of FinSI to its past shocks is short-lived. On the other hand, the dynamic response of FisSI to innovations in FinSI does not appear in the first period as shown in panel 4.2 (b). The response is somewhat present and negative, though still insignificant with a one-period lag. Results indicate that FinSI has a very short-lived and insignificant impact on FisSI. Thus, it is apparent from the first two panels that the financial crisis raises systemic risk in the BRICS countries without causing serious concerns for fiscal sustainability.

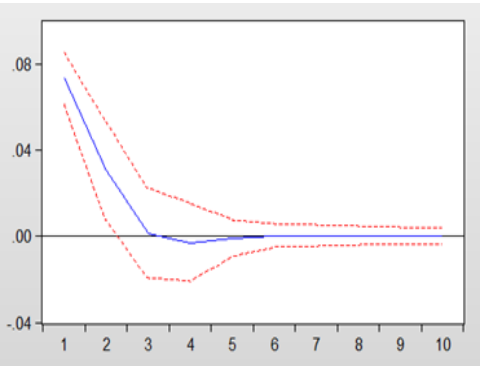
Panel c draws the impulse response function of the FisSI to its own shocks. FisSI increases immediately in the first period after the fiscal shock. This is attributed to a higher need for public borrowing instantaneously after the period of fiscal crisis. This finding is consistent with the inertia effect that persists for merely one period. The graph shows that this impact is statistically significant and lasts until the 10th period. Thus, any disturbances in the real economy carry long-term fiscal costs as compared to costs involved with financial crises (that lasted for only two years in panel a).

Figure 4.2 Dynamic Own and Cross effects of Stress Indices for BRICS

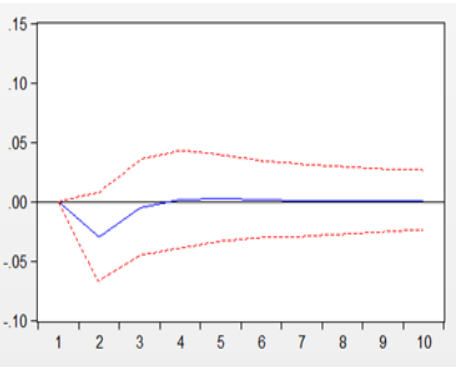
This figure draws the impulse response functions to one-standard deviation shocks in FinSI and FisSI for BRICS. The dotted lines plot a 95 percent confidence interval, while black lines indicate the impulse response functions.

Response of Cholesky One S.D Innovations ± 2 S.E.

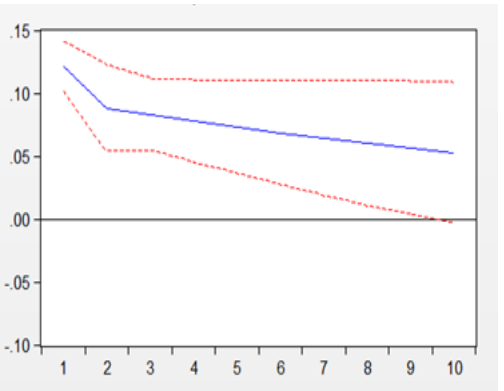
Response of FinSI to Shocks in FinSI



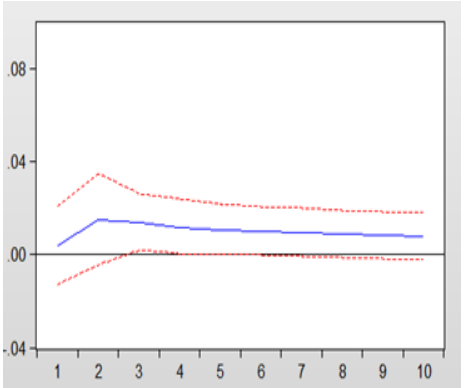
Response of FisSI to Shocks in FinSI



Response of FisSI to Shocks in FisSI



Response of FinSI to Shocks in FisSI



Note: The VAR model is estimated with one lag and constant terms.

