Foreign Portfolio Investment and Price Discovery of Indian Equity Stocks

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Abstract

Speed of price correction is an indicator of market efficiency. In this paper, we tried to find whether the speed of price adjustment of Indian equity stocks, measured by Damodaran's price adjustment coefficient (PAC), was indeed enhanced by foreign portfolio holdings. Applying the VAR Granger causality test, we found absence of any influence of FPI holdings in the speed of price corrections in Indian stocks and vice versa. We also observed that the speed of incorporation of stock level information was substantially lower than that of index level information, implying the existence of significant information asymmetry among different groups of investors and slow dissemination of firm specific information.

Keywords : **foreign portfolio investment, information asymmetry, price adjustment coefficient, vector autoregression**

JEL Classification : C580, G140, G230

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The degree of efficiency of a market and finding the points of inefficiency constitute the centre piece of the process of investment valuation. An efficient market provides easily comprehensible evaluation of the financial condition of individual companies as well as their future prospects and thus leads to the best and unbiased estimate of a security's value. In an inefficient market, prices may deviate from intrinsic value. Deriving a reasonable estimate of the intrinsic value helps in identifying overvalued and undervalued firms and thus is associated with a premium in terms of superior returns. A study of market efficiency, therefore, helps to filter out the segments of inefficiency. In an efficient market, the market price is an unbiased estimator of the intrinsic value of the investment, that is, there may be deviations from the intrinsic value, but the randomness of the deviation will deny any consistency in identifying undervalued or overvalued stocks by any group of investors using any investment strategy.

The efficiency of a market can be measured by the speed of price discovery or the process by which securities adjust to their intrinsic values. Based on the information reflected in prices, Fama (1970) classified market efficiency into three levels. If a market is efficient in the weak form, the current market price reflects the information contained in all historical prices, rendering technical analysis that uses historical prices alone useless in finding undervalued stocks. Under the semi-strong form of efficiency, the current market price reflects the information contained in all public information, including financial statements and news reports, thereby suggesting that fundamental analysis using public information will not consistently yield success in finding undervalued stocks. If a market is strongly efficient, then the adjustment is instantaneous, that is, the current price reflects all information, both public and private, leaving no opportunity for any investor to consistently find

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undervalued stocks by analyzing information. However, this does not imply that no investor will be able to outperform the market in the long run. In a market with extremely large number of investors, the laws of probability will ensure success of a large number of investors in consistently outperforming the market. Instead of their investment strategies, their success may be attributed to sheer luck. However, if a disproportionately large number of such investors follow the same investment strategy, then their success would be far from consistent.

Ryaly, Kumar, and Urlankula (2014) provided evidence of existence of weak form of market efficiency in India along with some more Asian stock markets, which was challenged by the finding of existence of day of the week effect in the Indian stock markets by Khanna (2015). For a market to become efficient, there should be profit maximizing investors who can identify the potential for excess returns, are able to employ the strategy which can outperform the market, and have adequate resources to trade on the stock till its price becomes efficient. This is contradictory as in an efficient market, there is no opportunity to outperform the market. However, as the investors realize the absence of such an opportunity, they stop searching for inefficiencies. This leads the market to be inefficient again. Hence, inefficiencies may appear at regular intervals, but disappear almost instantaneously as profit maximizing investors identify and trade on them, thus making efficient market a self correcting mechanism (Damodaran, 2002). Therefore, the speed of correction of prices may determine how efficient a market is. If the ease of trading on a stock increases, the price correction will be faster and reduce the probability of finding inefficiency. Similarly, the probability will be higher if costs of transactions and information acquisition become higher as it reduces the payoff associated with exploiting the inefficiency. Thus, speed of adjustment, in turn, is dependent upon the process of information dissemination by firms and information sharing process among the market participants. Instantaneous price correction is only possible when the information is disseminated by the companies and transmitted by the media, as also the information sharing among all groups of investors and other market participants have zero asymmetry. Also, technology plays a vital role in processing information for augmentation of the information dissemination and sharing.

Literature Review

Studies by many researchers portray institutional investors as smart traders possessing distinct informational advantages as against the individual traders. Their large volume of trades and larger resource base, coupled with superior analytical expertise impart economies of scale and bring down the marginal costs of information acquisition and processing. Therefore, the trade decisions of institutional investors may be driven by superior information.

