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Tech Tides: Analyzing Foreign Investment Flows and Volatility in the Information Technology Sector

Corresponding Author

1. **Ms. Neetu Chadha**, Research Scholar- School of Leadership and Management, MRIIRS and Assistant Professor, Delhi Institute of Advanced Studies, Correspondence Address: DIAS, Plot No.6, Sector-25, Rohini- Delhi- 110085, Email id: neetu.mhnd@gmail.com

Other Authors

2. **Dr. Ridhi Khattar**, Associate Professor- School of Leadership and Management, MRIIRS, Correspondence Address: MRIIRS, Sector-43, Faridabad, Haryana-121004, Email id: ridhi.slm@mriu.edu.in
3. **Dr. Meghna Chhabra,** Professor- FMS, Delhi School of Business, VIPS, Correspondence Address: AU Block, Outer Ring Road, Pitampura, Delhi-110034,
Email id: meghna.chhabra@dsb.edu.in

Abstract

India's IT industry is very attractive to foreign investors because of its low operating costs, large pool of highly skilled workers, and supportive business climate created by government regulations. These regulations are designed with investors' demands in mind, with a special focus on subjects like blockchain technology, cybersecurity, hyper-scale computing, and artificial intelligence. India is the market leader in the world of service sourcing in terms of market share. The computer hardware and software industries have attracted the highest inflows of foreign investment, with US$9.39 billion invested in them in FY23. This industry, which employs more than five million people, accounts for 53% of India's service export earnings. It is projected that the IT sector in India will contribute 10% of the country's GDP by 2025. FPIs have a significant impact on the IT sector in a number of ways, with an emphasis on how sector performance influences FPI investment decisions and vice versa while taking into account regional and global market trends, industry-specific regulations, and technological advancements.

This study examines the effects of foreign portfolio investments in the IT industry on sectoral returns and volatility of corresponding sector stock index using weekly time series data spanning an eleven-year historical period from April 2012 to the final day of March 2023. This research indicates that growth in the IT sector will drive more foreign portfolio investment (FPI) flows into the Indian IT industry, as the FPI flows into the Indian IT sector are primarily determined by the performance and returns of the IT sector. Overall, this study demonstrates the complicated relationships and complexity of these financial and economic variables, offering valuable insights into the behavior of financial portfolio investors and how such relationships impact sectoral dynamics and macroeconomic stability.

Keywords: FPI, FIIS, IT, NIFTY-IT, Returns, Relationship, Stock, Volatility

Introduction

India's IT industry's value proposition is based on its varied ecosystem, young and talented talent pool, outstanding physical and digital infrastructure, vibrant domestic market, and strong government support. This is because the world is turning to India to lead the way in driving global transformation.

In a year marked by financial uncertainty, the IT sector persevered thanks to the demand for corporate software and IT services, which fueled significant cost reduction and automation agreements. Year 2023 saw a 4.4% year-over-year decline in global tech spending, mostly as a result of declining hardware and gadget sales. The growth in spending

was mostly due to increases in corporate software and IT services, which accounted for approximately 1.1 times the total spending on technology.

With the ongoing geopolitical unrest across the world causing investors to be more cautious and decision-making to be postponed, India's technology industry revenue (including hardware) is predicted to expand by 3.8% year over year to $254 billion in FY2024, an increase of more than $9 billion over the previous year. With a 3.3% year-over-year growth rate, exports are forecast to reach $200 billion, while the domestic technology industry is predicted to increase at a 5.9% annual rate to surpass $54 billion. The industry is nevertheless a net hirer, adding 60K workers to bring the total number of employees to 5.43 million (1.1% y-o-y growth) despite the challenging market conditions. The manufacturing, retail, healthcare, APAC, and Europe sectors stand out as the industry's main development areas.

India is the most popular offshore location for IT companies worldwide. Top IT firms in India now have a whole new set of options thanks to developing technologies, after proving they could offer both on-shore and off-shore services to clients worldwide. Thanks to favorable government regulations and rising demand, India's information technology (IT) industry is booming. Foreign investors now have extremely profitable chances to take advantage of the sector's notable expansion in revenue, labor, and innovation. India is a desirable location for investment due to its significant role in the global IT landscape. The Indian government has instituted several sector-specific incentives to stimulate manufacturing and exports, built Software Technology Parks and Centers of Entrepreneurship, and started activities under the Digital India Scheme in an effort to further incentivize investments. The IT and telecom sectors have been allotted US$11.77 billion in the federal budget for FY 2023–2024.

