Application of Financial Mathematics to Enroute the Impact of FDI on BSE and NSE

Dr. Vinay Pandit

Mathematics and Statistics Department
Lala Lajpat Rai College

Abstract: **Financial mathematics is interesting because it synthesizes a highly technical and abstract branch of Maths, measure theoretic probability, with practical applications that affect peoples' everyday lives. Developed economies consider FDI as an engine of market access in developing and less developed countries vis-à-vis for their own technological progress and in maintaining their own economic growth and development. Any decision on investing is thus a combination of an assessment of internal resources, competitiveness, and market analysis and market expectations. The FDI may also affect due to the government trade barriers and policies for the foreign investments and leads to less or more effective towards contribution in economy as well as GDP of the economy.**

Key words: Financial Mathematics, FDI, BSE, NSC

I. INTRODUCTION

Financial Mathematics (commonly described using an array of roughly synonymous alternative titles including Financial Engineering, Computational Finance, Mathematical Finance, and Quantitative Finance) is an engineering discipline fundamentally enabled by the intellectual pursuits spanned by the faculty of Applied Mathematics and Statistics (AMS): probability, statistics, optimization, partial differential equations and scientific computing.

The unifying premise for Financial Mathematics is more than just a collection of techniques applied to a common problem area. Rather, it quantifies and enables much of the modern interplay in global markets among companies, investors, and financial agents; constrained or constructed by the actions of central banks, regulators and governments. Global financial agents, which include broker-dealers on Wall Street, in London, Hong Kong and elsewhere, create and package (or repackage) capital products and services into the instruments that are so vital to the course of world-wide capital allocation, investment, and risk transfer. None of this could occur today without the sophisticated approaches enabled by financial mathematics which have evolved over the past 25 years.

Financial mathematics is interesting because it synthesizes a highly technical and abstract branch of Maths, measure theoretic probability, with practical applications that affect peoples' everyday lives. Financial mathematics is exciting because, by employing advanced mathematics, we are developing the theoretical foundations of finance and economics. To appreciate the impact of this work, we need to realize that much of modern financial theory, including Nobel Prize winning work, is based on assumptions that are imposed, not because they reflect observed phenomena but because they enable mathematical tractability. Just as physics has motivated new Maths, financial mathematicians are now developing new Maths to model observed economic, rather than physical, phenomena.

Developed economies consider FDI as an engine of market access in developing and less developed countries vis-à-vis for their own technological progress and in maintaining their own economic growth and development. Developing nations looks at FDI as a source of filling the savings, foreign exchange reserves, revenue, trade deficit, management and technological gaps. FDI is considered as an instrument of international economic integration as it brings a package of assets including capital, technology, managerial skills and capacity and access to foreign markets. The impact of FDI depends on the country‘s domestic policy and foreign policy. As a result FDI has a wide range of impact on the country‘s economic policy. In order to study the impact of foreign direct investment on economic growth, two models were framed and fitted. The foreign direct investment model shows the factors influencing the foreign direct investment in India. The economic growth model depicts the contribution of foreign direct investment to economic growth. Foreign Direct Investment (FDI) is fund flow between the countries in the form of inflow or outflow by which one can able to gain some benefit from their investment where as another can exploit the opportunity to enhance the productivity and find out better position through performance. The effectiveness and efficiency depends upon the investors perception, if investment with the purpose of long term then it is contributes positively towards economy on the other hand if it is for short term for the purpose of making profit then it may be less significant. Depending on the industry sector and type of business, a foreign direct investment may be an attractive and viable option. Any decision on investing is thus a combination of an assessment of internal resources, competitiveness, and market analysis and market expectations. The FDI may also affect due to the government trade barriers and policies for the foreign investments and leads to less or more effective towards contribution in economy as well as GDP of the economy.

II. RESEARCH METHODOLOGY

2.1 Research problem

The researcher has identified the area of application of mathematics in the field of finance, thus made an attempt to know how finance can be observed or seen with the help of mathematical techniques. Hence the pain area or the research problem was focused with the view whetherthe FDI has an impact on BSE and NSE.