Numerous works have provided evidence of superior informational advantage of institutions (Dennis & Weston, 2001) and their ability to forecast returns, which is suggestive of better informative prices of stocks with higher institutional holdings or a greater share of institutional trading. Sias and Starks (1997) found that both individual security and portfolio daily return autocorrelations were positively related to the degree of institutional holdings and suggested that institutional trading reflected marketwide information and accelerated the incorporation of information into prices. Cohen, Gompers, and Vuolteenaho (2002) observed that institutions responded to good cash flow news by buying shares from individuals. Thus, institutions as a group exploited the under-reaction in price response to firm level cash-flow news and pushed prices to their fundamental values. Also, Indian firms with greater disclosure were found to have lower information risk and lower return volatility leading to higher foreign institutional ownership (Bhattacharjee & De, 2013). Nofsinger and Sias (1999) and Wermers (1999), using quarterly and annual ownership data, respectively provided evidence that herding by institutional investors moved stock prices toward their fundamental values.

Sias (2004) suggested that institutional herding reflects the manner in which information is incorporated into securities prices. With the number of competing institutional investors increasing, the market tends to exhibit

faster price correction, reduced mispricing, and gradual disappearance of exploitable irregularities. Holden and Subrahmanyam (1992) showed that greater competition among strategic informed traders accelerated incorporation of private information into prices. To the extent that institutional holdings were correlated with the proportion of informed traders, informational efficiency of prices increased with institutional activity in a security. Moreover, researchers observed that if other market participants expected institutions to be better information producers, they should find it beneficial to be more attentive about order flow in stocks with greater institutional holdings (Boehmer & Kelley, 2009). Huang and Shiu (2009) observed that foreign investors enjoyed an informational advantage over local investors in the long run.

Froot, O'Connell, and Seasholes (2001), by analyzing daily net portfolio flows into 44 countries between 1994 and 1998, provided evidence that inflows had positive and statistically significant forecasting power for future equity returns in emerging markets. Froot and Ramadorai (2008) found that in emerging markets, institutional flows not only predicted movements in close-end country fund net asset value (NAV) returns and price returns, but also displayed trend-following (trend-reversing) behavior in response to symmetric (asymmetric) movements in NAV and price returns. They suggested that institutional cross-border flows were linked to fundamentals.

Despite substantial presence of FIIs in the Indian equity markets and their potential effect in stock price formation, no study is found examining the influence of FII holding on informational efficiency of the stock prices and vice versa in the Indian context. This calls for filling the gap through extensive empirical research to explore the relationship between FII holdings and the informational efficiency of the stock prices in the Indian stock market.

Objectives, Data and Methodology

(1) Objectives of the Study : In view of the research gap identified in the previous section, the present study attempts to :

- evaluate the speed of price adjustment to new information in Indian stock markets.
- examine the contribution of FII holdings in price discovery.

(2) Data and Research Methodology : Fifty companies included in Standard & Poor (S&P) CNX Nifty constitute the universe of the firm level study. For index level analysis of market dynamics, S&P CNX Nifty index was used. The Nifty companies are the focus of this study for three reasons. First, they have widely dispersed shareholding in comparison to small cap companies and hence are expected to disclose more information. Second, these companies' market capitalization constitutes around 66.17% of market capitalization of all NSE listed companies. It was also observed that the FII ownership of the companies in Nifty constitutes 93% to 96% of overall FII ownership in all listed firms over the study period. For comparing the firms across 48 quarters, the sample was matched over the study period. One company was excluded due to partial unavailability of data. Thus, the sample selection procedure yielded a final sample of 49 firms.

The period 2004-05 to 2015-16 was selected for the purpose of the entire study. Subjecting the retrieved time series data of each firm to Chow Breakpoint Test found a structural break during 2003-04, which indicated the prudence of studying the period since then. This was further strengthened by the fact that in 2003, with the objective of streamlining the registration process of FIIs and reducing the time taken for registration, the dual approval process of Securities and Exchange Board of India (SEBI) and Reserve Bank of India (RBI) was changed into a single approval process of SEBI. This led to a sudden surge in annual net addition to the number of FIIs and the net investment by them.

