ORIGINAL RESEARCH PAPER

Economics

AN EMPIRICAL ESTIMATION OF ASYMMETRIC INFORMATION IN INDIAN STOCK MARKETS WITH SPECIAL REFERENCE TO PHARMACEUTICAL COMPANIES

KEY WORDS: Asymmetric Information,Pharmaceuticals, PIN

Manjunatha G — Research Scholar, Dept. of Studies in Economics & Cooperation, University of Mysore, Mysuru,

Prof. M. Mahesha* — Professor of Economics, Dept. of Studies in Economics & Cooperation, University of Mysore, Mysuru* Corresponding Author

ABSTRACT

Present study investigates the problem of asymmetric information in Indian Stock markets considering the trading of equity stocks of six pharmaceutical companies- Aurobindo Pharma Ltd, Cipla Ltd, Dr Reddy Laboratories, Glaxosmithkline Pharmaceuticals Ltd, Lupin Ltd and Sun Pharmaceuticals that are listed on BSE. The study found that Probability of Informed Trading (PIN), a proxy used for asymmetric information in trading of stock markets is significant for all the companies. Even PIN's parameters namely , , and are significant. However, Results for Aurobindo Pharma Ltd, Dr. Reddy Laboratories, Glaxosmithkline pharmaceuticals and Sun Pharmaceuticals are identical in all break periods. Similarly, Lupin Ltd and Cipla Ltd have identical results

1. INTRODUCTION:

Financial system and financial intermediation are very important for the healthiness and proper functioning on any economic system. These provide a channel for funds to move from savers and investors to value creating investment opportunities. A financial system is a facilitator of economic activity and growth. It accelerates the growth of savings, lowers intermediation costs, enables innovation cheaper, helps in evaluating the healthiness of economy, and thereby helps in promising success of monetary and fiscal policies.

It is quite significant that importance of money was recorded in the third quarter of Nineteenth Century. "Money is Economic Power. Lombard Street is by far the greatest combination of economic power and economic delicacy that world has ever seen" (Bagehot, 1873). Financial markets promote Economic Development is also seen in the works of Schumpeter (1912). Joseph Schumpeter combines real and monetary sectors of the economy. He further states that "current money supply is instrumentally used to possess more money in the future. Modelling the role of financial markets in economic growth was put forth through pioneering research works 'Financial Aspects of Economic Development' (Gurley & Shaw, 1955), 'Financial Structure and Development' (Glodsmith,1969), 'Money and Capital in Economic Development' (McKinnon, 1973), and 'Financial Deeping in Economic Development' (Shaw,1973). Even recent works of Pagano (1993a) and Levine (1996, 1998), Garcia (1999), Errunza (2001), Bekart, Harvey & Lundbland (2001), Arestis, Demriades & Luintel (2001), and Claessens etal., (2006) have made serious attempts to model the impact of stock markets or capital markets on the economy. Going a step ahead Mishkin (2000) argues that asymmetric information is a key factor of financial instability. Central banks should concentrate on financial stability along with price stability although both are related and price stability can further the financial stability. Greenwald and Stiglitz (1993), Bernarke and Gertler (1989) and Calomiris and Hubbard (1990) have held that whenever there is a market crash or a decline in markets, would lead to large depreciation in the market value of firms' net worth. Therefore the said theoretical and empirical works have emphasised the role of the financial sector in augmenting the economic growth. If financial markets collapse, they would have large and significant negative impact on the real economic sector.

Stock Market is heart of the financial system. It operates as a mechanism of transforming savings into financing of the real sector. It augments the real production by enhancing and improving the quality and quantity of the investments. Higher the savings mobilisation higher will be the amount available for investments. Stock markets can allocate increased pace of savings to investment projects that can yield higher returns. As a result, higher returns will prompt savers to save more makings savings attractive and these increased savings can be mobilised to corporate sector. Consequently, stock markets can become efficient and efficient markets make corporations more competitive and productive with higher returns (Wassal, 2013). However, existence of asymmetric information would affect the efficiency of the prices and may disturb the equilibrium price affecting the allocation of resources. Conflicts of interest in any financial transaction will hinder the true investment or profitability of the investment, if made.

Asymmetric information is an issue that attracted more researchers, academicians and financial economists today. It is an issue that arises whenever anyone in a transaction hides information pertaining to purchase/sale of that commodity, its price and quality. This is more severe and serious issue in all financial markets. It is because it reduces efficiency of the market disturbs proper functioning of the market, may play the role of culprit in downgrading economic growth.