2.2 Objective of study

1. TO STUDY THE IMPACT OF FDI ON BSE
2. TO STUDY THE IMPACT OF FDI ON NSE

2.3 Scope of study

The scope of the study was restricted from the year 2000 till 2013.

2.4 Hypothesis

In reference to the objectives considered above the following hypothesis was considered.

Ho: There is no relationship between FDI and BSE (SENSEX)

H1: There is a relationship between FDI and BSE (SENSEX)

Ho: There is no relationship between FDI and NSE (NIFTY)

H1: There is a relationship between FDI and NSE (NIFTY)

2.5 Method of data collection

The data collected for the research was secondary in nature for the last thirteen years. The data consisted of FDI(in millions US $) and BSE SENSEX (in Rs.)

2.6 Mathematical tools and technique

The mathematical technique deployed was bivariate linear Karl Pearson coefficient of correlation and t test which is used for test for significant.

2.7 Limitation of study

The study was restricted to the following limitation

1. The data collected for the study was secondary in nature which was assumed to be authentic.
2. Only one mathematical statistics was used for the research.
3. Data of thirteen years was only considered.

III. DATA ANALYSIS AND INTERPRETATION

The table 3.1 presents the amount of flow of FDI in India in terms of US$ million. The flow of FDIs has shown an increasing trend during the considered period except during the years i.e. 2001 to 2004 and the year 2010-11 and 2012-13.

Table 3.1

YEAR	FDI (in million US $)	BSE SENSEX (in Rs)	NSE NIFTY (in Rs)
2000-01	4029	4269.68	1334.76
2001-02	6130	3331.94	1077.02
2002-03	5035	3206.28	1037.22
2003-04	4322	4493.53	1427.5
2004-05	6051	5740.98	1805.26
2005-06	8961	8280.08	2513.44
2006-07	22826	12277.32	3572.44
2007-08	34843	16568.88	4896.59
2008-09	41873	12365.55	3731.02
2009-10	37745	15585.21	4657.76
2010-11	34847	18605.17	5583.54
2011-12	46556	17404	5295.55
2012-13	34298	18835.77	5682.55

Source: Secondary data

Correlation between FDI, SENSEX & NIFTY

For the calculation of correlation between FDI and BSE SENSEX and NSE NIFTY, FDI is considered as an independent variable (X) and BSE SENSEX and NSE NIFTY are taken as dependent variables (Y_1 and Y_2 respectively).

Table 3.2

Year	FDI (X)	BSE SENSEX (Y_1)	NSE NIFTY (Y_2)	XY_1	XY_2	X^2	Y_1^2	Y_2^2
2000-01	4,029	4,270	1,335	172,02,541	53,77,748	162,32,841	182,30,167	17,81,584
2001-02	6,130	3,332	1,077	204,24,792	66,02,133	375,76,900	111,01,824	11,59,972
2002-03	5,035	3,206	1,037	161,43,620	52,22,403	253,51,225	102,80,231	10,75,825
2003-04	4,322	4,494	1,428	194,21,037	61,69,655	186,79,684	201,91,812	20,37,756
2004-05	6,051	5,741	1,805	347,38,670	109,23,628	366,14,601	329,58,851	32,58,964
2005-06	8,961	8,280	2,513	741,97,797	225,22,936	802,99,521	685,59,725	63,17,381
2006-07	22,826	12,277	3,572	2802,42,106	815,44,515	5210,26,276	1507,32,586	127,62,328
2007-08	34,843	16,569	4,897	5773,09,486	1706,11,885	12140,34,649	2745,27,784	239,76,594
2008-09	41,873	12,366	3,731	5177,82,675	1562,29,000	17533,48,129	1529,06,827	139,20,510
2009-10	37,745	15,585	4,658	5882,63,751	1758,07,151	14246,85,025	2428,98,771	216,94,728
2010-11	34,847	18,605	5,584	6483,34,359	1945,69,618	12143,13,409	3461,52,351	311,75,919
2011-12	46,556	17,404	5,296	8102,60,624	2465,39,626	21674,61,136	3028,99,216	280,42,850
2012-13	34,298	18,836	5,683	6460,29,239	1949,00,100	11763,52,804	3547,86,231	322,91,375
TOTAL	**2,87,516**	**1,40,964**	**42,615**	**42503,50,697**	**12770,20,399**	**96859,76,200**	**19862,26,378**	**1794,95,785**