The study is based on secondary data at firm level and market level. The CMIE Prowess database acted as the source of information about the foreign institutional investors' activities, firm level quarterly financial data, and other stock market data.

(3) Variable Definitions and Measurement : This sub-section defines the variables for examining the relationship between FII holdings and stock efficiency.

↳ **Price Adjustment Coefficient (PAC) :** We measured the informational efficiency during any quarter by the price adjustment coefficient as developed by Damodaran (1993). This measures the speed of adjustment of a stock price or a market index to all new information and is superior to the traditional tests of efficiency which classify markets into three levels of efficiency, but do not provide a measure of efficiency. Damodaran's price adjustment coefficient (PAC) is calculated by using the daily stock returns (daily returns on S&P Nifty for PAC at index level).

Price adjustment coefficient (PAC_j) for j- interval returns :

$$g_j = \frac{2[\frac{\text{Var}(R_{jt})}{j} + \frac{\text{Var}(R_{qt})}{q}(j-1) + \frac{\text{Cov}(R_{qt}, R_{qt-1})}{j}]}{\frac{\text{Var}(R_{jt})}{j} + \frac{\text{Var}(R_{qt})}{q}(2j-1) + \frac{2\text{Cov}(R_{qt}, R_{qt-1})}{j}}$$

where,

R_{jt} = returns in time period t,

j = length of each return interval ($j = 1, 2, ..., q$),

q is of sufficient length to allow $g_q = 1$.

Var (R_{jt})= variance in observed return time series of returns of interval j.

↳ **Foreign Institutional Holding ($FII_{i,t}$) :** Contemporaneous and also lagged values of percentage ownership of FII holdings (i.e. percentage of outstanding common shares held by the FIIs for each company at the end of the quarter t) are used for the purpose of vector autoregression.

↳ **Return ($R_{i,t}$) :** Researchers have found strong contemporaneous relation between foreign institutional investors' equity flows and stock returns, which prompted us to include it in VAR analysis.

↳ **Illiquidity ($ILLIQ_{it}$) :** As liquidity may affect both of FII holdings and informational efficiency of stock prices, it is used for vector autoregression. Liquidity estimate of Amihud (2002) is used for the analysis as it is said to be one of the best measures to estimate within-country liquidity (Lesmond, 2005).

Amihud's (2002) formula is given by :

$$Amihud_{it} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{|R|_{idt}}{V_{idt}}$$

where, $Amihud_{it}$ is Amihud's illiquidity for stock i for the quarter t. R_{idt} and V_{idt} are, respectively the return and volume of stock i on day d in quarter t, and D_{it} is the number of days with observations in quarter t of stock i.

Natural logarithm of Amihud's illiquidity is used as an explanatory variable for vector autoregression :

$ILLIQ_{it} = ln\,(Amihud_{it})$

↳ **Volatility ($VOLAT_{i,t}$) :** High levels of return volatility are supposed to generate more portfolio rebalancing requirements and encourage investors to be more active in selling or buying shares. Thus, increased volatility is expected to increase stock liquidity which is necessary for faster incorporation of new information into security prices. On the other hand, FIIs may avoid stocks with high return volatility and prefer more stable returns.

Volatility ($VOLAT_{i,t}$) is measured by variance of daily log returns for each stock *'i'* or the index in each quarter *'t'* and calculated from daily closing stock prices as available in the CMIE Prowess database.

↳ **Size ($SIZE_{i,t}$) :** According to Kothari, Li, and Short (2009), since small firms usually have undiversified portfolio of assets and projects, they are riskier than large firms. Espinosa and Fructuoso (2005) in their study argued that as level of information availability is typically higher for bigger firms, they are less risky in terms of information asymmetry. Higher level of analyst-following for bigger firms provides filtered and processed information regarding these companies. Hence, a positive relationship between the proxy for size and stock price efficiency is expected and accordingly, size is used as an explanatory variable for VAR analysis and measured as natural logarithm of each firm's total market capitalization at the end of the quarter *t*.

↳ **Price to Book Value Ratio ($PB_{i,t}$) :** The price to book value ratio is measured by the market value of equity divided by the book value of equity as at the end of each quarter '*t*' of the study period. In the previous studies (Dahlquist & Robertsson, 2001 ; Edison & Warnock, 2004 ; Kang & Stulz, 1997), book-to-market (reciprocal of PB ratio) was considered as one of the factors for investment decision making by institutional investors.

