RESEARCH PAPERS

A STUDY ON THE CAUSAL RELATIONSHIP BETWEEN CNX NIFTY AND THE INDEX OF INDUSTRIAL PRODUCTION

By

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ABSTRACT

The Index of Industrial Production (IIP) is an important indicator of economic trends and investors, therefore assume that it has a bearing on the index. This study seeks to address the question as to whether changes in the Index of Industrial Production has a bearing on the movement of the index. The CNX Nifty has been taken as the market index for the purposes of this study. The study covers data for the period between 1990 and 2015. The augmented dickey fuller test has been used to test for stationarity and the data has been found to be stationary after first differencing. Causality and direction of causality is studied using the Granger Causality test. The findings were surprising as the causality was seen to be from CNX Nifty to IIP, which is contrary to what many investors assume. The key finding is that the markets are informationally efficient and investors have access to data well before they are published.

Keywords: CNX Nifty, Index of Industrial Production, Stock Markets, Variables, Augmented Dickey Fuller (ADF), Granger Causality.

INTRODUCTION

India has witnessed large scale economic transformation in the last two decades. The votaries of liberalization have linked this to the economic reform package initiated in 1991. The 1990's also witnessed a marked growth in transactions done on stock exchanges. This is best evidenced by the boom in closing prices of the BSE (Bombay Stock Exchange) post the 1990's, as compared to the pre liberalization period. Figure 1 depicts the movement of Sensex from 1980 to 2014. The y- axis represents the closing value of the Sensex. The period post the 1990's clearly displays the boom period.

Figure 1 clearly shows that the stock market has boomed during and after the liberalization phase. The National Stock Exchange (NSE) which was incorporated in 1992 rode in on this wave of reforms by bringing in innovations that provided investors easy access to the market. The NSDL (National Securities Depository Limited) was incorporated at the instance of NSE and screen based trading systems were setup to provide investors ready access to information. This brought in information efficiencies which are a necessary concomitant of an efficient market system. The indices give an indication of the economy's health, though it is difficult to pinpoint and quantify with any degree of precision, the impact of any specific factor. Kelly in 'how the stock markets really work', highlights the connect between stock markets and the economy 'The primary link between the stock market and the economy — in the aggregate — is that an increase in money and credit pushes up both GDP (Gross Domestic Product) and the stock market simultaneously'.An increase in consumption boosts production. Firms are generally highly profitable in a boom cycle and this impacts investor perception and thereby reflects on stock prices. The consumption – production cycle is shown in Figure 2.

Figure 2 clearly highlights the consumption cycle and how it has a bearing on the performance of the stock market. Investors look at stock market movements as correlating with the movement of a bundle of macroeconomic variables. Information access to economic data is public and is accessible to all investors. The data on GDP, monetary policy, etc. are examples of information which can be accessed by any investor. One of the key indicators in this

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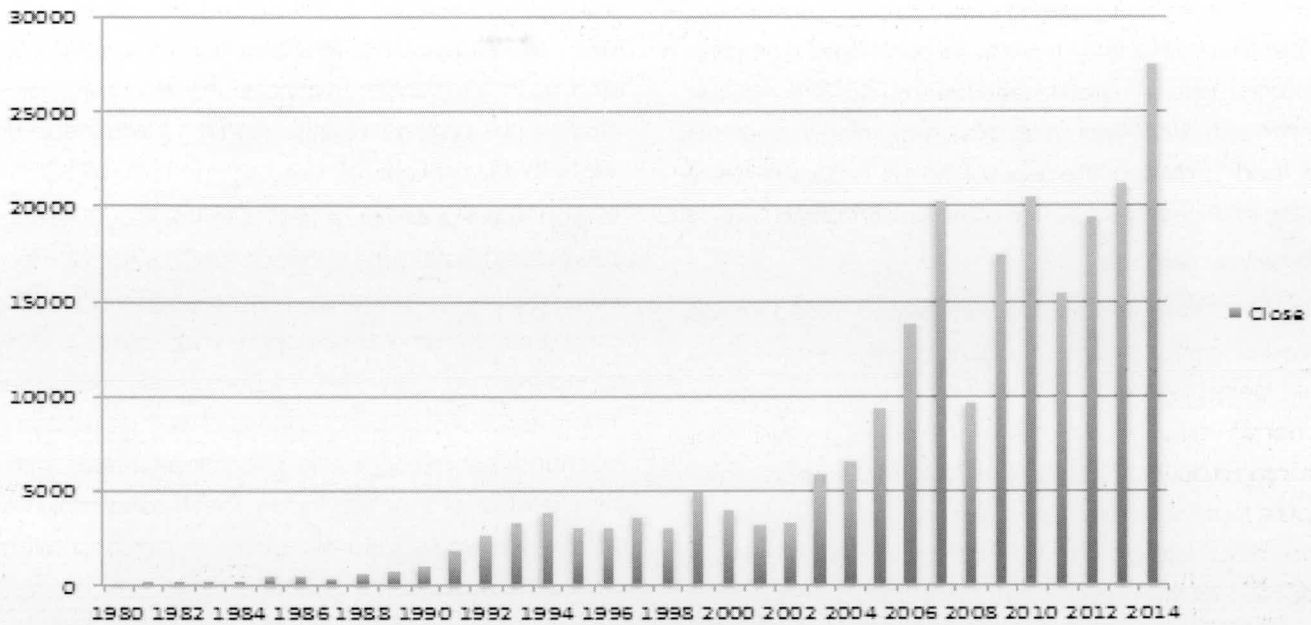
Source: Author Research based on data related to Sensex