2. DATA AND METHODOLOGY:

Present study is conducted using only secondary data of Bombay Stock Exchange (BSE) Market from 01-04-1999 to 31-03-2017. The data is collected from BSE Sensex reports. The data is also collected from Reserve Bank of India, Reports of Respective Companies, Moneycontrol.com and tradingeconomics.com. Of all the securities traded on BSE, equity share market is selected for the study as it is liquid and more frequently traded security. The performance of equity market dominates the performance of stock market.

Data pertaining to daily trades, Opening and Closing prices, Number of Shares traded, Daily Stock market returns and Daily Turnover is collected from S&P BSE SENSEX. A total of 6 companies with Market capitalisation of Rs. 10,000 Crores manufacturing of pharmaceuticals are selected for the study. The value of market capitalisation is calculated by multiplying the price of a stock and total number of a company's outstanding shares. Technically,Market Cap = Price X Total Number of Outstanding Shares.

Market Cap is an important concept to understand the relative size of one company over others. It also explains how much worth a company is in market and provides perception of investors for its future projects.

For the data collected, Probability of Informed Trading (PIN),

Submitted : 10th April,2019 | Accepted : 11th July,2019 | Publication : 15th September, 2019

which is a proxy of asymmetric information, is estimated. This PIN Model is most frequently used in measuring the extent of asymmetric information in the stock market. In the absence of Intra-day trading data, pertaining to bid-ask prices, and buys and sells of equities on BSE, available data is used for the estimation. No where the data is available as the estimation of original PIN requires. Therefore, Opening prices and Closing prices is used in the place of bid-ask prices. Opening prices do possess the information of the previous days' trading, which is clearly observed in the closing prices are used for the PIN estimation.

Further, PIN is estimated for the data of 60 companies of S&P BSE Sensex with five multiple structural break points. These five break points were identified using Bai and Perron Test (1998).

1.1 THEORETICAL FRAMEWORK OF PIN

Probability of informed Trading model (PIN) is the most relevant and appropriate model used to measure the extent of asymmetric information in any given stock market. David Easley, Kiefer, Maureen O'hara and Paperman, popularly known as EKOP made an attempt to estimate asymmetric information providing a first framework for PIN in 1996. Their model was based on the sequential trading model proposed by Glosten and Milogram in 1987, and 'Continuous auctions and Insider Trading model. This was extended by Easley, Hvidkjaer and O'hara (EHO) in 2002, and Easley, Engle, O'Hara and Wu (2008).

All above said works proposed that always and everytime market participation consists of non-homogeneous group of traders. One group is always informed and other group is uninformed. Everyday, both trading activities, buying and selling activities will take place. Both of their corresponding orders, i.e., buy orders and sell orders arrive at constant rate in addtion to constant possibilities of trading days' conditions. A competitive Market-maker will buy or sell a security based on the quoting of prices of a security which they announce publicly in the market. However, market-maker is always risk neutral and buys and sells a security at a price quoted in the market.

In any trading day, market participants in the form of two disjoint and independent groups, informed and uninformed traders. Informed traders are always assumed to be less-risky or riskfree and competitive. Informed Traders would buy if positive signals hit in the market on Good News trading days. And they would sell if any negative signal hits the market on Bad News trading days. On the Other hand, Uninformed traders are active on all trading days. Uninformed traders would trade for the reasons of liquidity, diversification etc. On No-information days, only uninformed traders trade. At the end of the day, the information held by each trader or player is complete and thus the value of the stock is realized. In general, the PIN Model is defined as the relation of the expected number of transactions due to private information to the expected total number of trades. Symbolically,

$$\text{PIN} = \frac{\text{Expected Number of information based transactions}}{\text{Expected total Number of Transactions}}$$

The market-maker knows both the probability of arrival news pertaining to said events, and the its arrival order to the market. Nevertheless, market-maker do not know which event is realized (EKOP, 1996). Before the time of commencement of trade, in both EKOP and EHO model setting, nature determines the occurrence of any type of information relevant to stock. The sequence of trading days is assumed to be independent and discrete. However, the sequence od trading in a day is continuous process. Information events are independently distributed and occur with probability α. These informational events can be private and price relevant. Always trading day occurs with three probabilities. They occur in and as a) Good news, b) Bad news and c) No news. Events with good news occur with a probability of 1-δ; Events with bad news occur with a probability of δ.