↳ **Promoter's Holdings ($PROM_{i,t}$) :** Higher promoter's holdings in firms causes lower dispersion in ownership, which results in inadequate information being made available to the stock market investors, thereby impeding efficient price discovery. Promoter's holding $(PROM_{i,t})$ is measured by percentage of outstanding common shares held by the promoters of each company '*i*' at the end of the quarter *t*.

(4) Statistical Tools : Suitable financial and econometric tools were employed for processing the data and drawing logical inferences in the study. All the variables were first tested for stationarity using Augmented Dickey-Fuller (ADF) test. Vector auto regression (VAR) and VAR Granger causality or Wald tests were used to explain the interrelationship of the variables, existence of causality, and the direction thereof.

All statistical calculations including panel data analysis was done using EVIEWS software packages on the computer.

(5) Hypotheses : To determine whether FII holdings in the economy in general, or in a firm's stock, in particular, affect the efficiency of stock pricing and vice versa, the following null hypotheses were framed and tested :

↳ **H_{01} :** An increase in FII holdings in a firm does not result in an increase in efficiency of stock pricing.

↳ **H_{02} :** An increase in efficiency of stock pricing of a firm does not result in an increase in FII holdings in that firm.

(6) Steps in Research : At first, the price adjustment coefficients (PACs) were calculated for the stocks of selected 49 companies over 48 quarters of the study period using the models proposed by Damodaran (1993) and Amihud and Mendelson (1989). The firms were then split into quartiles based on percentage FII holdings at the beginning of each quarter in order to test for any significant difference between the price adjustment coefficients of the top quartile and the bottom quartile. As the price adjustment coefficient measures the speed with which new information is discounted into security prices, existence of a significant difference in PACs between top and

bottom quartiles may indicate a potential relationship between firm level FII holdings and the speed with which prices adjust to new information. If higher FII holding is related to faster (slower) adjustment of stock prices to new firm specific information, the price adjustment coefficients of the top quartile firms should be significantly higher (lower) than those of the bottom quartile firms.

Thereafter, VAR Granger causality was performed to determine possible causal relationships, and the direction thereof, between firm level FII holdings and price adjustment coefficients in presence of other potentially affecting variables.

The regression model used for the purpose is as follows:

$$PAC_{it} = \alpha + \sum_{j=1}^{k} \beta_j PAC_{i,t-j} + \sum_{j=1}^{k} \gamma_j VOLAT_{i,t-j} + \sum_{j=1}^{k} \delta_j FLL_{i,t-j} + \sum_{j=1}^{k} \theta_j PROM_{i,t-j} + \sum_{j=1}^{k} \vartheta_j R_{i,t-j} + \sum_{j=1}^{k} \mu_j ILLIQ_{i,t-j} + \sum_{j=1}^{k} \pi_j SIZE_{i,t-j} + \sum_{j=1}^{k} \rho_j PB_{i,t-j} + \varepsilon_{i,t} \quad (1)$$

$$FII_{it} = \alpha' + \sum_{j=1}^{k} \beta'_j PAC_{i,t-j} + \sum_{j=1}^{k} \gamma'_j VOLAT_{i,t-j} + \sum_{j=1}^{k} \delta'_j FII_{i,t-j} + \sum_{j=1}^{k} \theta'_j PROM_{i,t-j} + \sum_{j=1}^{k} \vartheta'_j R_{i,t-j} + \sum_{j=1}^{k} \mu'_j ILLIQ_{i,t-j} + \sum_{j=1}^{k} \pi'_j SIZE_{i,t-j} + \sum_{j=1}^{k} \rho'_j PB_{i,t-j} + \varepsilon'_{i,t} \quad (2)$$

Each equation contains *k*-lag values of all the variables included and Schwarz information criterion was used to determine the optimum lag length because including too many lagged terms consumes degree of freedom and introduces possibility of multicollinearity, while inclusion of too few lags leads to specification errors.