Figure 1. BSE Sensex closing prices from 1980 to 2014
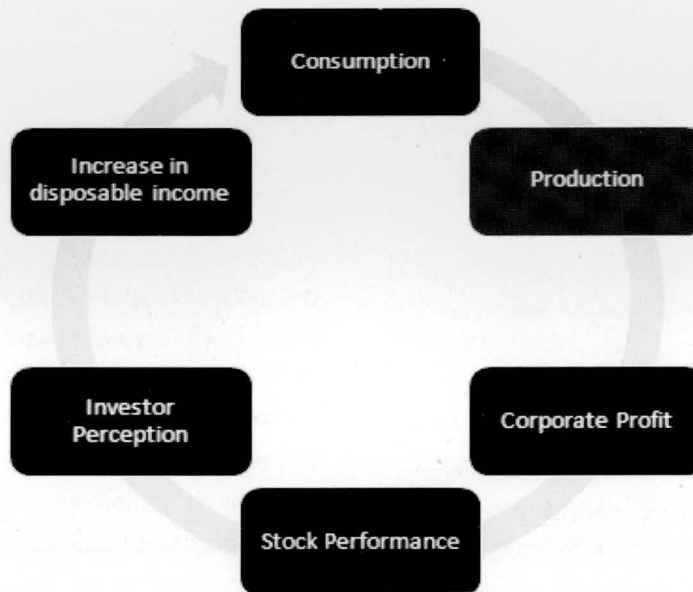
Source: The consumption cycle based on research done by author

Figure 2. The Consumption Cycle and Stock Market Performance

regard is the index of industrial production that is released by the Government of India at periodic intervals.

The Index of Industrial Production (IIP) is compiled by the Central Statistical Organization and serves as a composite indicator for measuring industrial production. This paper explores the possibility of patterns existing between the IIP data and the movement of stock indices based on the assumption that, any correlation can be established by tracking time series movements for the relevant period. The NSE has been chosen for this purpose as NIFTY is broad-based as compared to the BSE- Sensex. The CNX Nifty constitutes largely of stocks pertaining to the manufacturing sector. The IIP data has almost 80% representation from the manufacturing sector and

changes in IIP data signal critically changes the overall macro-economic environment.

This paper seeks to study the causal connection between production and the movement of stock prices. The paper takes off with a review of available literature on the subject and then assessing the causal nexus between data, relating to IIP and the direction of the stock market.

1. Review of Literature

A decision to buy or hold an investment is based on the analysis of various factors impacting the movement of the stock being studied. An investor analyses macro-economic variables form the largest chunk of data, prior to making a buy or hold decision. A key macro-economic variable that should form a necessary part of the analysis is the data related to industrial production. The key contention of this paper is that IIP and stock movement are interlinked and there is a causal relation between them.

