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BANKING & FINANCE | LETTER

Investigating impact of financial stress on FII flows in Indian equity market

Amanjot Singh^{1*} and Manjit Singh¹

Abstract: The present study attempts to capture the impact of financial stress prevailing in the Indian as well as US financial system on FII flows in the Indian equity market by employing logistic regression model. The span of monthly data ranges from 2004 to 2014. Owing to non-existence of any standardized index, the study firstly constructs Indian Financial Stress Index. The empirical results have established that with an increase in financial stress in the Indian and US financial system, probability of positive FII flows reduces and consequently the probability of negative flows increases. The results are critically important for the international as well as Indian investors.

Subjects: Business, Management and Accounting; Economics; Finance

Keywords: financial stress; FII; India; logit; logistic regression; US

1. Introduction

With the onset of globalization and financial integration among the international economies, the domestic stock markets are prone to both internal as well as external financial shocks. The adverse events taking place in one economy like the “US sub-prime crisis (2007–2009)” have a “contagion or ripple effect” on other international economies through trade as well as financial linkages shared between the said economies. Above all, irrational behavior and investors’ sentiments also play pivotal role in directing international financial flows across foreign boundaries. Seemingly, there are



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PUBLIC INTEREST STATEMENT

Owing to liberalization, volatile FII flows in the emerging equity markets are a matter of concern to the domestic financial market investors and policy-makers. There are numerous factors accounting for FII flows in the latter equity markets. Out of these factors, the present study attempts to capture the impact of financial stress prevailing in the Indian and US financial system on FII flows in the Indian equity market making the study first of its kind. The logistic regression model is used to account for the said relationship. Interestingly, with an increase in financial stress in the Indian and US financial system, probability of positive FII flows reduces. These results are critically important for the policy-makers as well as equity investors in their act of managing portfolio risk and contagion phenomenon.

wide variety of factors ranging from fundamental-based to sentimental-based that guide the behavior of international financial flows or more specifically Foreign Institutional Investors (FII hereafter) in channelizing their funds.

According to SEBI (Foreign Institutional Investors) regulations (1995), a Foreign Institutional Investor means “an institution established or incorporated outside India and proposing to make investment in Indian securities.” Over a period of 14 years, non-resident portfolio investment liabilities have registered a compounded annual growth rate of around 90% in India, thereby indicating substantially increasing foreign portfolio investments in the Indian financial market. Accordingly, volatility in these international financial flows makes the domestic or recipient markets to witness huge swings in asset prices causing transmission of financial shocks across foreign boundaries (Frank & Hesse, 2009). The authors argued that during a crisis or financial stress, international investors prefer relatively safer asset classes like developed equity markets pushing sell button in the emerging equity markets like India. Consequently, the emerging equity markets witness a downward phase in their respective markets owing to unwinding of long positions and reversing of capital flows having a magnified impact on the shareholders’ wealth.

In today’s scenario, the Central Bankers around the world are not independent in the context of their monetary policy initiatives. The US dollar has effectively become the global reserve currency for the emerging markets underpinning implied dependence of the latter markets on direction of global capital flows and US monetary policy actions (Sheel, 2016). Moreover, there is “Impossible Trinity” of the Mundell–Fleming framework, whereby it is impossible to follow three objectives of fixed exchange rate, monetary policy independence, and free capital flows simultaneously by a domestic economy. So, it is quite pertinent to account for various factors that direct and channelize these foreign financial flows or “Hot Money flows” in a domestic economy. In this regard, voluminous literature has examined various factors channelizing foreign flows in the emerging equity markets. For instance, according to Rai and Bhanumurthy (2004), FII flows to the Indian equity market are strongly dependent on stock market returns, inflation rates, and ex-ante risk. On a similar note, Kaur and Dhillon (2010) and Srinivasan and Kalaivani (2013) examined various determinants ranging from stock market returns, P/E ratios, conditional volatility, etc. causing FII flows to the Indian equity market. These studies have tried to establish number of factors driving financial flows to the Indian equity market.