Analysis and Results

In Damodaran's price adjustment coefficient (PAC), the limiting return interval (q) is taken as 10 days to 40 days and the price adjustment coefficients are re-estimated using each of these limiting return intervals. It is found that the coefficient estimates stabilize for limiting return intervals beyond 16 days. Therefore, 20 days is chosen as limiting return interval to safely assume full price adjustment by this interval.

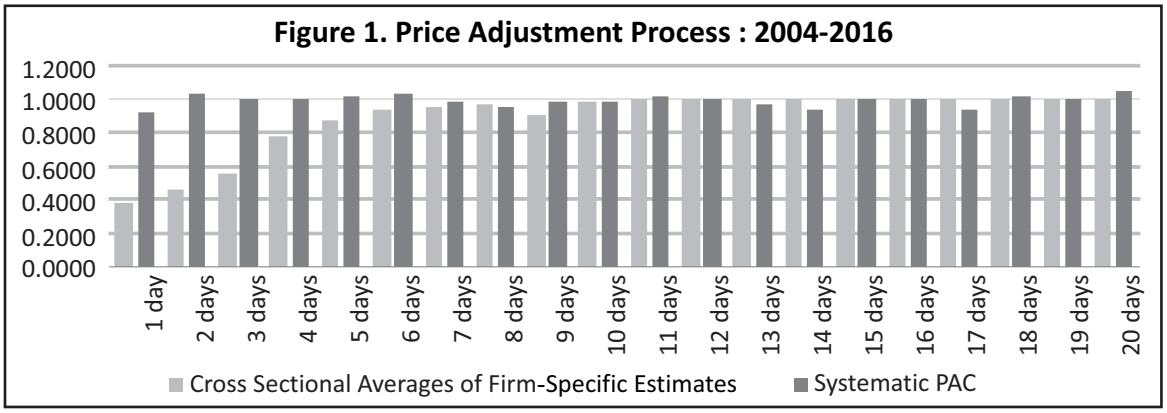
Price adjustment coefficients of the 49 firms over 48 quarters are estimated by averaging the quarterly PAC estimates for each firm (refer to the Appendix). A PAC value of 1 signifies full price adjustment. The cross sectional averages, medians, and standard deviations of the distributions of the coefficients are reported in the Table 1.

Table 1 leading to Figure 1 shows evidence of a lagged adjustment to new information. Using a simple median *t* - statistic based upon a binomial test, the price adjustment coefficients are found to be significantly less than one for return intervals up to 9 days. The estimates of price adjustment coefficients ('mean' in Table 1) suggest that 37.98% of new information is reflected in prices by the end of the day of release of the information, and 46.72% is reflected by the end of the next day. By the end of the 10th day, 99.4% of the information is discounted in the market prices. The market price is reflective of the full information by the end of the 12th day of the release of the new information. A fall in PAC at the end of the 9th day in comparison to the 8th day suggests a secondary price reaction as traders may temporarily perceive that the information has been fully discounted.

This evidence of lagged adjustment is in agreement with the previous studies (Damodaran, 1993 ; Hasbrouck & Ho, 1987 ; Woodruff & Senchack Jr., 1988). However, in this study, it is found that the lag of the adjustment is much longer than that observed in previous studies. One possible explanation can be the fact that all of those

Table 1. Estimates of Price Adjustment Coefficients : 2004 - 2016
Cross Sectional Averages of Firm-Specific Estimates

