

Behavioural Pattern of FDI Inflows: Autoregressive Study

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Abstract

The study investigates on the behavioral pattern of sectoral foreign direct investment (FDI) inflows in Indian economy for the period 2002-2010. Thirteen sectors of the economy as categorized by the Government of India are used for the study. Econometrics tools of analysis are applied. In particular the study uses Autoregression of Order One denoted as AR (1). The study seeks to explain behavioral pattern of FDI inflows. The study uncovered that Telecommunications and Construction sectors exhibited explosive behavior. Housing and Real Estate and Automobile sectors exhibited non-stationary behavioral pattern during the period. However, some sectors viz electrical equipment including Computer Software and Electronics; Transportation Industry; Chemicals (other than fertilizers); Drugs and Pharmaceuticals; Food processing industries; Cement and Gypsum products and Metallurgical industries have exhibited stationarity. Also the study exposes foreign investors' biases in choosing some sectors in relation to other sectors.

Keywords: Autoregression, stationarity, FDI, behavior, explosive behavior

1. Introduction

UNCTAD (2010) reported that global foreign direct investment (FDI) inflows increased from USD 1,401,466 million in 2000 to USD 2,099,973 million in 2007. Global economy expanded from USD 32,113.500 billion in 2000 to USD 55,392.480 billion in 2007 (IMF, 2010). Furthermore, UNCTAD (2010) published that in 2001 USA received FDI inflows amounting to USD 159,461 million and in 2007 received USD 265,957 million. USA economy expanded from USD 9,951.475 billion in 2000 to USD 14,077.650 billion in 2007 (IMF, 2010). In 2000 China attracted FDI inflows amounting to USD 40,715 million and in 2007 received USD 83,521 million (UNCTAD, 2010). China economy grew from USD 1,198 billion in 2000 to USD 3,382 billion in 2007 (IMF, 2010).

In the Indian context, OECD (2010), FICCI (1999), Joshi and Little (1997) substantiate reforms of 1991 for a shift to a consistently higher rate of annual Gross Domestic Product (GDP) than the country has experienced in the recent history. In relation to this study, reforms have led to relaxation and removal of restrictions on large-scale investments. Also, many sectors of the economy opened up for private investments including import substitution industries and economic protectionism got replaced by open trade regime. Indian economic reforms of 1991, better infrastructure and a more vibrant financial sector became catalyst to FDI inflows into India and further accelerated FDI in 2006-07. On gross basis, FDI inflows in India fell to USD 4.5 billion in 2003-04 after rising to a level of USD 6.2 billion in 2001-02; favorable policy not only recovered but also risen the FDI to reach USD 23.0 billion in 2006-07 (Economic Survey, 2007-08:123; Chandran & Krisnan, 2008).

FDI inflow to Indian economy is predicted to be the second largest receiver in 2020 after China (UNCTAD, 2010). But, efforts to attract FDI inflows are not easy and straight forward (Shapiro, 2008). Actually, all nations are striving to attract more FDI inflows in different forms like equity or in the form of foreign indirect investments (FII). For policy makers, behavioral pattern of the factors of production is important impetus in decision and policy making. For the period of 2001 to 2010 Indian economy had experience huge inflows of FDI. Naturally, some sectors received more FDI inflows in relation to other sectors. What we do not know is the fact that usually it is capital (FDI) movement exhibiting stationarity or non-stationarity behavior across sectors.

As observed over decades, naturally, international investments movements are found to be very volatile since history (UNCTAD, 2010; IMF, 2010). International investments are volatile particularly at the times of global

financial volatility coupled with just ended Great Recession. Global financial inflows seem not yet stable to the extent that policy makers, governments or private investors are needed to change policy comfortable zones. Policy makers need not only to intervene in policy formulation (Stock & Watson, 2001) but also, forecast future FDI inflows taking into consideration the help of dynamic analysis (Lu, 2001).

1.1 Objectives of the Study

The study seeks to diagnose behavioral pattern of the sectoral FDI inflows in Indian economy. Specifically, the following objectives were investigated to determine behavior of FDI inflows to the sectors of the economy.

Proposition 1: There are behavioral differences in FDI inflows across sectors of Indian economy.

Proposition 2: Foreign investors are biased in choosing sectors to invest.

2. Literature Review

FDI flows have been characterized by periods of stagnation (such as the first half of the 1980s and 1990s), followed by periods of explosive growth. During the second half of the 1980s and 1990s, the annual rate of FDI growth has been close to 25 percent (Ernesto & Christian, 2001). Sectoral distribution of FDI stock declined by half of the share of the primary sector between 1988 and 1999 globally, as well as in developed and developing countries. In Developing countries Primary sector FDI inflows decreased from 10.3 percent in 1988 to 5.4 percent in 1999.