Out of “*n*” number of factors, one of the factors that the present study attempts to report is the “Financial Stress” prevailing in an economy. A priori one would expect an inverse relationship between the respective financial stress episodes and FII inflows to the Indian equity market due to risk aversion attitude of the investors. In the present study, we have made an attempt to empirically capture the impact of financial stress prevailing in the US (being economically dominant) and Indian financial system on FII flows to the Indian equity market. The term financial stress can be regarded as disturbance or uncertainty in an economy’s financial system. A financial system further comprises different subsystems in the form of equity, debt, money, and foreign exchange markets. Our objective is to encapsulate overall stress in the US and Indian financial system in the form of an index and then analyzing its impact on FII flows to the Indian equity market by employing logistic regression model across the years 2004–2014. The study adds empirical evidence to the literature by measuring concomitant relationship shared between Indian–US financial stress episodes and FIIs’ Indian equity market flows.

The results report statistically significant impact of the said financial stress indices on FII flows in the Indian equity market. The study is the first of its kind, empirically capturing impact of the Indian as well as US financial stress on FII flows in the Indian equity market. A case of one emerging market and one developed market has been considered to analyze the impact of the same. These results are critically important for the policy-makers as well as equity investors in their act of managing portfolio risk and contagion phenomenon as a response to financial stress. Moreover, FIIs’ equity investment behavior also act as financial contagion medium, transmitting financial shocks from one economy to another and further directing investment strategies of the domestic institutional

investors. So, it becomes an imperative task to account for the impact of financial stress episodes on FIIs' equity investment behavior. The rest of the paper is divided as follows: Sections 2 and 3 explain empirical framework and findings respectively. Section 4 concludes the paper.

2. Empirical framework

To account for the impact of financial stress on FII flows in the Indian equity market, we have considered Kansas City Financial Stress Index (KCFSI) reflecting stress in the US financial system and constructed Indian Financial Stress Index (IFSI) across the monthly sample period: January 2004–October 2014. The monthly data reduce sensitivity and increase reliability of the analysis comparing to daily or weekly data. The KCFSI is a monthly measure of stress in the US financial system based on 11 financial market variables.¹ On a similar note and following the studies like, Balakrishnan, Danninger, Elekdag, and Tytell (2011), Park and Mercado (2013) and Yiu, Ho, and Jin (2010), the study initially develops IFSI by considering four different sectors of the Indian financial system, namely, equity, debt, foreign exchange, and money market owing to non-existence of a standardized index.

$$\text{FSI} = \text{Equity Market Return} + \text{Equity Market Volatility} + \text{Debt Market(Spread)} + \text{Banking Sector(Spread)} + \text{Exchange Rate Volatility} \quad (1)$$

To capture stress in the Indian equity market, the NIFTY 50 (Indian equity market benchmark index) monthly continuously compounding gross index returns and conditional volatility are taken. The NIFTY monthly continuously compounding gross index returns are computed as follows:

$$R_t = \log(P_t/P_{t-1}) \times 100 \quad (2)$$

where R_t is the monthly return, P_t is the current month closing price, and P_{t-1} is the previous month closing price. To model conditional volatility of NIFTY index, GARCH (1,1) model has been employed. The conditional volatility also captures an implied impact of negative equity market returns because higher volatility is generally backed by negative returns. To capture stress in the banking sector/money market, spread between MIBOR (Inter-bank rate) 3 monthly rate and Treasury Bill 3 monthly yield is taken. The spread captures inter-bank lending risks. For an emerging market like India, major worry with regard to the foreign exchange market is volatility in the exchange rate owing to its dependence on export–import led policies. So, the study employs GARCH (1,1) model to account for volatility in the real time Dollar/Rupee exchange rate. Furthermore, to capture stress in the sovereign debt market, spread between the India Government securities 10-year yield and US Government securities 10-year yield is taken. All of the five variables are firstly converted into their standardized form.² The study employs principal component analysis (PCA) for the purpose of creating an aggregative index encapsulating overall stress in the Indian financial system across the sample period from 2004 to 2014 through standardized weights (Hakkio & Keeton, 2009).

While constructing a financial stress index, other indicators like, GDP growth rate, unemployment levels, inflation index, etc. can also be considered but these variables capture overall financial condition of an economy. Contrary to this, our objective is to capture core and overall financial stress irrespective of overall financial condition.³ Finally, to capture the impact of the US and Indian financial stress on FII flows to the Indian equity market, logistic regression model has been employed. We have considered net FII flows on a monthly basis. A positive flow indicates buying behavior of the international investors, whereas a negative flow denotes selling behavior of the investors. The main benefit of employing a logistic-based regression model is that the model helps in computing probabilities for the existence of a particular condition, for instance, probability of a positive flow with a corresponding increase in financial stress.