$$r = \frac{n\sum xy - \left(\sum x\right)\left(\sum y\right)}{\sqrt{n\left(\sum x^2\right) - \left(\sum x\right)^2}\sqrt{n\left(\sum y^2\right) - \left(\sum y\right)^2}}$$

Correlation between FDI and BSE SENSEX (X and Y_1) = 0.92

Correlation between FDI and NSE NIFTY (X and Y_2) = 0.92

According to the above observation both FDI and BSE SENSEX and FDI and NSEI NIFTY have strong positive correlation which is 0.92 and 0.92 respectively. Hence FDI investment strongly and positively influences the Indian stock market.

To test the significance of the correlation between FDI and BSE t- test is used

t cal = r* SQT[(n-2)/(1-r^2)]

Thus t cal= 7.79

t critical at 1% LOS and 11 d.f. = 3.106

t cal > t critical

Therefore correlation is significant.

Similarly to test the significance of the correlation between FDI and NSE t- test is used

t cal = r* SQT[(n-2)/(1-r^2)]

Thus t cal= 7.79

t critical at 1% LOS and 11 d.f. = 3.106

t cal > t critical

Therefore correlation is significant.

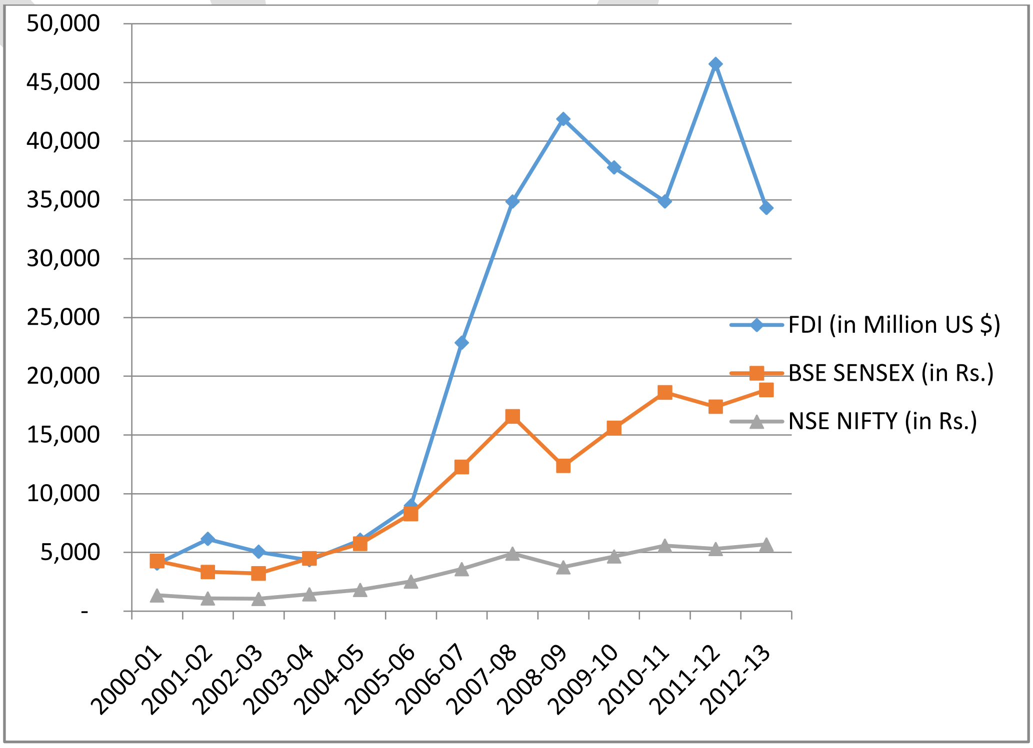
Coefficient of determination table

Table 3.3

INDEX	FDI
BSE SENSEX	0.84
NSEI NIFTY	0.84

From the above observation we can say that there is a strong relation between both FDI and BSE SENSEX and FDI and NSEI NIFTY (As r^2 is more than 0.8)

Graphical representation of representation between FDI, BSE SENSEX & NSEI NIFTY



IV. CONCLUSION

4.1 Findings

- The FDIs flow has shown increasing trend during the considered period of study except in the recent past two years and during 2002 to 2004.
- There is a strong positive correlation between FDI & Sensex and FDI & nifty.
- Flow of FDIs into India and BSE Sensex trend are dependent.
- Flow of FDIs into India and NSE Nifty trend are dependent.

4.2 Conclusion

In the past years, due to globalization and India's LPG policy there have been an increasing amount of foreign direct investment into the Indian economy. Business organizations from all over the world are trying to set up their business here and take advantage of India's cheap labor for production and also the huge population of India to sale their products. Also the Indian stock markets have come of age where there are significant developments in the last 15 years that make the markets on par with the developed markets. The important feature of developed markets is the growing clout of institutional investors. This paper sets out to find whether our stock market is or is not influenced by these growing amounts of foreign direct investment and for institutional investments.