Next, panel 4.2(d) shows the dynamic response of FinSI to the one standard deviation shock in FisSI. Higher fiscal stress tends to raise the likelihood of financial stress in the future. It happens when government debt enters the bank's balance sheets as government opts for bank bailouts to rescue the sovereign defaults. The size of the impulse response is the highest but insignificant at two years lag. We observe significant impulse response with lags of three and four years. Thus, we conclude that fiscal stress feedbacks financial stress through the sovereign-bank relationship. Our finding confirms the theoretical viewpoints

documented byAcharya et al. (2014). However, the bank to sovereign feedback loop does not exist in panel b.

Further, Table 4.2 reports the decomposition of variances of FisSI and FinSI for BRICS. Most of the variation in FisSI is explained by FisSI, suggesting that intense shocks in fiscal stress in BRICS explain the overall variations in fiscal stress the most, with the contribution of shocks in financial stress being negligible. Similarly, financial stress contributes the most to explaining variation in FinSI. But as we move far in time the variations in fiscal stress also play a vital role in explaining variability in FinSI. Thus, we find that both the FisSI and FinSI contribute to explaining variation in FinSI.

Table 4.2 Variance Decomposition of FinSI and FisSI: Case of BRICS

Variance Decomposition of FisSI			Variance Decomposition of FinSI		
Periods	FisSI	FinSI	Periods	FisSI	FinSI
1	100.0000	0.000000	1	0.423243	99.57676
2	95.52642	4.473582	2	2.536821	97.46318
3	96.47707	3.522929	3	4.639977	95.36002
4	97.06342	2.936582	4	6.529828	93.47017
5	97.44450	2.555498	5	8.149260	91.85074
6	97.70808	2.291922	6	9.540654	90.45935
7	97.90026	2.099745	7	10.74047	89.25953
8	98.04568	1.954320	8	11.77906	88.22094
9	98.15885	1.841154	9	12.68092	87.31908
10	98.24884	1.751161	10	13.46615	86.53385

Note: Cholesky ordering is FisSI FinSI

4.2.2 Interconnection between FinSI and FisSI for OE Countries

Before estimating the VAR model for the OE block, we identify lag order in VAR through various model selection criteria. These criteria confirm the optimal order for endogenous variables is 1. Furthermore, we apply the Wald test on system OLS to select the optimal lag length for exogenous variables. Finally, we estimate the unrestricted VAR model with one and no lags for endogenous and exogenous variables respectively. The dynamic response to shocks in FinSI and FisSI for OE block are visualized in Figure 4.3. Panel a shows the dynamic response of FinSI to its own one standard deviation shock. We find a little increase in financial stress with two years lag. This impact is, however, short-lived, and equilibrium is retained in the 5th period. The weak response attributes to strong macroeconomic fundamentals and low deficits in OE countries. The next panel draws the impulse response of FisSI to one standard deviation innovation to FinSI. A stimulus in FinSI raises FisSI instantaneously in the first period. This trend halted thereafter, and equilibrium is re-attained after the lag of four years. Thus, a financial shock is coped with immediately through government support. The strong macroeconomic fundamentals enabled the governments to respond promptly to financial disturbances. The third and fourth panels trace out the response of FisSI and FinSI to one standard deviation shock in FisSI. A fiscal shock tends to raise FisSI in OE countries. This also lowers the government's income and revenues and elevates fiscal stress with the accumulation of a stock of debt. It takes these economies almost 10 years to regain fiscal sustainability.