As per the National Association of Software and Service Companies (NASSCOM), the revenue generated by the Indian IT industry in FY 2022 amounted to US$227 billion, indicating a rise of 15.5 percent on a year-over-year basis. By 2026, the use of cloud computing is expected to boost India's GDP by US$380 billion and generate many job possibilities for 14 million people.

Further foreign investment means that IT companies have access to additional capital. Increased sales and profits may result from using this money for expansion, R&D, and technological advancement. Best practices and cutting-edge technologies from their native nations are frequently brought by foreign investors. Higher returns may result from increased production and efficiency in the IT industry. IT companies can grow their customer base and potential revenue streams by entering new markets with the assistance of foreign investment. The influx of foreign investors frequently results in increased demand for IT sector equities, which can raise stock prices and raise the sector's overall market valuation.

Foreign investment has the potential to increase returns, but it can also increase volatility. When there is substantial foreign investment, the IT sector becomes more susceptible to developments in the world economy and investor mood. Increased volatility may result from things like shifts in foreign policy, geopolitical tensions, or worldwide economic downturns. Exchange rate fluctuations have an impact on foreign investments. The returns of foreign investors can be significantly impacted by significant variations in exchange rates, which might result in more volatile investment behavior. Speculative investing by foreign investors might lead to more short-term volatility. Sharp fluctuations in stock prices might result from unexpected capital inflows and outflows. Market volatility may rise in response to modifications to laws governing foreign investments, such as limitations or additional compliance standards.

Industries that receive a lot of foreign investment typically have more volatility. This is especially true for developing economies where there may be more unpredictable inflows of foreign cash. Foreign investment has proven to be beneficial for the Indian IT sector, as evidenced by the notable growth experienced by businesses such as Infosys and TCS. However, because of the state of the world market, the industry has also seen times of extreme volatility. Increased capital, technological transfer, and market expansion can result from foreign investment in the IT sector, potentially yielding higher profits. Because of its sensitivity to world events, exchange rate swings, speculative

investments, and regulatory issues, it also increases volatility. Investing professionals can effectively handle the effects by understanding these dynamics and utilizing proper risk management techniques.

There seems to be a close relationship between foreign portfolio investments, inflation, interest rates, sectoral performance, and predicted volatility. FPIs play a significant role in shaping the evolution of various economic sectors, and factors such as development opportunities, regulatory frameworks, and market conditions often influence their preferences. Furthermore, changes in expected volatility could lead to variances in FII behavior, which could alter how capital is allocated across different markets and industries. It is also well known that interest rates and exchange rates are correlated, with FPI inflows and outflows being influenced by central bank policies, which in turn affect changes in exchange rates. In a similar vein, FPI choices and changes in currency rates are seen to be impacted by inflation predictions, particularly in countries that are experiencing high inflation.

Overall, this analysis demonstrates the complexity and close relationships between these financial and economic variables, offering valuable insights into the behavior of FPIs and how it influences macroeconomic stability and sectoral dynamics.

Literature Review

Numerous studies, both qualitative and quantitative, are carried out with an emphasis on empirical research that sheds light on the mechanisms and impacts of FII influx. There are several recurrent topics and tendencies in the FPI literature. According to the Efficient Market Hypothesis (EMH), markets become more efficient with the presence of informed investors, including FIIs. This increased efficiency can lead to better pricing of stocks but can also introduce volatility as markets react swiftly to new information. The Capital Asset Pricing Model (CAPM) suggests that the expected return on an asset is related to its systematic risk. FIIs, by diversifying their portfolios internationally, can influence the risk-return profile of stocks. This can result in higher returns due to better risk management practices, but also increased volatility due to global risk factors.

FIIs bring capital, technology, and managerial expertise, which contribute to higher returns in the IT sector. FIIs introduce additional volatility due to their sensitivity to global events, rapid capital movements, and speculative behavior. Research continuously shows that FPIs display sectoral preferences according to variables including industry outlook, economic fundamentals, and regulatory environment. Aggarwal and Klapper's (2012) and Lahrech and Sylwester's (2017) empirical research emphasizes the significance of sectoral allocation techniques in FII behavior.

The IT industry frequently draws significant foreign direct investment (FDI) because of its high growth and profitability potential. Anticipations of technical innovation, digital transformation, and worldwide demand for IT products and services are frequently the driving forces behind foreign direct investment (FDI) flows into the IT sector (Chen et al., 2018; Cavusgil et al., 2004). Research looks into how FPI affects IT companies' success as well as the performance of the larger technology sector. FPI inflows have the potential to boost IT firms' market capitalization, liquidity, and funding availability, all of which can support the expansion and competitiveness of the industry (Cameron et al., 2011; Cavusgil et al., 2004).