In consistent with the literature developed by Easley et. al (1996,2002), the role and measure of asymmetric information is estimated by the Probability Of Informed Trading (PIN_t). It is defined as the unconditional probability that informed traders would buy or sell an asset or security at each point in time is, and equal to

$$PIN_t = \frac{\alpha\mu}{\alpha\mu + 2\varepsilon}$$

PIN_t lies between 0 and 1. Whenever the value of PIN_t obtained is near or equal to 1, there is higher probability of trading by informed traders. When this probability is high, uninformed traders face a higher risk of trading with a counterparty that is better informed.

3. RESULTS AND DISCUSSIONS:

Pharmaceuticals are promoters of health, longevity of man and income. Further provides employment to millions in manufacturing, R&D, sales and marketing of medical drugs, and economic growth through exports and enables industry competitive. Important players in this sector are Aurobindo Pharma Ltd, Cipla, Dr Reddy Laboratories, Glaxosmithkline Pharmaceuticals, Lupin ltd and Sun Pharmaceuticals. Equity Stocks of these companies are frequently traded on BSE.

Stylized factors of selected 6 Pharmaceutical companies and Results of estimation of PIN and its parameters for Pharmaceutical companies are provided in this section.

Table 1 Stylized Factors of Selected Companies in Pharmaceuticals Sector

Sl. No.	Company	Area of Operation	Headquarters	Shareholding as on 31st March, 2017	Total Income as on March, 2017 (in Crores)	Market Capilisation as on 20/07/2019
1	Aurobindo Pharma Ltd	Pharmaceutical manufacturing	Hyderabad, Telangana	Indian Promoters- 48.80% (Family-12.32%) Foreign promoters-3.07% Institutional- 33.75% (QFIs- 20.99%, MFs-12.11%) Non-institutional- 14.38% (Individuals-9.74%)	9,711.68	33,414.77
2	Cipla India	Pharmaceuticals	Mumbai, Maharashtra	Indian promoters- 14.94% (Family-14.18%) Foreign individuals-22.54% Institutional- 36.05% (QFIs-18.03%, MFs-9.45%) Non-institutional- 26.47% (Individuals-18.32%)	10,849.00	42,757.26

3	Dr. Reddys Laboratories	Pharmaceuticals	Hyderabad, Telangana	Indian Promoters-32.04% (Family-2.72%) Institutional- 51.38% (QFIs-38.75%, MFs-5.72%, Ins. Cos-6.57%) Non-institutional-16.58% (Individuals- 9.98%)	10,309.10	43,704.83
4	Glaxosmithkline Pharmaceuticals Ltd	Pharmaceuticals	Mumbai, Maharashtra	Foreign promoters- 75.00% Institutional- 12.08% (FIs-8.42%, MFs-1.84%)	2,941.24	30,556.92
5	Lupin Ltd	Pharmaceuticals	Mumbai, Maharashtra	Indian Promoters- 46.52% (Family-1.35%) Foreign individuals- 0.18% Institutional- 41.24% (QFIs-31.87%, MFs-5.39%) Non-institutional- 12.06% (Individuals-9.54%)	12,899.93	34,209.07
6	Sun Pharmaceutical Industries Ltd	Pharmaceuticals	Mumbai, Maharashtra	Indian Promoters- 54.39% (Family-10.81%) Institutional-33.49% (QFIs-21.28%, MFs-5.36%, FIs-5.18%) Non-institutional- 12.13% (Individuals-7.05%)	8,306.82	103,192.85

Stylized factors of pharamaceutical companies (Table 1) explain us that Aurobindo Pharma, Cipla India, Dr Reddy laboratories, Glaxosmithkline Pharamaceuticals Ltd, Lupin Ltd and Sun Pharamceuticals Ltd are indian companies headquartered either at mumbai or Hyderabad. They are family enterprises with founder family having stake in shareholdings i.e, Aurobindo Pharama ltd (12.32%), Cipla india (14.94%), and Sun Pharamceuticals (10.81%). Upto 51% stake in shareholdings in these companies are held by institutional investors. Lupin Ltd has total income of Rs. 12,899.93 Crores in 2017. Sun Pharamceutical Industries Ltd has largest market capitalisation on BSE with Rs. 103,192.85