A review of literature on the subject showed that macro-economic variables do indeed have an impact on the movement of stock prices. For instance, Yu II (2014) had conducted a study on the "Impacts of Macro-economic Factors on the Stock Market in Estonia" based on a sample during (2000.Q1-2013.Q3) and found that the Estonian stock market index is positively affected by the debt/GDP ratio, real GDP and the German stock market index and is negatively associated with the exchange rate, the domestic interest rate, the expected inflation rate, and the euro area government bond yield. Khodaparasti R.B (2014) had conducted a study on the role of macro-economic variables in the Stock market in Iran. The study conducted on data relating to the period between 2007 and 2011 showed that the exchange rate and industrial index have a greater impact on the stock market than inflation and M1.

A scan of literature related to research done on the Indian stock exchanges is in keeping with the finding that macro-economic factors do have an influence on stock price movement. Dr. Chandra Mohan et.al (2014) investigated the impact of inflation on stock market performance in the Indian context. Multiple correlation and linear multiple regression tools which were used to find out the relationship between Inflation and Exchange rate are taken as Independent variables and Price return of NSE NIFTY as the dependent variable. The results showed that inflation has a negative influence on the price return of NSE NIFTY.

Joseph Ato Forson et.al (2013) analyzed the long-run equilibrium relationship between the Thai stock Exchange Index (SETI) and selected macro-economic variables using monthly time series data, that cover a 20-year period from January 1990 to December 2009. The key macro-economic variables studied for the purpose were the money supply, consumer price index, Interest rate and the Industrial production index. They found interlinkages between macro-economic variables and the movement of the stock index.

Haruna Issahaku et.al (2013) studied the association between macro-economic variables and stock market returns in Ghana using ADF (Augmented Dickey–Fuller), PP (Phillip-Perron) and KPSS (Kwiatkowski– Phillips– Schmidt– Shin) tests. The study revealed that a significant long run relationship exists between stock returns and inflation, money supply and Foreign Direct Investment (FDI). In the short-run, a significant relationship exists between stock returns and macro-economic variables such as interest rate, inflation and money supply. In the short-run, the relationship between stock returns and FDI is only imaginary. VECM (Vector Error Correction Model) coefficient showed that it takes approximately 20 months for the stock market to fully adjust to equilibrium position in case of a macro-economic stock. The study also established a causal relationship running from inflation and exchange rate to stock returns. The above research justifies the findings of earlier research, notably that of J. K. M. Kuwornu (2012). J. K. M. Kuwornu (2012) which examined the relationship between Macro-economic Variables and the Ghanaian Stock Market Returns. The study employed the Johansen Multivariate Co-integration Procedure. The empirical results revealed that the macro-economic variables and stock returns in Ghana were co-integrated and thereby indicated long run equilibrium relationship.

Ifuero Osad Osamwonyi (2012) studied the relationship between Macro-economic Variables and Stock Market Index in Nigeria. The research assessed the impact of the following macro-economic variables on the stock market viz Interest rates, Inflation rates, Exchange rates, Fiscal deficit, GDP and money supply. Yearly data from 1975 to 2005 was analysed and the main finding was that macro-economic variables do indeed have an impact on the movement of stock prices.

Mohd Yahya Mohd Hussin et.al (2012) had conducted a study on Macro-economic Variables and Malaysian Islamic Stock Market to observe the relationship between Industrial Productions Index (IPI), Consumer Price Index (CPI), Aggregate Money Supply (M3), Islamic Inter Bank Rate (IIR) and the Malaysian Islamic Stock market. The findings showed that Islamic stock prices are co-integrated with the selected macro-economic variables. The stock price is also seen to be positively correlated with the Production index and the CPI variables.

An important study that does not support our hypothesis, is that of a study done in 2011 by Ashish Kumar. Ashish Kumar (2011) explored the causal relationship between the stock market and macro-economic variables in India. In this study, data relating to IIP, WPI and Stock market were tested using Augmented Dickey Fuller (ADF) Test, Phillips-Perron (PP) Test, KPSS Test, Co-integration Test and Granger Causality Test. The results showed that there is no evidence of co-integration among the economic indicators chosen and Indian Stock market, except with inflation WPI (Wholesale Price Index). The Granger Causality test was applied, but the results showed that there was no causality between the two variables and neither Nifty Granger causes WPI nor WPI causes Nifty. The implication of the research was that real sector does not impact the stock market and even the volatility in it is due to some other external factors and not these real economic factors. The period of study (April 2006 to March 2010) is too short and also corresponds with a period when the markets worldwide were moving through a turbulent phase.