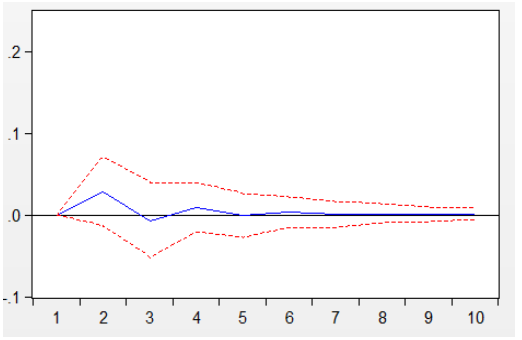
The last panel displays the response of FinSI to innovations in FisSI. The impulse response is positive but statistically insignificant. This positive response prevails for up to 5 years. Unlike BRICS, the response of FinSI and FisSI to shocks in FinSI are short-lived when financial stress surface in these high-growth economies. On the other hand, similar to BRICS countries, fiscal

Figure 4.3Dynamic Own and Cross Effects of Stress Indices for OE Countries

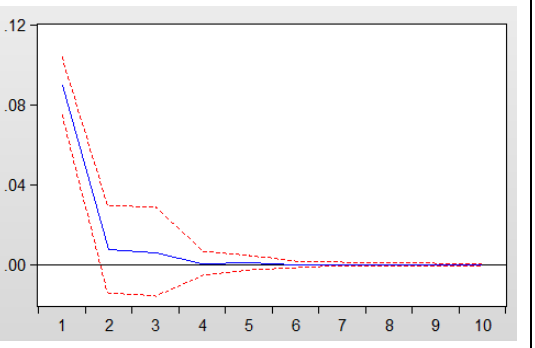
This figure draws the impulse response functions to one-standard deviation shocks in financial and fiscal stress for OE countries. The dotted lines plot a 95 percent confidence interval, while the black lines indicate the impulse response functions.

Response of Cholesky One S.D Innovations ± 2 S.E.

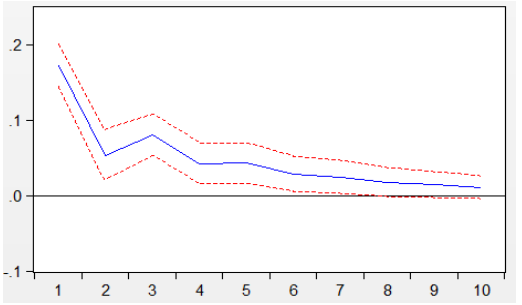
a) Response of FinSI to Shocks in FinSI



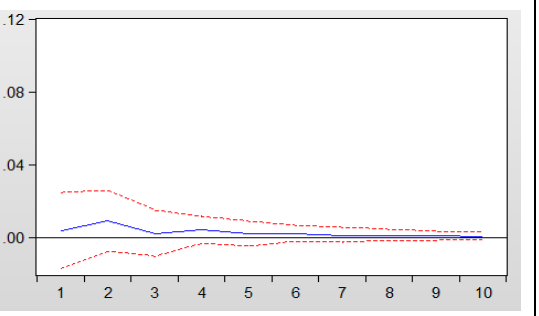
b) Response of FisSI to Shocks in FinSI



c)Response of FisSI to Shocks in FisSI



d) Response of FinSI to Shocks in FisSI



Note: The VAR model is estimated with two lag and constant terms.

stress imposed huge long-run costs in the shape of frequent debt restructuring. A stimulus in financial stress raises fiscal stress instantaneously in the first period, but the trend halted thereafter. The equilibrium is re-attained after the lag of four years. Thus, a financial shock is coped with immediate government support and strong macroeconomic fundamentals.

From panels (b) and (d), we conclude that although the adverse feedback loop is long-lasting from financial to fiscal stress, the feedback in the reverse direction is not statistically significant. The variance decomposition analysis in Table 4.3 confirms that FinSI and FisSI explain most of their own variations. We lack support for the impact of the fiscal shock on financial stress and vice versa.