Interval	No. of Firms	Mean	Std. Dev.	Median	*t* (Median)	Serial Correlation of Returns on NIFTY	Systematic PAC
1 day	49	0.3798	0.1095	0.3438	-7.0000	0.0704	0.9296
2 days	49	0.4672	0.1075	0.4649	-7.0000	-0.0422	1.0422
3 days	49	0.5570	0.0901	0.5399	-7.0000	-0.0068	1.0068
4 days	49	0.7804	0.0637	0.7730	-7.0000	0.0009	0.9991
5 days	49	0.8845	0.0436	0.8822	-7.0000	-0.0197	1.0197
6 days	49	0.9365	0.0306	0.9372	-6.7143	-0.0440	1.0440
7 days	49	0.9639	0.0222	0.9648	-6.7143	0.0162	0.9838
8 days	49	0.9796	0.0167	0.9805	-6.4286	0.0410	0.9590
9 days	49	0.9149	0.0251	0.9050	-7.0000	0.0160	0.9840
10 days	49	0.9940	0.0102	0.9953	-2.7143	0.0195	0.9805
11 days	49	0.9975	0.0080	0.9983	-1.8571	-0.0165	1.0165
12 days	49	1.0000	0.0063	0.9994	-1.0000	-0.0015	1.0015
13 days	49	1.0006	0.0050	1.0006	1.2857	0.0300	0.9700
14 days	49	1.0012	0.0039	1.0012	3.0000	0.0510	0.9490
15 days	49	1.0013	0.0030	1.0017	3.2857	-0.0029	1.0029
16 days	49	1.0011	0.0022	1.0015	3.5714	-0.0021	1.0021
17 days	49	1.0008	0.0015	1.0011	3.8571	0.0506	0.9494
18 days	49	1.0005	0.0009	1.0007	3.8571	-0.0158	1.0158
19 days	49	1.0002	0.0004	1.0003	3.5714	-0.0037	1.0037
20 days	49	1.0000	0.0000	1.0000	7.0000	-0.0499	1.0499



studies have been on the informational efficiency of the developed markets ; whereas, the results of a slower price adjustment process, that is, lower level of efficiency is for an emerging market like that of Indian stock markets.

The appearance of price adjustment coefficients greater than one between 12and 15 days suggests a tendency of overreaction over longer intervals. Positive autocorrelation for 1 day interval is observed, which may have been induced by a delayed price adjustment process (Roll, 1984), and negative autocorrelations for longer-run intervals. It is also found that the standard deviations of the price adjustment coefficients decrease with an increase in return intervals, the value being largest for the daily return.

When the cross sectional averages of firm specific estimates of price adjustment coefficients are compared with systematic price adjustment coefficients, it is found that the latter is higher for shorter return intervals (ref.

Table 2. Estimates of Price Adjustment Coefficients : 2004 - 2016
Cross Sectional Averages of Firm-Specific Estimates
(Top and Bottom Quartile Firms Based on FII Holdings at the Beginning of the Quarter)

Interval	Top Quartile			Bottom Quartile			*z*-value	Probability
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.		
1 day	0.422	0.010	0.738	0.326	0.010	0.668	2.299	0.989
2 days	0.496	0.103	0.620	0.425	0.010	0.588	2.017	0.978
3 days	0.559	0.655	0.638	0.566	0.625	0.568	-0.204	0.419
4 days	0.786	0.836	0.363	0.780	0.819	0.337	0.318	0.625
5 days	0.889	0.909	0.233	0.882	0.902	0.214	0.556	0.711
6 days	0.939	0.949	0.164	0.934	0.940	0.144	0.575	0.717
7 days	0.966	0.970	0.119	0.962	0.963	0.102	0.615	0.731
8 days	0.981	0.983	0.088	0.977	0.975	0.076	0.751	0.774
9 days	0.906	0.910	0.062	0.923	0.924	0.065	-4.691	0.062
10 days	0.995	0.993	0.052	0.992	0.988	0.046	0.889	0.813
11 days	0.998	0.994	0.041	0.996	0.992	0.037	0.863	0.806
12 days	1.000	0.996	0.032	0.998	0.994	0.029	1.016	0.845
13 days	1.001	0.997	0.025	0.999	0.996	0.023	1.145	0.874
14 days	1.001	0.998	0.020	1.000	0.997	0.018	1.217	0.888
15 days	1.001	0.999	0.015	1.000	0.998	0.014	1.161	0.877
16 days	1.001	1.000	0.011	1.001	0.999	0.010	1.087	0.862
17 days	1.001	1.000	0.008	1.000	0.999	0.007	0.905	0.817
18 days	1.001	1.000	0.005	1.000	0.999	0.004	0.936	0.825
19 days	1.000	1.000	0.003	1.000	1.000	0.002	0.774	0.781
20 days	1.000	1.000	0.000	1.000	1.000	0.000	0.000	0.500

Figure 2. Cross - Sectional Averages of Firm Specific Estimates of Price Adjustment Process : April 2004 - March 2016 (Top and Bottom Quartile Firms Based on FII Holdings at the Beginning of the Quarter)