Yu Hsing (2011) analysed the effects of Macro-economic Variables on the Stock Market in the Czech Republic applying the GARCH (Generalized Auto Regressive Conditional Heteroskedasticity) model. They found that the Czech stock market index generally has a positive correlation with the US and German stock market indices. They also found a correlation albeit negative correlation between the Stock market movement and the Government borrowing to GDP ratio. They further noted that a negative correlation exists between the exchange rate (CZK /USD) and the stock market index.

It is interesting to note that studies on the Dhaka and Pakistani stock exchanges have arrived at a conclusion which contrasts with the results of the studies given above. Nasrin Afzal et. Al (2011) attempted to establish the relationship between the Dhaka stock market and four macro-economic variables. The surprising conclusion of their study is that the stock market of Bangladesh is not sensitive to information flows with respect to money supply and inflation rate. On similar lines, a study by Imran Ali et.al (2010) reported that no causal relationship exists between macro-economic indicators and stock exchange prices in Pakistan. They concluded that performance of macro-economic indicators cannot be used to predict stock prices. However, this cannot be considered as conclusive evidence as Pakistan is witnessing a highly volatile political environment and therefore political factors also could have influenced the market movement.

The findings from Dhaka and Pakistan stock exchanges discussed above are at variance with research done on the Indian stock exchange. An example of the same is the study conducted by Dharmendra Singh (2010). Dharmendra Singh (2010) conducted a study on the relationship between S&P Sensex and Economic growth rates and attempted to explore the relationship between stock market index i.e. BSE Sensex and three key macro-economic variables of the Indian economy by using correlation, unit root stationarity tests and Granger causality test and concluded that, Indian stock market is information efficient, at least with respect to two macro-economic variables, viz. exchange rate and inflation.

On a tangentially different note, a survey was done by Khaled Hussainey (2009) to study the impact of macro-economic indicators of the United States on the

Vietnamese stock prices showed that, there was a statistically significant relationship between the variables. Another finding from the study is that, the US real sector movement has a greater impact compared to the more volatile money market. However, this study is relevant for the purposes of understanding the interlinkages between the macro-economic variables of different countries. Macro-economic variables cannot be studied in isolation and their movement is influenced by numerous factors. Investors are concerned about the movement of key indices read with a few variables. The reason production data has been chosen for the study is that the index subsumes a larger number of stocks from the manufacturing sector.

China is one of the fastest growing economies and thereby it was considered important to scour literature related to the Chinese stock exchange. Rui Tan (2011) had initiated a study to investigate the relationship between the stock returns of the beverage and food sector and nine macro-economic variables in China. The study was conducted using monthly data pertaining to the whole beverage and food industry index between 2005 and 2009. They used multiple regression analysis to examine these relationships. The conclusion from the study was that the movement of stock prices reflected the changing ground realities in China.

Sezgin Acikalin et.al (2008) examined the relationships between stock market returns and domestic macro-economic variables in the Turkish economy. Co-integration tests, a Vector Error Correction Model (VECM) and Causality tests were used to interpret the relationship between the selected variables. They found that there was a long-term stable relationship among stocks of the Istanbul Stock Exchange (ISE) and four macro-economic variables – GDP, exchange rates, interest rates, and Current Account Balance.

Andreas Humpe et.al (2007) analysed the long run relationship between macro-economic variables and stock market movements. A co-integration analysis was applied in order to model the long term relationship between industrial production, the consumer price index, money supply, long term interest rates and stock prices in

the US and Japan. They found that US stock prices were influenced positively by industrial production. On similar lines, a survey of macro-economic variables and stock market indices was conducted by Maysami et al (2004). The key conclusion was that the Singapore's stock market and the property index form a co-integrating relationship with changes in the short and long-term interest rates, industrial production, price levels, exchange rate and money supply.