In recent economic growth, the service sector experienced a corresponding increase in both developed and developing countries. However, in developing countries, FDI inflows in the service sector increased from 42.3 percent in 1988 to 50.3 percent in 1999. But, the share of the manufacturing in total FDI remained stable at 41.4 percent in 1988 and 41.6 percent in 1999 (Chopra, 2003:50-52). Sectors related to export- oriented FDI may help relieve the balance of payment constraint on development. For example, South Korea pushed FDI into high technology and export oriented sectors using various policy instruments to support economic development. Mexico, Brazil and Thailand used performance requirement for triggering a burst of export focused investment in the auto industry (Kumar, 2002).

Southeast Asian countries such as Malaysia, Indonesia, Thailand, and China have successfully replaced East Asian Newly Industrialized Economies (NIEs) viz. Hong Kong, Korea, Taiwan, and Singapore as the most important hosts of export oriented FDI inflows in Asia. South Asian countries have failed to attract any significant volume of export-oriented FDI despite abundance of cheap labour and skills (Ibid, 2002:91). Vietnam has popped up as one more dear location and majority of FDI inflows in Vietnam are directed towards manufacturing in terms of the number of projects, registered capital and implemented capital. The tendency of FDI inflows to Vietnamese economy reveals that in 1990s the majority of FDI inflows were in oil and mining sector in the manufacturing domain. And by the end of the last century and early this century, light and heavy industry sectors dominated the field.

Furthermore, while FDI in agriculture were marginal in the 1990s, now this sector accounts for a significant share in the total FDI both in terms of the number of projects and also in registered/implemented capital. In the service sector, the hotel and tourism sectors still remain significant. Service sectors such as the construction of industrial zones, office, apartment, are attracting significant portion of FDI inflows in Vietnam (Nguyen & Nguyen, 2007).

Altomonte and Resmini cited in Kippenberge (2005) found evidence that for a positive influence of FDI firms in the manufacturing sector on the entry of indigenous firms in Ireland, and also found presence of positive linkage effects generated by foreign manufacturing firms to the Polish economy. However, FDI flows to labour-intensive and manufacturing sectors generate positive backward linkages. Intra-sectoral linkages are significantly negative in labour-intensive sectors. This may indicate that linkages act as a channel for spillovers, which may generate higher efficiency in labour-intensive production and, therefore, lead to a shedding of labour.

Bajo-Rubio and López-Pueyo (1996) propound that manufacturing sector and industrial demand grew in real terms at a yearly average rate of 6.0 percent between 1986 and 1992, which meant that growth rates were extraordinary. Manufacturing investment also grew at annual rate of 9.3 percent. In nutshell, sectoral destination of investment revealed that manufacturing activities have been the traditional major recipients of FDI inflows accounting for around 70 per cent of total, mainly in the chemicals, motor vehicles and machinery sectors.

In India, FDI in services has also grown over the past decade, in part reflecting the liberalization of many erstwhile government monopoly services such as telecommunications, banking, and insurance during 1990s. Services sector account for around 50 percent of India's total FDI flows. In 2004 the World Bank study found that FDI in services has growth more rapidly than FDI inflows in manufacturing in India. The average share of various services

segments in India's inward FDI flows indicate that software services and finance, insurance, real estate, telecom, and various business services have accounted for over 30 percent (Chanda, 2009:37).

Foreign direct investment inflows started picking up in 1995-96 and reached at USD 2.9 billion in 1996-97, and further moved to USD 3.6 billion in 1997-98. The bulk of this investment have been in infrastructure projects that do not directly generate exports but have to be paid for. FDI in manufacturing is targeted almost exclusively to exploit the domestic market (FICCI, 1999: 297). Kundra (2009: 151) observes that the analysis of sectoral inflows reveals that five sectors viz electrical equipment including computer software and electronics, transportation industry, service sectors, telecommunications and fuels (power and refinery) received 49.85 percent of FDI inflows from 1991-2006. However, the share of electrical equipment was highest at 14.37 percent, service sector (14.35 percent), Telecommunication (8.02 percent), and transport (7.36 percent). Other major sectors attracting FDI inflows to India include: Chemicals (4.75 percent), food processing industries (2.55 percent), and Drugs and Pharmaceuticals (2.42 percent). In the least recipients of FDI are Cement and Gypsum (1.99 percent) and metallurgical industries (1.67 percent). And, 13.79 percent of the FDI inflows went to miscellaneous industries (Note 1).