Choe, Kho, and Stulz (1999) examined the impact of foreign equity flows on emerging markets and found that foreign inflows tend to increase market returns and liquidity. However, these inflows also introduce higher volatility as foreign investors react more quickly to global events compared to domestic investors. Rai and Bhanumurthy (2004) analyzed the impact of FII flows on the Indian stock market, showing that FIIs have a significant effect on market returns and volatility. The study highlighted that while FIIs bring capital and growth, they also contribute to short-term market volatility.

(2019) shed light on how FII trading behavior and institutional traits affect market volatility. Kang et al. (2017) look into the connection between FII ownership and stock return volatility in emerging markets, while Choi and Lee (2019) study the effect of FII trading activity on volatility in Korean stock markets. One area of interest for investigation is the volatility of FPI flows in the IT industry. FPI exposes IT companies to market volatility and outside shocks, but it can also give them much-needed funding and expertise. Research looks at ways to reduce the effects of abrupt capital withdrawals and manage FPI-related risks (Gompers and Metrick, 2001; Li et al.,2020)

Alfaro, Chanda, Kalemli-Ozcan, and Sayek (2004) discussed how foreign direct investment (FDI) can positively impact economic growth through capital accumulation, technology transfer, and increased competition. These factors contribute to enhanced returns for the sectors receiving such investments, including IT. Kim and Singal (2000) found that stock markets tend to become more efficient and exhibit higher returns following the liberalization of foreign investments. Their study indicated that the IT sector, in particular, benefits from the technological and managerial expertise brought by foreign investors.

Bekaert and Harvey (1997) explored the volatility implications of financial market integration. They noted that while integration and foreign investment can lower the cost of capital and lead to higher returns, they also expose markets to global shocks, thereby increasing volatility. Eun and Resnick (1988) provided evidence that international diversification through FIIs reduces risk for global investors but can increase market volatility in the host country due to the rapid movement of capital.

Garg and Bodla (2011) focused on the IT sector in India and found that FII investments are a significant determinant of market returns and volatility. Their empirical analysis showed that periods of high FII inflows corresponded with higher stock prices and increased volatility in the IT sector. Narayan, Narayan, and Prasad (2008) studied the impact of FIIs on the stock markets of South Asia, highlighting the IT sector as a key beneficiary of foreign investments. They noted that while FIIs contribute to the growth of the IT sector, they also lead to greater sensitivity to global financial conditions.

Understanding the balance between these positive and negative impacts is crucial for policymakers and investors aiming to maximize the benefits of foreign investments while mitigating associated risks. This body of literature provides a comprehensive understanding of how FPIs shape the financial dynamics of the IT sector.

There are still a number of questions and points of contention in the literature on the relationship between FII, sectoral allocation, and volatility, despite the progress made in this area. First off, opinions differ over the precise processes by which FII inflows influence market volatility. Some research indicate that FIIs have a stabilizing influence on markets, while others highlight heightened volatility brought on by speculative activity and herding behavior.

Furthermore, little research has been done to investigate how FII sectoral allocation affects market dynamics in ways that go beyond the stock market. Future research might examine how FII inflows affect volatility across a range of asset types, such as bonds, commodities, and currencies.

With an emphasis on the stock market, this literature review offers insightful information about the connections between FII, sectoral allocation, volatility, and financial markets. Even though our understanding of these processes has advanced significantly, further study is still necessary to close the current knowledge gaps and resolve ongoing debates. This will help investors and policymakers better understand how FII inflows affect the efficiency and stability of the market.

Objectives of the Study

This study intends to investigate and evaluate the short- and long-term links and associations between flows of foreign portfolio investment in the Indian IT sector and the returns of IT companies in the Indian equities market, taking into

account the Nifty IT returns over an eleven-year period. An attempt has also been made to examine how sectoral returns and the volatility of the IT sector stock indexes are affected by foreign portfolio investments in the IT sector.

Methodology

The current research uses weekly time series data of the IT sector's FPI, and the sectoral index or Nifty IT taken from the NSE, as well as data of the VIX, interest rate, CPI, and exchange rate USD-INR for an eleven-year period, from April 2012 to March 2023.

The National Stock Exchange website has the VIX and Nifty-IT data, while from the official NSDL website, the weekly time series figures of FPI in the IT industry was retrieved. Information about interest rates, CPI, and the USD-INR exchange rate is taken from Investing.com.