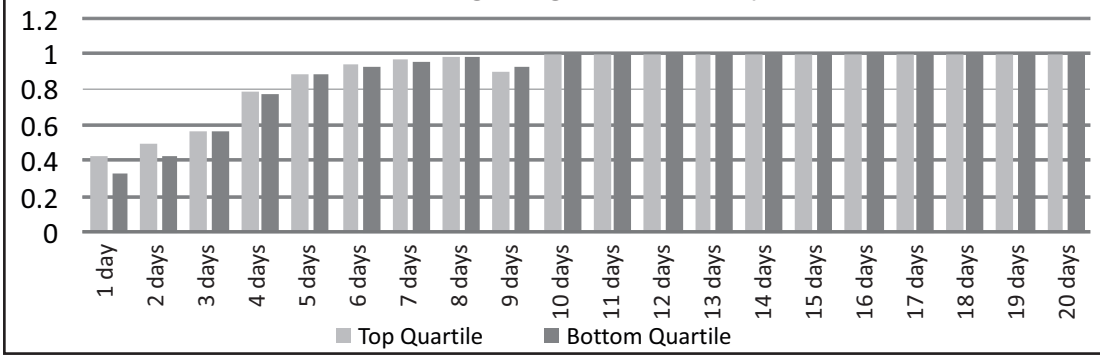


Table 3. Schwarz Information Criterion for Various Lags

Lag	0	1	2	3	4	5	6	7	8
SC	-5.3325	**-17.9975***	-17.3772	-16.4559	-15.2879	-14.1390	-12.9971	-11.8785	-10.7616

Note : * indicates lag order selected by the criterion

Table 4. Summary of VAR Granger Causality Tests

Interval	H_{01}: FII does not cause price adjustment coefficient.			H_{02}: Price adjustment coefficient does not cause FII.		
	Chi-sq	*df*	Prob. (*p* - value)	Chi-sq	*df*	Prob. (*p* - value)
1 day	2.149	1	0.143	0.461	1	0.497
2 days	1.928	1	0.165	0.059	1	0.808
3 days	0.051	1	0.822	0.042	1	0.837
4 days	0.169	1	0.681	0.009	1	0.924
5 days	0.204	1	0.651	0.056	1	0.812
6 days	0.155	1	0.693	0.966	1	0.326
7 days	0.083	1	0.774	0.697	1	0.404
8 days	0.038	1	0.846	0.005	1	0.947
9 days	0.878	1	0.349	4.529	1	0.063
10 days	0.019	1	0.891	0.186	1	0.666
11 days	0.021	1	0.884	0.000	1	0.983
12 days	0.013	1	0.910	0.092	1	0.761

Table 1). One day price adjustment coefficients are 37.98% and 92.96% for firm-specific and market-wide information, respectively. A new firm specific information is fully reflected in the prices by the end of the 12th day of the release ; whereas, a new market-wide information is fully reflected only by the end of second day as evident from the systematic PAC and serial correlation estimates of NIFTY (ref. Table 1). This may indicate that new market wide information is discounted in the prices faster than new firm-specific information.

A test for difference in means is performed to examine whether there is any significant difference between PACs of firms with high FII holding and those with low FII holding (ref. Table 2).

The comparison of price adjustment coefficients between top and bottom quartile firms (on the basis of FII holdings at the beginning of each quarter) does not show any significant difference between the two (refer to Table 2 and also Figure 2). This may be suggestive of an absence of relationship between price adjustment coefficients and FII holdings. For further confirmation, Granger causality test under VAR framework was performed (refer to Table 4) in the presence of contemporaneous and lagged values of other variables, which may have a bearing on FII holdings and price adjustment coefficients. Lag 1 is taken as the optimum lag on the basis of Schwarz information criterion (refer to Table 3). Since it is found that by the 12th day of the release of new information, the prices are fully reflective of it, the tests are confined up to a 12-day return interval.

The results of the VAR causality test in Table 4 clearly fail to find any causal linkage from any direction for all the return intervals (at 5% level of significance), that is, both the null hypotheses are accepted (H_{01} and H_{02}) - neither FII holding causes speed of price adjustment, nor is caused by it. So, stocks with higher foreign institutional holdings do not lead to better informative prices. Therefore, it can be concluded that FII holdings do not affect or depend upon informational efficiency of Indian stocks.