Under logistic regression model, a dependent variable is a non-linear function of the independent variables and a binomial probability distribution as it has only two values either 0 or 1 (Chauhan, 2015). The value 1 denotes the existence of a condition (P), whereas the value 0 denotes absence of

a condition $(1 - P)$. In the present study, the probability distribution is expressed as follows: Net Positive flows = 1 and Net Negative flows = 0. So, the value 1 indicates FII inflows in the Indian equity market and the value 0 denotes FII outflows from the Indian equity market. The whole model is estimated using Maximum Likelihood Estimation method and further Wald test statistic captures the impact of an independent variable on the dependent one. The logistic regression equation is expressed as follows:

$$\log \left(\frac{P_i}{1 - P_i} \right) = a_0 + \beta_1 \text{ US or Indian Financial Stress index} + \varepsilon_t \quad (3)$$

where a_0 is the constant term and β_1 is the slope coefficient of respective financial stress indices. Technically, (P_i) , the probability of existence of a condition is regarded as $\left(P_i = \frac{e^{\beta_1 x}}{1 + e^{\beta_1 x}} \right)$; logit model and $(1 - P_i)$, the probability of absence of a condition is regarded as $\left(\frac{1}{1 + e^{\beta_1 x}} \right)$. $e^{\beta_1 x}$ is the exponential function of the regression equation. So, $\log \left(\frac{P_i}{1 - P_i} \right)$ is the odd ratio and hence its quite complicated to comprehend the impact of independent variables. However, exponential betas are computed which can be defined as rate of change in odd ratio relating to per unit change in independent variable. If exponential beta is greater than 1, then the independent variable has a positive impact on the existence of a condition or an increasing impact on the probability of existence of a condition and if it is less than 1, then the independent variable has a negative impact on the existence of a condition.

The overall analysis has been done taking respective financial stress indices as separate independent variables and binomial probability distribution as a dependent variable. Lastly, to capture the impact of respective indices on FII flows in a graphical format, the ex-ante probabilities $\left(P_i = \frac{e^{\beta_1 x}}{1 + e^{\beta_1 x}} \right)$ are computed out of the regression model results. The overall data have been collected from the Bloomberg terminal, Yahoo finance database, and moneycontrol real-time financial database as per availability.

3. Empirical findings

For the construction of IFSI, second component of the PCA model explains around 66% of the total variations in five variables. So, normalized component loadings of the second component are used for constructing IFSI across the period 2004–2014.⁴ Figure 1 is the graphical presentation of Indian as well as US financial stress index.

Both of the indices have fairly captured the Global Financial Crisis period that got triggered at a full force aftermath the Lehman Brothers' episode (shaded area) thereby confirming accuracy of the indices thereon. It is quite apparent from the movement of IFSI that the US sub-prime crisis had a financial contagion impact on the Indian financial system during the years 2007–2009.

3.1. Indian financial stress and FII flows in the Indian equity market

Now we move on to the logistic regression model results taking probability distribution of FII flows and IFSI as dependent and independent variables respectively. Table 1 reports R-square (R^2) values

Figure 1. Graphical presentation of Indian and US financial stress.

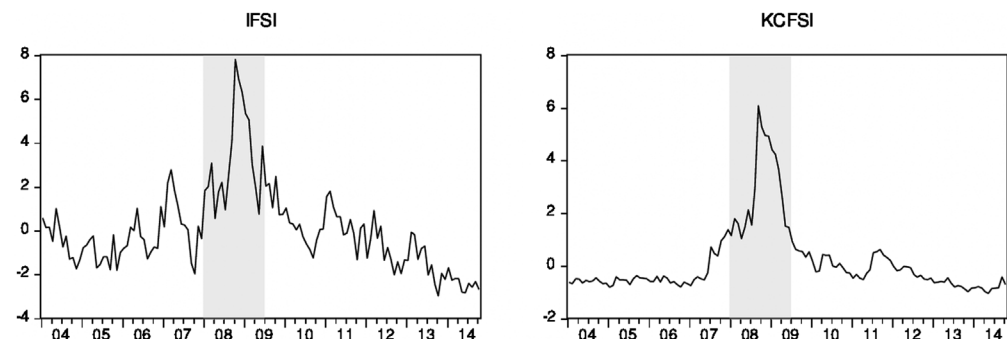


Table 1. R² values

Step	-2 log likelihood	Cox and Snell R ²	Nagelkerke R ²
1	134.725 ^a	.107	.156

^aEstimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Source: Authors.

of the model employed or explanatory power of IFSI in explaining FII flows. The values are quite reasonable because FII flows in the Indian equity market are not only a function of Indian financial stress alone, but it also depends on so many other factors as well.