3. Significance of the Study

Policy makers need not only to intervene in policy formulation (Stock & Watson, 2001) but also, forecast future FDI inflows taking into consideration dynamic analysis (Lu, 2001). Investors whether foreign or domestic need to forecast his returns on investment with accuracy (Chordia & Swaminathan, 2000). At many times policy makers or governments operate in very complex economic environment. At such complex economic environments, planning and managing costs and revenues are paramount for survival (Edward, 2001).

Volatility of Foreign capital (FDI) inflows calls for careful policy formulation. Forecasting of future inflows is another impetus in attracting more FDI inflows and refining investment climate. Cases of foreign capital withdrawal are aplenty in the world. Latin America, in particular Argentina and East Asia financial crises of 1990s are good examples for policy makers to tail dynamics of FDI inflows. Vector Autoregression has been used extensively in managing highly / extremely complex economic phenomenon (Edward, 2001; Lu, 2001; Stock & Watson, 2001).

4. Methods of Analysis and Data Sources

Penrose (2004) defined stationary as a situation basically similar to that which happens in ordinary calculus where $df(x)/dx = 0$ are called stationary. Baumol (2006) acknowledges that the state of stationary is often employed in capital theory in which capital expenditures are replicated precisely every year. Burstein (1968) asserted that the richest and most prosperous countries would very soon attain the stationary state, if no further improvements were made in the productive arts, and if there were a suspension of the overflow of capital.

Moreover, (David Ricardo cited in Thirlwall, 2006) adduced that stationary state, with no growth, exhibits diminishing returns. Burstein (1968) cited Pigou's three degrees of stationary states: first the system of industry as a whole may be stationary, while several industries that compose it are in movement. Secondly, every separate industry may be stationary, while the individual firms in it are in movement. Thirdly, individual firms as well as industries may be stationary.

In search for much better understanding of bewildering behavior of FDI inflows to India, the study intends to discern whether FDI inflows to India exhibited stationary or non-stationary behavior. The application of Autoregression of order one denoted as AR (1) seeks to explain behavioral pattern of FDI inflows. Koop (2000), Maddala (2002), Wooldridge (2003), Barnett et al. (2008) and Black (2009) illustrated the methods for testing autoregression of order one denoted as AR (1) as indicated in equation below. This section, therefore aims at investigating the behavior of FDI inflows across sectors overtime. The study aims to underpin characteristics of FDI inflow on stationarity tendency for 2002-10 period of study. Descriptive and AR (1) analyses detailed above aim at diagnosing FDI inflows behavior in static-dynamic sphere. Sunders et al. (2005), Cooper and Schindler (2003), Zikmund (2000), Arrow (1971) contended that descriptive or behavior analysis is a means to an end. The end is determining the optimal criteria for sectoral FDI inflows in India.

Koop (2000) explained that autoregression of order 1 denoted as AR (1) is a regression model where the explanatory variables lag dependent variable for one period (i.e. auto means self and hence an autoregression is a regression of a variable on lags of itself). The word "Autoregression" is usually shortened to "AR". Black (2009:692) and Koutsoyiannis (2005:204) underlined that there is close relationship between autocorrelation and autoregression of the time series data. AR (1) model can also used for test autocorrelation.

But, for purpose of this study, FDI inflows in Indian economy are lagged by one year for calculation of the AR (1). In general form the model is:

$$FDI_t = \alpha + \beta FDI_{t-1} + \varepsilon_t \quad (1)$$

The value of β in the AR (1) model is closely related to the behavior of the autocorrelation function and the concept of nonstationarity. Interpretation of β coefficient in equation (3) above is provided as follows:

- a) If $\beta = 0$, the series exhibits random type of fluctuations around an average of about (α).
- b) If $\beta = 1$, the series exhibits strong positive trend behavior of non-stationarity, and
- c) If $\beta = 0.8$, for example then the series exhibits behavior that is somewhere in between the random fluctuations and the strong trend of nonstationarity.

Note also that if $\beta = 1$ it implies the type of trend behaviour of nonstationarity, while the other values of β imply stationary behavior. Thus, for all AR (1) model, we can say that Y is stationary if absolute values of β . That is $|\beta| < 1$ and non stationary if $\beta = 1$. The other possibility is when absolute values, that is $|\beta| > 1$ is rarely considered in economics. However, the latter possibility implies that the time series is exhibiting explosive behavior over time. Since such explosive behavior is only observed in unusual cases (e.g. Hyperinflation), it is of little empirical relevance (Koop, 2000).

The main purpose of testing for AR (1) is to establish characteristics and biases of FDI inflows overtime. In this context, Barnett et al. (2008:467) define stationary matrix mathematically. They define stationary matrix for Markov Chain as follows: The state matrix $S = [s_1, s_2, \dots, s_n]$ is stationary matrix for a Markov chain with transition matrix P if:

$$SP = S \quad (2)$$

Where $s_i \geq 0$, $i=1, \dots, n$, and $s_1 + s_2 + \dots + s_n = 1$

Alternatively, Koop (2000) provides model for measuring Autoregression of order one denoted as AR(I) for estimating stationary and nonstationary of the FDI inflows in India as denoted in equation (3) above. The concepts of stationarity have been discussed by both mathematicians and economists. Below is the review of some of them.