Conclusion

Firm level information is found to be fully reflected in the equity prices by the end of 12th day from the release of new information. A decline in price adjustment coefficients is observed on 9th day indicating at a secondary price reaction which is possibly driven by misperception of the investors that the new information has already been fully/over discounted or profit booking by short term traders. This is found to be corrected over the next day when the secondary reaction is over. A systemic or market wide information is fully reflected in prices by the end of 2nd

day from the release of new information. The price adjustment coefficients of the top and the bottom quartile (based on percentage of FII holdings) firms do not show any significant difference, which suggests the absence of any substantial influence of FII holdings on price discovery of the firms' stocks. Results of VAR Granger causality tests reiterate the same. These findings indicate the absence of informational advantage of FIIs over domestic investors and that, at least in the Indian context, foreign institutional holdings do not improve the information environment to enhance the speed of price discovery of equity shares.

Research Implications

- As price adjustment coefficients (PAC) signify the speed of incorporation of a new information into stock prices or the market index, they can be used to identify undervalued or overvalued stocks when and after a relevant information is released. Thus, profit potential from equity portfolios or index portfolios can be significantly enhanced by using PAC.

- The time taken by a stock's price or the value of an index to fully adjust to new information can be reasonably estimated using PAC. Therefore, for short term traders, use of PAC can help in deciding the right time of exit from a stock, stock or index options, or futures.

- The significant difference in time required for incorporation of index level and stock level information indicates lack of transparency in corporate affairs, high level of information asymmetry between insiders and outsider investors, and between different groups of investors, and slow dissemination of firm specific information. Measures to ensure faster and quality disclosure of corporate developments are required to be taken in order to protect the interests of the minority shareholders.

Limitations of the Study and Scope for Further Research

- Firm level FII holdings data in Indian context are available only at the end of each quarter as firms disclose them at quarterly intervals and CMIE collects and compiles these data from quarterly financial statements of the firms. Analysis of data of higher frequency could have revealed more about the relationships and the VAR models could be made more efficient for forecasting purposes.

- The response pattern of FIIs and domestic institutional investors (DII) due to idiosyncratic volatility shocks and its effect on speed of price adjustments to new information can be studied and compared, which may throw light on various important aspects of institutional behaviour.

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Appendix. List of the Sample Companies

1	ACC Ltd.	26	IndusInd Bank Ltd.
2	Adani Ports and Special Economic Zone Ltd.	27	Infosys Ltd.
3	Ambuja Cements Ltd.	28	Kotak Mahindra Bank Ltd.
4	Asian Paints Ltd.	29	Larsen & Toubro Ltd.
5	Axis Bank Ltd.	30	Lupin Ltd.
6	Bajaj Auto Ltd.	31	Mahindra & Mahindra Ltd.
7	Bank of Baroda	32	Maruti Suzuki India Ltd.
8	Bharat Heavy Electricals Ltd.	33	NTPC Ltd.
9	Bharat Petroleum Corporation Ltd.	34	Oil & Natural Gas Corporation Ltd.
10	Bharti Airtel Ltd.	35	Power Grid Corporation of India Ltd.
11	Bosch Ltd.	36	Punjab National Bank
12	Cairn India Ltd.	37	Reliance Industries Ltd.
13	Cipla Ltd.	38	State Bank of India
14	Dr. Reddy's Laboratories Ltd.	39	Sun Pharmaceutical Industries Ltd.
15	GAIL (India) Ltd.	40	Tata Consultancy Services Ltd.
16	Grasim Industries Ltd.	41	Tata Motors Ltd.
17	HCL Technologies Ltd.	42	Tata Power Co. Ltd.
18	HDFC Bank Ltd.	43	Tata Steel Ltd.
19	Hero MotoCorp Ltd.	44	Tech Mahindra Ltd.
20	Hindalco Industries Ltd.	45	UltraTech Cement Ltd.
21	Hindustan Unilever Ltd.	46	Vedanta Ltd.
22	HDFC Ltd.	47	Wipro Ltd.
23	I T C Ltd.	48	Yes Bank Ltd.
24	ICICI Bank Ltd.	49	Zee Entertainment Enterprises Ltd.
25	Idea Cellular Ltd.		

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