Table 2.38 Results of PIN and its Parameters for Pharmaceutical companies

Company	Break Points	Epsilon (ε)	Mu(μ)	Alpha (α)	Delta (δ)	PIN
Aurobindo Pharma Ltd	Ist Break	0.997567	0.999996	0.904836	0.03541	0.312015
	IInd Break	1	1	0.596314	0.009914	0.229677
	IIIrd Break	1	1	0.596314	0.009914	0.229677
	IVth Break	1	1	0.596314	0.009914	0.229677
	Vth Break	1	1	0.596314	0.009914	0.229677
Cipla	Ist Break	0.999885	0.999952	0.913073	0.035646	0.313454
	IInd Break	1	1	0.596314	0.009914	0.229677
	IIIrd Break	1	1	0.596314	0.009914	0.229677
	IVth Break	1	1	0.596314	0.009914	0.229677
	Vth Break	1	1	0.596314	0.009914	0.229677
Dr. Reddy Laboratories	Ist Break	0.997567	0.999996	0.904836	0.03541	0.312015
	IInd Break	1	1	0.596314	0.009914	0.229677
	IIIrd Break	1	1	0.596314	0.009914	0.229677
	IVth Break	1	1	0.596314	0.009914	0.229677
	Vth Break	1	1	0.596314	0.009914	0.229677
Glaxosmithkline Pharmaceuticals	Ist Break	0.997567	0.999996	0.904836	0.03541	0.312015
	IInd Break	1	1	0.596314	0.009914	0.229677
	IIIrd Break	1	1	0.596314	0.009914	0.229677
	IVth Break	1	1	0.596314	0.009914	0.229677
	Vth Break	1	1	0.596314	0.009914	0.229677
Lupin ltd	Ist Break	0.999885	0.999952	0.913073	0.035646	0.313454
	IInd Break	1	1	0.596314	0.009914	0.229677
	IIIrd Break	1	1	0.596314	0.009914	0.229677

	IVth Break	1	1	0.596314	0.009914	0.229677
	Vth Break	1	1	0.596314	0.009914	0.229677
Sun Pharmaceuticals	Ist Break	0.997567	0.999996	0.904836	0.03541	0.312015
	IInd Break	1	1	0.596314	0.009914	0.229677
	IIIrd Break	1	1	0.596314	0.009914	0.229677
	IVth Break	1	1	0.596314	0.009914	0.229677
	Vth Break	1	1	0.596314	0.009914	0.229677

crores in 2019.

From the Table 2, it is observed that the probability of occurrence of informational event for these stocks occur with the probability of 90.4% for Aurobindo Pharma Ltd, Dr. Reddy Laboratories, Glaxosmithkline Pharmaceuticals and Sun Pharmaceuticals in the first time period and 59.63% in all other succeeding periods. It is seen that the Probability with which an information event occurs is 91.30% in the first time period and 59.63% in all other following time periods for Lupin Ltd. The probability with which unfavourable signal on stocks of these companies occurs, indicated by δ, is 3.54% in the first period and 0.99% in all succeeding periods for Aurobindo Pharma Ltd, Dr. Reddy Laboratories and Sun Pharmaceuticals Ltd. Any unfavourable or bad signal for Lupin Ltd occurs with the probability of 3.56% in the first time segment and 0.99% in all other following time segments.

The probability of informed trader trading these stocks occurs with the probability as indicated by μ is more or less similar for all companies ranging from 99.9% to 100%, given information signal occurs. Likewise, the uniformed trader trading stocks of these companies as indicated by ε is 99.75% to 99.98% in the first time period, and 100 % in all other time periods.

The probability of informed trading of stocks occurs, given trade takes place, with the probability of 31.20% in the first time segment for Aurobindo Pharmaceuticals Ltd, Dr Reddy laboratories and Sun Pharmaceuticals Ltd. For Cipla and Lupin Ltd, the probability of informed trading occurs with the probability of 31.34% in the first segment; and 22.96% in the following time segments for all companies.

4. SUMMARY:

The PIN and its parameter results for the equity stocks of Pharmaceutical companies show that most of the parameters are identical for Aurobindo Pharma Ltd, Dr. Reddy Laboratories, Glaxosmithkline pharmaceuticals and Sun Pharmaceuticals. Lupin Ltd and Cipla Ltd have identical results. The results are identical as trends and patterns of equity stock prices of these pharmaceutical companies are more or less similar.