The R² value ranges from 10 to 15%. Table 2 is classification table which indicates percentage of correctness or correct predictions of the model employed. In technical terms, percentage of correct predictions is regarded as “HIT” ratio. The hit ratio is around 74.6, which is quite adequate and more than the cut-off value of 50. For instance, both the observed and predicted values report positive FII flows in 92 of the cases.

Table 3 reports logistic regression equation results. The stress in the Indian financial system has a statistically significant impact on FII flows in the Indian equity market. The coefficient is found to be significant at 5% significance level. However, the exponential beta value is less than 1, thereby indicating a decreasing impact of IFSI on the probability of positive FII flows in the Indian equity market. In other words, with an increase in overall stress in the Indian financial system, probability of positive FII flows reduces and probability of outflows increases in the economy. The results support strong implications for the domestic investors in the Indian equity market.

It is well documented that both foreign as well as domestic flows to equity markets share a feedback relationship with each other. Subsequently, the present study contributes to the literature by quantifying the impact of financial stress episodes on FII flows in the Indian equity market and thereby on the domestic equity flows. As mentioned earlier, explanatory power of the IFSI in explaining FII flows in the Indian equity market ranges from only 10 to 15%, however, still the results are quite effective in directing the impact of the same.

Table 2. Classification table^a

	Observed		Predicted		
			Probability		Percentage correct
			0	1	
Step 1	Probability	0	5	29	14.7
		1	4	92	95.8
	Overall percentage				74.6

^aThe cut value is .500.

Source: Authors.

Table 3. Variables in the equation

		Coefficient	SE	Wald	df	Sig.	exp (B)
Step 1 ^a	IFSI	-.405	.117	12.041	1	.001*	.667
	Constant	1.142	.217	27.624	1	.000*	3.132

^aVariable(s) entered on step 1: IFSI.

*Reject null hypothesis of no significant relationship at 5% significance level.

Source: Authors.

Table 4. R² values

Step	-2 log likelihood	Cox and Snell R ²	Nagelkerke R ²
1	137.290 ^a	.089	.130

^aEstimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Source: Authors.

3.2. US financial stress and FII flows in the Indian equity market

The R² value ranges from 8 to 13% (Table 4), again quite reasonable. The hit ratio is 76.2 (Table 5) stating that approximately 76% of the predictions are correct.

On a similar note, financial stress in the US financial system has a statistically significant impact on FII flows in the Indian equity market (Table 6). The coefficient is found to be significant at 5% significance level. The exponential beta value is less than 1 signifying a reducing impact of the US financial stress on probability of positive FII flows in the Indian equity market. Lastly, we have tried to report expected probabilities of positive FII flows in relation to both of the financial stress indices.

For this, the financial stress index values are firstly arranged in an increasing order with an interval of 0.5, respectively. After this, the ex-ante probabilities are computed out of the results generated from logistic regression model. Graphically, the results support “flight to safe haven” concerns of the foreign institutional investors (Figure 2.). Hence, with an increase in financial stress in the Indian as well as US financial system, the probability of positive FII flows decreases in the Indian equity market. The impact of Indian financial stress on FII flows in the Indian equity market is quite obvious. However, on a very interesting note, the stress in the US financial system also leads to reversal of FII flows in the Indian equity market. Consequently, the foreign institutional investors switch to other safer asset classes during stressful episodes.

Overall, the results accentuate significant role of the financial stress episodes in directing FII flows in the Indian equity market. A decrease in probability of positive FII flows may further magnify financial stress in the overall Indian financial system through propagation of shocks via equity market.

Table 5. Classification table^a

	Observed		Predicted		
			Probability		Percentage correct
			0	1	
Step 1	Probability	0	6	28	17.6
		1	3	93	96.9
	Overall percentage				76.2

^aThe cut value is .500.

Source: Authors.