Christopher Gan et.al (2006) assessed the impact between the New Zealand Stock Index and a set of seven macro-economic variables. They examined the data from the period, January 1990 to January 2003 and arrived at the conclusion that there is a clear relationship between the New Zealand stock exchange and the macro-economic variables studied. The paper investigated the short run dynamic linkages between NZSE40 and macro-economic variables for the period between 1990 and 2003. They concluded that the NZSE40 stock price movement is consistently determined by the interest rate, money supply and real GDP. The interesting finding is that investors seeking to invest in the New Zealand Exchange should pay more attention to the mentioned macro-economic variables rather than limiting themselves to assessing the impact of exchange rate and inflation rate.

Abdullah Al. Mutairi et.al (1999) explored the effects of macro-economic variables and the behavior of Kuwait stock exchange. They studied the behavior of stock prices and its interlink age with interest rate, money supply, inflation, and government expenditure. The study spanned the period 1995 to 2005 and the study uncovered a clear connect between the variables and the index. Further to this, Al-Sharkas, Adel (2004) had conducted a study on the dynamic relationship between macro-economic factors and the Jordanian stock market. The VECM used for the purpose clearly highlighted the existence of a long term relationship between the indices and the macro-economic variables. The literature scan has given clear indications of a connection between macro-economic variables and stock market returns. The current study assumes that production data is

the key indicator of an economy's health and thereby restricts the study to an assessment of its impact on the movement of stock prices. The study also hopes to benefit investors who are looking forward to a clear causal connect between production data and the movement of stock prices.

2. Objectives of the study

John Kenneth Galbraith (1955) stated that 'the stock market is a mirror, which provides an image of the underlying or fundamental economic situation. The study hypothesizes a causal connect between stock prices and production data. The objectives of the study are as follows:

- To shed light on the nature of the causal relationship that exists between CNX Nifty and the Index of Industrial Production.

- To explore to what degree the two variables cause each other.

- To assess the causal relationship, if any, and as to whether the causality is bivariate.

3. Hypothesis Postulated

Since the study seeks to explore causality from IIP to Sensex and vice versa, the hypothesis for the purpose is explored from both directions. This paper hypothesizes a positive relationship between industrial growth with the IIP data serving as a proxy for production and the stock market, with the CNX- Nifty representative of the market.

3.1 Hypothesis 1

H_0: Industrial production has no bearing on the direction of the stock market

H_1: Industrial production data has bearing on the direction of the stock market

3.2 Hypothesis 2

H_0: Stock market movement has no causal relationship with production data

H_1: Stock market movement has a causal relationship with production data

4. Research Methodology

An efficient market is one in which the prices of securities in the market reflects all available information. The reason

for the same is that internet based trading has seen a larger number of investors foraying into equity investing. The number of investors in a market is also an important factor in determining market efficiency. The period from 1990 to 2015 has been selected for the purposes of this study. The study takes off by examining literature revealing a causal connect between macro-economic variables and movement of stock prices.

Macro-economic variables and stock market for more than 16 countries have been studied to identify the gap in studies. It is also assumed that a fifteen year period is long enough for any cyclical or seasonal trend to manifest itself. It also helps in weeding out distortions arising out of exogenous shocks.

A scatterplot analysis hints at the possibility of the data being stationary. This assumption is tested using the Augmented Dickey Fuller test. The final assessment of causality is tested using the Granger Causality test and the lags for this purpose have been selected based on the Akaike Information Criterion.

4.1 Tools Used

4.1.1 Augmented Dickey Fuller test

An Augmented Dickey–Fuller test (ADF) is run to test for stationarity on the IIP data and Nifty data, taken independently.

4.1.2 Granger Causality test

The Granger Causality test is used to test bivariate causality flowing from Nifty to IIP and vice versa.

4.1.3 Sampling Technique

Simple random sampling technique has been used and, the data relating to Nifty has been obtained from the NSE website and the data relating to production has been sourced from the website of the ministry of statistics and programme implementation of the Government of India.

5. Analysis and Interpretation

The assumptions relating to asymptotic analysis will not hold well if the regression variables are not stationary and this would make it difficult to run a valid hypothesis test. The Augmented Dickey Fuller test (ADF) has been used to test for stationarity in the variables. The Augmented Dickey

Fuller test was first done on data relating to the Index of Industrial Production. The data was seen to be non-stationary and the ADF test was run again after first differencing. The results were shown to be stationary after first differencing. The ADF test on the Nifty threw up similar results. The tables given below detail the results of the study.