REFERENCE:

1. Ady, P., 1974. "Money and capital in economic development: By R.I. McKinnon. (Washington, D.C.: The Brookings Institution, 1973. Pp. 177. index.)," World Development, Elsevier, vol. 2(3), pages 87-88, March. Retrieved from https://ideas.repec.org/a/eee/wdevel/v2y1974i3p87-88.html
2. Arestis, P., Demetriades, P.O., Luintel, K.B (2001), Financial Development and Economic Growth: The Role of Stock Markets.Journal of Money, Credit and Banking, 33(2),16-41
3. Bagehot, Walter, (1873), Lombard Street: A Description of the Money Market, McMaster University Archive for the History of Economic Thought, Retrieved from https://EconPapers.repec.org/RePEc:hay:hetboo:bagehot1873.
4. Bai, Jushan & Perron, Pierre (1998), Estimating and Testing Linear Models with Multiple Structural Changes, Econometrica, Vol.66, No.1, 47-78
5. Bekaert, G., Harvey, C.R., Lundblad, C. (2001), Does Financial Liberalization Spur Growth?.NBER Working Paper No. 8245
6. Bernanke, B., & Gertler, M. (1989). Agency Costs, Net Worth, and Business Fluctuations. The American Economic Review, 79(1), 14-31. Retrieved from http://www.jstor.org/stable/1804770
7. Charles W. Calomiris, R. Glenn Hubbard, Firm Heterogeneity, Internal Finance, and `Credit Rationing', The Economic Journal, Volume 100, Issue 399, 1 March 1990, Pages 90–104, https://doi.org/10.2307/2233596
8. Claessens, S., Klingebiel, D., Schmukler, S.L. (2006), Stock Market Development and Internationalization: Do Economic Fundamentals Spur both Similarly?. Journal of EmpiricalFinance, 13(3), 316–50
9. Easley, David, Soeren Hvidkjaer, Maureen O'Hara, and Joseph Paperman. 1996. "Liquidity, Information, and Infrequently Traded Stocks." The Journal of Finance 51 (4):1405–36. Retrieved from 10.1111/j.1540-6261.1996.tb04074.x
10. Easley, D., S. Hvidkjaer, and M. O'Hara. 2002. Is Information Risk a Determinant of Asset Returns? Journal of Finance 57:2185-2221
11. Easley, D. R. F. Engle, M. O'Hara, and L. Wu. (2008) Time-Varying Arrival Rates of Informed and Uninformed Traders. Journal of Financial Econometrics, 6(2):171–207, p83,84
12. Ehnts, Dirk (2016). Book review: Theory of Economic Development (Schumpeter, 1912). Book review originally published in Int. J. Pluralism and Economics Education, Vol. 6, No. 3, 2015
13. El-wassal, Kamal (2013), The Development of Stock Markets: In Search of a Theory, International Journal of Economics and Financial Issues Vol. 3, No. 3, 2013, pp.606-624 retrieved from http://econjournals.com/index.php/ijefi/article/viewFile/489/pdf
14. Errunza, V. (2001), Foreign Portfolio Equity Investments, Financial Liberalization, and Economic Development. Review of International Economics, 9, 703-726
15. García, V.F., Liu, L. (1999), Macroeconomic Determinants of Stock Market Development. Journal of Applied Economics, 4, 29–59
16. Glosten, L.R. and P. R. Milgrom. Bid Ask and Transaction Price in a Specialist Market with Heterogeneously Informed Traders. Journal of Financial Economics, 14(1):71–100, 1987. [p81]
17. Goldsmith, R. W.(1969), Financial Structure and Development, New Haven and London: Yale University Press, 1969. Retrieved from https://doi.org/10.2307/2230134
18. Greenwald, Bruce C. and Stiglitz, Joseph, (1993), Financial Market Imperfections and Business Cycles, The Quarterly Journal of Economics, 108, issue 1, p. 77-114, https://EconPapers.repec. org/RePEc:oup:qjecon:v:108:y:1993:i:1:p:77-114
19. Gurley, J. G., & Shaw, E. S. (1955). Financial Aspects of Economic Development. The American Economic Review, 45(4), 515-538
20. Kyle, A.S. (1985) Continuous Auctions and Insider Trading, Econometrica, 53(6):1315–1335, 1985. [p81]
21. Levine, R., Zervos, S. (1996), Stock Market Development and Long-Run Growth. World Bank Economic Review, 10(2) , 323-340
22. Levine, R., Zervos, S.(1998), Stock Markets, Banks and Economic Growth. American Economic Review, 88, 537–58
23. Mishkin, F. (2001), Financial Policies and the Prevention of Financial Crises in Emerging Market Countries. NBER Working Paper No. 8087
24. Pagano, M. (1993a), Financial Markets and Growth: An Overview. European Economic Review, 37, 613-622
25. P. Zagaglia. PIN: Estimates the Parameters of a Trading-tree Model for the Computation of the Probability of Informed Trading, 2013. URL http://CRAN.R-project.org/package=PIN. R package version 0.8. [p80]