The Augmented Dickey-Fuller (ADF) test is used to test the assimilation sequence for the FII-IT and Nifty IT series initially. In order to accomplish the stated goal of the investigation, this paper applies the Granger causality test. Another method in the study to determine whether the future expectedness of one variable effects another is the Granger causality test.

This paper uses the Granger causality test to achieve the study's declared objective. For the FII-IT and Nifty IT series, the sequence of assimilation is first tested using the Augmented Dickey-Fuller (ADF) test. The Granger causality test is another tool used in the study to assess if one variable's prospective expectedness influences another.
The next stage is to look for autoregressive conditional heteroscedasticity (ARCH) when stationarity has been determined. To put it simply, an ARCH test is a statistical model that is used to estimate future volatility by analyzing the time series volatility in data sets. One of the model's properties is its volatility clustering, which states that periods of low volatility are followed by low volatility and time frames of high volatility are followed by high volatility. The Lagrange Multiplier (LM) test (Jarque & Bera, 1980) is the most often used method for determining if the ARCH effect, as hypothesized by Engel (1982), is present in univariate time series data sets.
To put it simply, the alternate hypothesis (H1) contends that the series of residuals contains an ARCH effect, while the null hypothesis (H0) asserts that there are no ARCH effects in the series of residuals. In order to determine which of the ARCH models—GARCH/TARCH, EGARCH, and Threshold GARCH—is the best fit for each index, it was imperative to test for the presence of the ARCH effect in the corresponding Nifty-IT.
According to Hansen and Lunde (2001), GARCH (1,1) yields the most accurate volatility forecasting outcomes. Since Hansen and Lunde (2001) also contend that GARCH (p,q) will be employed in situations involving daily data spanning several decades or hourly data spanning multiple years, GARCH (2,1) is used in this instance. Since weekly data are used in this investigation, GARCH (2,1) is the most appropriate predictor for calculating the degree of volatility in the IT sector because GARCH (2,1) responds to shocks quickly.

Analysis & Results

TABLE 1: AUGMENTED DICKEY FULLER TEST(ADF)

Variables	t-statistics	Probability
FPI-IT at Level	-9.050281	0.0000
Nifty-IT Returns at Level	-23.65695	0.0000
USD/INR Rate at 1st difference	-22.16254	0.0000
CPI at 1st difference	-26.05023	0.0000
Interest Rate at 1st difference	-23.90475	0.0000

The findings of the Augmented Dickey Fuller Test, which are displayed in Table 1, indicate that the FPI in the IT sector series and the Nifty IT return series are stationary at level. Rest Three series of exchange rate, Inflation and Interest rates are stationary at first difference.

TABLE 2: GRANGER CAUSALITY TEST

Null Hypothesis	F-statistics	Probability
Nifty-IT does not granger cause FPI-IT	33.1127	3.E-14
FPI-IT does not granger cause Nifty-IT	4.65325	0.0099
Interest rate does not Granger Cause Exchange rate	0.6315	0.5321
Exchange rate does not Granger Cause Interest rate	0.0260	0.9743
FPIIT does not Granger Cause Exchange rate	0.97913	0.3763
Exchange rate does not Granger Cause FPIIT	6.48695	0.0016
Interest rate does not Granger Cause NIFTY_IT	3.11065	0.0453
NIFTY_IT does not Granger Cause Interest rate	0.94726	0.3884
Inflation rate does not Granger Cause NIFTY_IT	1.70322	0.1830
NIFTY_IT does not Granger Cause Inflation rate	0.48627	0.6152
FPIIT does not Granger Cause Interest rate	0.80569	0.4473
Interest rate does not Granger Cause FPIIT	6.34572	0.0019
Inflation rate does not Granger Cause Interest rate	0.02849	0.9719
Interest rate does not Granger Cause Inflation rate	0.38668	0.6795
Inflation rate does not Granger Cause FPIIT	7.69817	0.0005
FPIIT does not Granger Cause Inflation rate	0.52704	0.5906

Moreover, the lead-lag relationship between FPI in the IT sector and Nifty-IT returns is investigated using the Granger causality test. The findings of the study categorically disprove the hypothesis that Nifty-IT does not cause FPI-Auto and vice versa. After examining the causal relationship between Nifty-IT and FPI movement in the IT sector, it was discovered that Nifty IT granger causes FPI flows in the industry. This illustrates how Nifty IT values can be used to forecast the industry's short-term FPI movements and how FPI flows within the IT sector impact sector returns. The test also demonstrated how the movement of FPI in the IT sector is influenced by the interest rate, inflation rate, and currency rate. The economy's interest rates have an effect on the changes in the It sector index i.e., NIFTY IT.