Table 4.3Variance Decomposition of FinSI and FisSI: Case of OE Countries

Variance Decomposition of FisSI			Variance Decomposition of FinSI		
Periods	FisSI	FinSI	Periods	FisSI	FinSI
1	100.0000	0.000000	1	0.171218	99.82878
2	99.06816	0.931842	2	3.001611	96.99839
3	99.02976	0.970243	3	2.539195	97.46080
4	98.81847	1.181531	4	2.689867	97.31013
5	98.77663	1.223365	5	2.578248	97.42175
6	98.72107	1.278926	6	2.572770	97.42723
7	98.70058	1.299417	7	2.543653	97.45635
8	98.68354	1.316463	8	2.535646	97.46435
9	98.67528	1.324723	9	2.527128	97.47287
10	98.66959	1.330406	10	2.523484	97.47652
Cholesky ordering is FisSI FinSI					

4.2.3 Interconnection between FinSI and FisSI for G5

We record the dynamic response of the FinSI to own shocks in Figure 4.4 (a). An optimal lag length for endogenous and exogenous variables is chosen as one through various model selection criteria. The impulse response function demonstrates a positive response in the first period, which slowly falls in the subsequent periods. A compelling feature of the response is that it resurfaced slightly at the lag of three years before it vanished entirely at the fifth-year lag. This behavior is in stark contrast to the response of BRICS countries, where the impact declines smoothly.Panel 4.4 (b) shows behavior of FisSI in response to

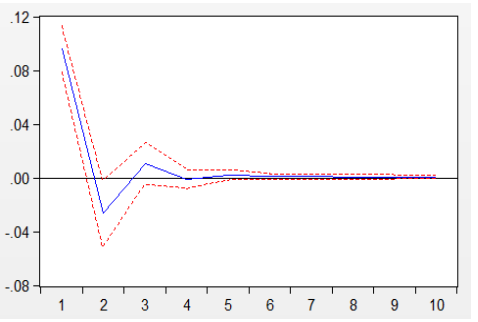
one standard deviation innovation in FinSI. The response is negative and insignificant throughout, and it gets even close to zero as

Figure 4.4 Dynamic Own and Cross Effects of Stress Indices for G5

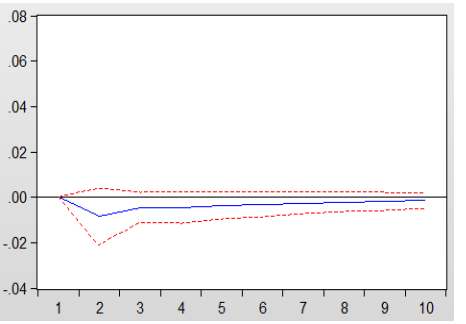
This figure draws the impulse response functions to one-standard deviation shocks in FinSI and FisSI for the G5 block. The dotted lines plot a 95 percent confidence interval, while the black lines indicate the impulse response functions.

Response of Cholesky One S.D Innovations ± 2 S.E.

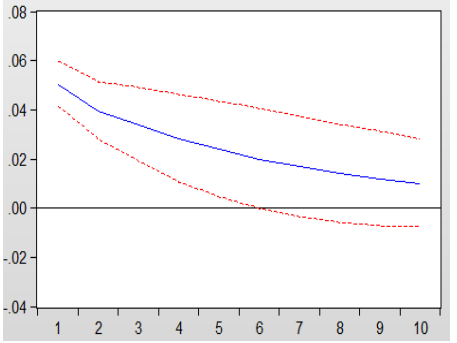
a) Response of FinSI to Shocks in FinSI



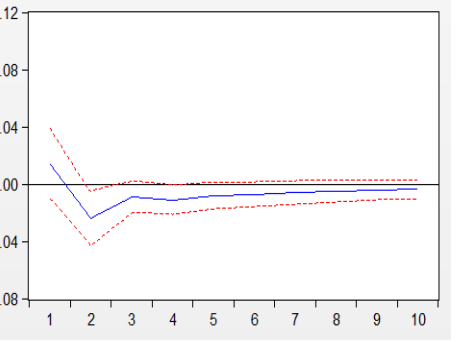
b) Response of FisSI to Shocks in FinSI



c) Response of FisSI to Shocks in FisSI



d) Response of FinSI to Shocks in FisSI



Note: We estimate the VAR model with two lags and constant terms.