6. Test Results

6.1 Test for Stationarity on Data related to the Index of Industrial Production

Table 1 shows the result of the ADF test run on the IIP data. The null hypothesis is accepted and the study concludes that the series is not stationary. The ADF test has been used to assess stationarity after first differencing. The results obtained after first differencing are given in Table 2.

The IIP data was differenced and the ADF test was run on the data after 'first differencing'. Table 2 shows the output of the ADF test. The null hypothesis stands rejected and the series is seen to be stationary after first differencing.

Table 3 shows the results of the ADF test run on data relating to the NIFTY. The data was tested again after first differencing and it was found to be stationary.

6.2 Causality Test

The Granger causality test has been used to test the hypothesis that CNX NIFTY closing data Granger causes IIP

Null Hypothesis: IIP has a unit root
Exogenous : Constant
Lag Length: 12 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-2.596943	0.0967
Test critical values:	1% level	-3.492523	
	5% level	-2.888669	
	10% level	-2.581313	

Source: Author Research

Table 1. Test for Stationarity on IIP data
-The Augmented Dickey Fuller test

Null Hypothesis: D(IIP) has a unit root
Exogenous : Constant
Lag Length: 11 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-3.1844	0.0236
Test critical values:	1% level	-3.4925	
	5% level	-2.8887	
	10% level	-2.5813	

Source: Author Research

Table 2. Test for Stationarity on IIP data- Augmented
Dickey Fuller Test after first differencing

Null Hypothesis: D(Nifty Closing) has a unit root
Exogenous : Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.10574	0.0000
Test critical values:	1% level	-3.486551	
	5% level	-2.886074	
	10% level	-2.579931	

Source: Author Research

Table 3. Test for Stationarity on data related to CNX Nifty

Sample: 1120
Lags: 2

Null Hypothesis :	Obs	F-Statistic	Prob.
NIFTYCLOSINGD does not Granger Cause IIPD	117	3.82562	0.0247
IIPD does not Granger Cause NIFTYCLOSINGD		0.25874	0.7725

Source: Author Research

Table 4. Pairwise Granger Causality Test

data and also the hypothesis shows that IIP data Granger causes Nifty closing values. The results of the test are given in Table 4.

Table 4 shows the result of the pairwise Granger causality test run on the differenced NIFTY and IIP data. The null hypothesis states that Nifty closing does not Granger cause IIP data stands get rejected and the study concludes that Nifty closing values granger causes IIP values. However, surprisingly IIP data does not granger cause Nifty closing values. This anomaly can be explained by taking into account the fact that information trickles in well before the data on industrial production is published.

The Granger causality test indicates that there is a unidirectional causality between the stock movements on the NSE and the movement of the Index of Industrial production. This could be because stock markets incorporate real time information, whereas the IIP data being studied is the one released long after the actual production data has been obtained. The data is published monthly, though the lag between obtaining the data and its publication is about six weeks. It is possible that the IIP data made available merely serves to validate information which is already available to investors.

Market efficiency implies that stock prices incorporate all available information. Information sources about production data are available well before they are published by the Central Statistical Organization. Quarterly financial statements, RBI databases and other

numerous sources of information related to a specific industry or firm give indications of the movement of economic variables. Investors also pick up cues relating to consumer confidence which have an impact on consumer demand. An increase or decrease in consumer confidence automatically impacts production. Investor expectations relating to future earnings reflect in an early buildup of stock prices. This is another key reason that the stock prices project early on what is finally reflected in the data. The early movement also projects positively on stakeholder expectations and thereby making it possible for the firm to access more capital and improve on their production capacity.

An important limitation of this study is that the study has limited itself only to variables related to production. However, a panoply of factors impact the movement of stock prices such as, for example, FII inflows, scams or changes in the political scenario.

Conclusion

The study has validated what happens to be an obvious connect between industrial production and industry performance. Positive performance data drives investor sentiment and reflects on stock performance. The analysis shows that investors apparently have access to information well before the data on industrial production is actually published. This is counter-intuitive, but the explanation probably lies in the fact that investors wade through vast swathes of information before taking a decision to invest. Investors and policy makers would find this study useful as it highlights the importance of informational efficiency as it relates to the Indian market. However, the study has not focused on a sector wise analysis and further research in this direction could throw up information that could be of greater use to decision makers.

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