Investigating the Causal Relationship among Returns of NIFTY50 stocks in Nine industries Using High-frequency Data

Balachandru B, Student, Amrita School of Business, Amrita Vishwa Vidyapeetham, Coimbatore

Guidance - Dr. P. Balasubramanian, Associate Professor, Amrita School of Business, Amrita Vishwa Vidyapeetham, Coimbatore.

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Objective

The objectives of this study is to:

•Investigate the presence of Granger causal relationship between stock returns among different companies in the same industry using high frequency data (converted from tick - tick data).
•Examining the predictability of Stock return among NIFTY50 Stocks.
•Checking for the resilience of Efficient Market Hypothesis.

Introduction

- Efficient Market Hypothesis (EMH) suggests that there is no possibility of predicting the future prices by analyzing the past data or publicly available new information or through a combination of public and private data.
- Fama E.F. also splits the efficiency into three forms:

Weak Form
- Current stock prices depend on historical data

Semi-strong Form
- Current stock prices depend on the information that is publicly available

Strong Form
- Current stock price depends on both the company's insider information and information that is publicly available

- The purpose of this study is to determine whether a causal relationship exists in stock return among the companies in the same industry and where the efficient market hypothesis holds good in these cases or not..
- Pairwise Granger causality test has been used to check for the existence of causal relationship among companies.
- Differentiating factor is the use of five-minute wise closing price data of Nifty50 companies for the duration of July 2014 to June 2015.

Literature Review

Efficient Market Hypothesis
- Efficient capital markets: A review of theory and empirical work by Fama E.F.
- Stock Price Predictability by W.E. Ferson

Granger Causality Test
- Price-Volume Relationship: Some Evidence from the Indian Stock Market by D. Singh & P Balasubramanian.
- The Stock Price -- Volume Relationship -- Evidence from the Indian Stock Market M.H. Pesaran & A Timmermann
- Trading volume and cross-autocorrelations in stock returns by T Chordia & B Swaminathan
- Stock market integration: Granger causality testing with respect to nonsynchronous trading effects by E Baumöhl & T Výrost
- Measuring stock price and trading volume causality among Nifty50 stocks: The Toda Yamamoto method by Abinaya P, Kumar VS 7 Balasubramanian P.

Predictability of Stock Returns
- Intraday return dynamics and volatility spillovers between NSE S&P CNX Nifty stock index and stock index futures by Pati. P.C & Rajib P
- Stock prices and trading volume: An assessment for linear and nonlinear Granger causality by A Rashid

Methodology

Data:

- Second by Second (Tick – Tick) closing price data of companies that are list in the NSE was collected for the duration from July 2014 to June 2015 (One year).
- Spark, SPSS and MS-Excel were used to clean the data.
- To calculate Stock returns rom stock price data, we use,

$$\textbf{Stock Returns} = \ln\left(\frac{\textit{Price during time } (t)}{\textit{Price during time } (t-1)}\right)$$

- EViews software is used to run the Granger Causality Tests.
- Augmented Dickey-Fuller (ADF) Unit root test has been used to check for stationarity and the data has been found to be stationary.
- Finally, Granger Causality test has been performed to check for causal relationship in stock returns.

Framework:

- Generalized model for pairwise granger causality test between two companies A and B,

$$A_t=\alpha_0+\alpha_1B_{t-1}+\ldots\ldots+\alpha_nB_{t-n}+\beta_1A_{t-1}+\ldots\ldots+\beta_nA_{t-n}+\varepsilon_t$$
$$B_t=\gamma_0+\gamma_1A_{t-1}+\ldots\ldots+\gamma_nA_{t-n}+\sigma_1B_{t-1}+\ldots\ldots+\sigma_nB_{t-n}+\mu_t$$

Variable Description:
$\alpha, \beta, \gamma, \sigma$ = Pairwise granger causality model coefficients
ε_t, μ_t = the residual term for each time series.
n = Lag

Hypothesis:

- Generalized hypothesis for pairwise granger causality test to study the causal relationship between two companies A and B are as follows:

H01a: A's returns does not granger cause B's returns
H11a: A's returns does granger cause B's returns

H01b: B's returns does not granger cause A's returns
H11b: B's returns does granger cause A's returns

Results

- The Nifty 50 companies were split into different groups based on the industry which they belonged to.
- Since industrial manufacturing, media & entertainment and services industries had only one company granger causality test could not be performed for those industries.
- Unit Root Test is performed and all data is found to be stationary.

Industry	Bidirectional	Uni-Directional	No Causal Relationship
Automobile Industry	1	5	5
Cement & Construction Industry	4	2	2
Consumer Goods Industry	1	1	3
Energy Industry	2	7	31
Financial Sector	5	13	49
Metals Industry	2	1	1
Telecom Industry	1	0	0
IT Sector	1	3	15
Pharma Industyr	3	3	3
Total	20	35	109

Conclusion

- The results from the granger causality test suggests that efficient market hypothesis does not hold good in fifty-five instances
- The results also suggest that there is a lead-lag relationship in stock returns of different companies in the same industry and hence there is possibility for predicting future stock returns using lead indicators for the stock.

Limitations

- The scope of this study is limited to only Nifty50 companies and further research can include more companies from both NSE and BSE.
- Current study is for one year, which can be extended to a longer period so as to test the limits of efficient market hypothesis even further.