The lag length increases. Panel 4.4 (c) shows the dynamic response of FisSI to its shock. It reveals that the response of FisSI to fiscal innovation remains positive but continues to decline. The impact remained significant until the fifth lag before it become insignificant at the sixth and onward lags. This finding confirms the existence of the inertia effect.Finally, the last panel draws the impulse response function for FinSI to fiscal shocks. A positive shock in FisSI raises financial stress immediately after the shock. However, once again the impact becomes negative and statistically insignificant at lag two before it disappears completely. Shocks in FisSI explain a fair degree of variation in FinSI at the higher lags. This confirms the interconnection through the feedback loop from fiscal to financial stress. Next, another method to interpret the VAR model is variance decomposition, as reported in Table 4.4. Both stress indices explain their variations the most. However, fiscal stress causes substantial variation in financial stress. This confirms the interconnection through the feedback loop from fiscal to financial stress.

Table 4.4Variance Decomposition of FinSI and FisSI: Case of G5

Variance Decomposition of FisSI			Variance Decomposition of FinSI		
Periods	FisSI	FinSI	Periods	FisSI	FinSI
1	100.0000	0.000000	1	2.115389	97.88461
2	98.23209	1.767907	2	7.291056	92.70894
3	98.23380	1.766197	3	7.920657	92.07934
4	98.11920	1.880800	4	8.950250	91.04975
5	98.08422	1.915777	5	9.507029	90.49297
6	98.05598	1.944017	6	9.935840	90.06416
7	98.03968	1.960315	7	10.22561	89.77439
8	98.02848	1.971519	8	10.43166	89.56834
9	98.02104	1.978959	9	10.57581	89.42419
10	98.01593	1.984075	10	10.67744	89.32256
Note: Cholesky ordering is FisSI FinSI					

The comparison of the three blocks suggests the following observations. First, patterns of FinSI and FisSI are more pronounced in G5 as compared to BRICS and OE. Second, a fiscal shock carries a long-term and significant impact on fiscal stress. While a delayed response to high financial stress is realized for fiscal innovation. Thus, we find support for feedback from fiscal shocks to the financial stress for both BRICS and G5 regions. Third, both stress indices are self-explanatory phenomena. Financial and fiscal shocks alter

systemic risk and fiscal sustainability, without any spillover impacts of financial (real) shocks to the real (financial) side of the economy.

5. Conclusion and policy recommendations

This study examines the dynamic interlinkages between the real and financial sides of the economy within various country blocks. We consider three blocks, namely BRICS, OE, and G5 countries. The analysis covers the annual observations ranging from 2000 to 2016. We exploit the unrestricted panel VAR model to explore how shocks to the financial side create responses on the real side of the economy and vice versa. Based on our analysis we draw the following inferences. First, we confirm the existence of a feedback loop from bank to sovereign in the case of BRICS countries if crises stem from financial markets. However, they established a weak adverse feedback loop if a shock, in the first instance, appears in the real economy. Second, the adverse feedback loop from the financial to the real side of the economy is more pronounced in the OE countries than in BRICS. This may reflect high growth in the OE countries financed through high debt. However, the feedback loop from the real to the financial side is not observed as these economies experienced higher growth and a decline in the fiscal deficit. Third, the feedback loop from financial to fiscal stress does not exist for G5 countries as financial and fiscal stresses are self-explanatory phenomena for these economies.

We propose the following policy guidelines from this analysis. First, the accumulation of enough fiscal buffers can help governments avoid banks to sovereign feedback loops. Second, better management of fiscal deficits and debt helps to retain fiscal sustainability.

In the context of the Pakistan economy, the study pinpoints monitoring the unsustainable debt levels to restore fiscal sustainability. Besides that, enhanced independence of the central bank ensures the conduct of such monetary policy which safeguards financial stability besides price stabilization. The political uncertainty may be reduced, if not eliminated, to avoid systemic risk and build the credibility of the governments regarding fiscal sustainability. There is a need to bridge a gap between the process of policy-making and its successful implementation, which requires political support and will.

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