Table 6. Variables in the equation

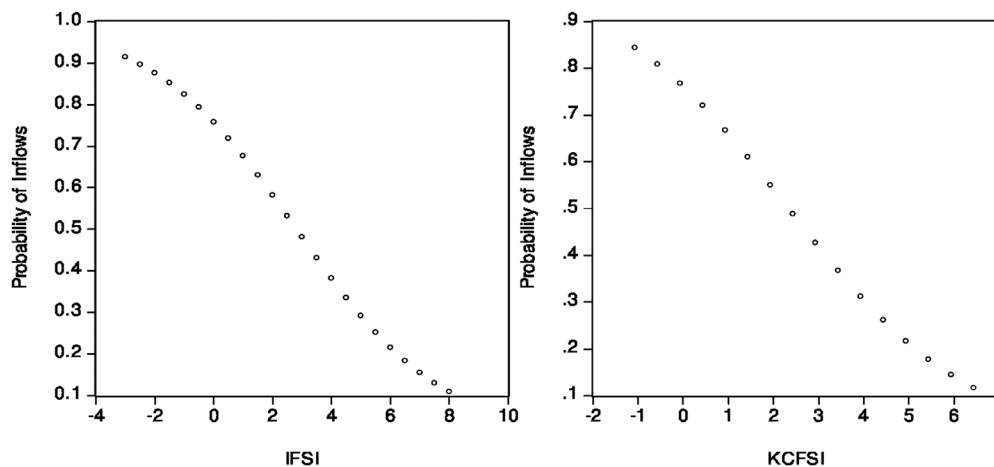
		Coefficient	SE	Wald	df	Sig.	exp (B)
Step 1 ^a	KCFSI	-.495	.155	10.138	1	.001*	.610
	Constant	1.159	.214	29.199	1	.000*	3.187

^aVariable(s) entered on step 1: KCFSI.

*Reject null hypothesis of no significant relationship at 5% significance level.

Source: Authors.

Figure 2. Ex-ante probabilities vis-à-vis financial stress.



The crux of the whole study is that the emerging markets like India are considered to be riskier and relatively volatile in comparison to the developed equity markets like the US, Europe, Japan, etc. owing to greater degree of information asymmetry present in the former markets; evidenced from Celik (2012) and Lhost (2004). So, with an increase in financial stress, either in the Indian or US financial system, foreign investors switch to “withdrawal of funds” strategy from the Indian equity market which may augment already existing stress in the overall Indian financial system.

4. Concluding remarks

The present study attempts to capture the impact of financial stress prevailing in the Indian as well as US financial system on FII flows in the Indian equity market by employing logistic regression model across the sample period 2004–2014. The results exhibit that with an increase in financial stress in the Indian and US financial system, probability of positive FII flows reduces and consequently the probability of negative flows increases. The study provides an insight regarding possible future FII flows against stressful episodes in the domestic and foreign markets, thereby spotlighting different possible actions that may be undertaken in combating negative impact of the same.

On the whole, the results are important for both the international as well as Indian investors. They should discount in advance these probable FII flows and undertake positions in derivative market so as to hedge themselves from adverse market scenarios. At the same time, the findings are also important for policy-makers in their attempt to channelize overall Indian financial system. According to IMF (April, 2014), the emerging markets with higher volatility in the capital flows and current account deficit or fiscal imbalances are likely to be more vulnerable to global financial shocks. So, the impact of the US and Indian financial stress on FII flows in the Indian equity market significantly matter for the equity investors. Furthermore, FII flows in an emerging market, like India, direct investment positions of domestic equity market investors. Eventually, volatility and factors affecting FII flows should be accounted by the market participants on regular basis. As a future scope of study, other factors responsible for directing FII flows in the Indian equity market can also be considered and factored into the logistic regression framework.

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Notes

1. Collected from the website of the Federal Reserve Bank of Kansas City.
2.
$$Y_t = \frac{(X_t - \text{Mean Value})}{\text{Standard Deviation}}$$
3. For further details on Indian Financial Stress Index (see Singh & Singh, 2016).
4. The respective standardized weights are .97, .23, -.29, 0.94, and -.65 for bank spread, exchange rate volatility, debt spread, equity market volatility, and equity market returns. A negative weight highlights an increasing impact of the respective variable during negative phases, for instance, negative equity market returns enhance financial stress.

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