From the above finding and the data analysis researcher concluded that there is a strong impact of FDI on BSE and NSE. The researcher had analyzed two views on the issue of FDI and stock market development. The first view is that FDI is positively correlated with the development of Bombay stock markets. The second view is that FDI is positively related to National stock market development. After addressing the issues that might lead to these conclusions, the hypothesis is tested that the level of stock market development in a country is positively correlated to FDI. Thus this data collected may be used to build an empirical model which will propose to explain the observed relationship. Additional explanatory variables may be included, to understand a model.

REFERENCES

[1]. B. Mandelbrot, The variation of certain Speculative Prices, The Journal of Business 1963 [1]
[2]. Bachelir, Louis. "The Theory of Speculation". Retrieved 28 March 2014.
[3]. Brown, Angus (1 Dec 2008). "A risky business: How to price derivatives". Price+ Magazine. Retrieved 28 March 2014.
[4]. "Financial Modelers' Manifesto". Paul Wilmott's Blog. January 8, 2009. Retrieved June 1, 2012.
[5]. Gillian Tett (April 15, 2010). "Mathematicians must get out of their ivory towers". Financial Times.
[6]. Johnson, Tim. "What is financial mathematics?". +Plus Magazine. Retrieved 28 March 2014.
[7]. "Quantitative Finance". About.com. Retrieved 28 March 2014.
[8]. Karatzas, Ioannis; Shreve, Steve (1998). Methods of Mathematical Finance. Secaucus, NJ, USA: Springer-Verlag New York, Incorporated. ISBN 9780387948393.
[9]. Lindbeck, Assar. "The SverigesRiksbank Prize in Economic Sciences in Memory of Alfred Nobel 1969-2007". Nobel Prize. Retrieved 28 March 2014.
[10]. Meucci, Attilio (2005). Risk and Asset Allocation. Springer. ISBN 9783642009648.
[11]. Svetlozar T. Rachev, Frank J. Fabozzi, Christian Menn (2005). Fat-Tailed and Skewed Asset Return Distributions: Implications for Risk Management, Portfolio Selection, and Option Pricing. John Wiley and Sons. ISBN 978-0471718864.
[12]. Taleb, Nassim Nicholas (2007). The Black Swan: The Impact of the Highly Improbable. Random House Trade. ISBN 978-1-4000-6351-2.