TABLE 3: JOHANSEN COINTEGRATION TEST

VARIABLES		Number of Hypothesised Equations	Maximum EIGEN Value	Critical Value at 0.05 Level	TRACE Statistic	Critical Value at 0.05 Level	Probability
FPI- IT	Nifty-IT	None	125.6910	40.07757	199.4651	95.75366	0.000
FPI- IT	Nifty-IT	Atmost 1	41.23703	33.87687	73.77415	69.81889	0.0055

Table 3 displays the results of the Johansen Cointegration test, which demonstrate that there is no cointegrating vector between FII in the IT industry and Nifty-IT. Since the Eigen value and Trace value for both series are bigger than their tabular values at the 5% level of significance, the test's basic premise is refuted. The rejection of the null hypothesis indicates the existence of a long-term relationship between FPI in the IT sector and Nifty-IT prices in the study, as well as at least one co-integrating vector between both. This shows that Nifty-IT and FPI in the IT industry have some long-term informational commonalities.

TABLE 4: GARCH results of FPI- IT, Macroeconomic factors and Nifty-IT volatility.

	β	**S.E**
C	0.027570	0.023737
FPIIT	2.41E-06	4.45E-07
Variance Equation		
Interest Rate	-0.001296	0.001490
USD/INR	-0.000235	0.000620
VIX	-0.000500	0.000229
CPI	8.40E-05	0.000305
C	0.000239	9.05E-05
RESID(-1)^2	0.039425	0.051348
RESID(-2)^2	0.071025	0.045446
GARCH(-1)	0.561676	0.147130

FPIIT is Foreign portfolio investment in IT sector, RESID(1)2 is squared error term and GARCH(ˆ1) is effect of prior-period volatility. CPI is consumer price index, USD/INR exchange rate, VIX is Implied Volatility Index. SE is the standard error terms.

The volatility of the Nifty IT is significantly impacted by FPI. It suggests that rising FPI causes rising Nifty IT volatility. Interest rates, exchange rates, and inflation in the nation all affect international portfolio flows, especially those in the IT sector. The findings also demonstrate that when FPIs grow, stock prices become more vulnerable to their selling pressure, which drives down stock values. These findings suggest that interest rates have a significant influence in luring foreign portfolio investors (FPI) to the nation and in providing a framework upon which FDI can be pursued. Furthermore, the importance of FPI in the IT sector indicates that the Indian financial system is developing, which will aid in understanding various investment environments.

Conclusion & Discussion

The current study examined the impact of foreign portfolio investments on returns in the Indian IT industry. Apart from the impact, the association between FPI flows in the IT sector and Nifty IT returns was also determined by examining the weekly time series data over an eleven-year span, beginning in April 2012 and concluding on the final day of March 2023, using the Granger Causality and Johansen co-integration tests. The two variables in the study exhibit more integration and more tightly coordinated motions. The results show that the FPI has a great influence on the Nifty IT's volatility. It implies that increased volatility in the Nifty IT is caused by rising FPI. Interest rates, exchange rates, and inflation in the nation all affect international portfolio flows, especially those inside the IT sector.

The study provides policymakers with a number of recommendations for bolstering the Indian stock market. First, given the current state of the economy, India has embraced a policy to encourage Foreign Portfolio Investors (FPIs) in its capital markets. This is because FPIs boost capital inflows into the nation while maintaining the nation's low level of foreign debt. However, when FPIs expand and put pressure on stock prices to sell, stock prices become more vulnerable. However, because DIIs offer a reliable source of funding, the government must increase domestic

involvement and investment. This is to be achieved by altering the nation's tax laws, investment, and saving outlooks. Second, increased financial stability and efficiency are needed by small-cap companies, particularly those that are still developing. Due to the fact that these companies are a significant source of employment and national development, the government must create appropriate rules for their sustainable financial development. There is a shortage of jobs in these companies after any financial setback. The goal of policy should be to keep FPIs and DIIs in balance. In addition to promoting the FPI flow, domestic investment institutions such mutual funds, insurance funds, and pension funds should be highlighted. Investors and portfolio managers will find the study's findings useful in understanding the relationship between FPI and stock market volatility and developing more effective volatility strategies to maximize investment returns. This research can be expanded in a number of ways. To start, high-frequency data provides further understanding of market activity. While high-frequency information about market pricing is accessible, it is not available for FPI and DII trading. Second, it will be helpful to look into how the flow of FPIs and DIIs affects things both generally and specifically for individual stocks.

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