Goode and Hatt (1952) and Penrose (2004) opined that good data makes good scientific research. In this context, the study collected and applied data from authentic sources believed to be of good quality. Therefore the study applied secondary source of data published by Government of India.

5. Sources and Types of Data for the Study

This section underscores types of data for the investigation which are both primary and secondary. Also, the section argues about the importance of secondary data for the study. Data used in the study is from government of India sources as government sources are found to be most authentic (Note 2). One important tool for undertaking data sources is the use of government and industry reports. These materials are especially useful for identifying statistics about various issues (Polonsky & Waller, 2005; Cooper & Schindler, 2002:282). This study uses Economic Surveys database published by government of India. However, secondary data have also been used to complement the primary data when necessary.

Due to the fact that FDI flows are obtained from published secondary sources. Succinctly, data were obtained from annual reports on economic growth, public accessed reports published by Reserve Bank of India (RBI) and Government of India, Ministry of Industry and Commerce, Department of Industrial Policy and Promotion (DIPP), and Economic Surveys' reports published by Government of India, Ministry of Finance related to FDI inflows to Indian constituted major source of data.

Moreover, The Government of India publications (i.e. DIPP) started to publish sectoral FDI inflows for 2002-2010. IMF database was used to obtain GDP in dollar values at current prices for Indian economy. The study resorted to IMF database for GDP in dollar values at current prices because Economic Surveys data are not published in current prices.

6. Data Analysis, Interpretation and Discussion

In search for much better understanding of bewildering behavior of FDI inflows to India, the study applied Autoregression of order one denoted as AR(1) method for discerning whether FDI inflows to India exhibited stationary or non-stationary behavior. The application of AR (I) seeks to explain FDI inflows from its own distribution. Koop (2000), Maddala (2002), Wooldridge (2003), Barnett et al. (2008) and Black (2009) illustrated the methods for testing autoregression as indicated in equation (1) and (2) above. This section, therefore aims at

investigating the behavior of FDI inflows across sectors overtime. The study underpins behaviour of FDI inflows for the duration of 2002-10 across sectors, starting with Electrical Equipment sector.

6.1 Electrical Equipment Including Computer Software and Electronics

Summary results of AR (1) for electrical equipment including computer software and electronics is presented in table 1.

Table 1. AR (1) of Electrical equipment including computer software and electronics sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	795.4022048	420.6073	1.89108
FDI (1) ₋₁	0.393500095	0.307615	1.279196

Source: Research Study, 2010: *Results are at 95% Confidence level.

Koop (2000) provide a rule of thumb that coefficient of FDI_{-1} decides the behavior of the FDI inflows. For this result, coefficient of FDI_{-1} ($| \beta | > 1$) 0.39 is less than 1 hence this sector exhibits stationarity tendency for the period. It implies that the sector exhibits no statistically significant change in FDI inflows. The series exhibits random type of fluctuations (α) and statistically insignificant at 5 percent level.

6.2 Service (Financial and Non Financial)

Summary results of AR (1) for service sector are presented in table 2.

Table 2. AR (1) of service sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	1074.365	845.1927	1.271148
FDI (2) ₋₁	0.768387	0.234807	3.272424

Source: Research Study, 2010: *Results are at 95% Confidence level.

With reference to Koop's rule of thumb that coefficient of FDI_{-1} decides the behavior of the FDI inflows. For this result, coefficient of FDI_{-1} ($| \beta | > 1$) 0.77 is less than 1 hence the sector exhibits stationarity tendency. It implies that the sector exhibits no statistically significant change in FDI inflows. The series exhibits behavior that is somewhere in between the random fluctuations and the strong trend of nonstationarity and statistically significant at 5 percent level.

6.3 Telecommunications (Radio Paging, Cellular Mobile, Basic Telephone Services)

Summary results of AR (1) for telecommunication are presented in table 3.

Table 3. AR (1) of Telecommunication sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	303.7775	262.178	1.158669
FDI (3) ₋₁	1.011897	0.24851	4.071857

Source: Research Study, 2010: *Results are at 95% Confidence level.

With reference to Koop's rule of thumb, coefficient of FDI_{-1} ($| \beta | > 1$) 1.01 is greater than 1 hence the sector exhibits explosive behavior and statistically significant at 5 percent level. This explosive behavior implies that there is statistically significant rapid change in FDI inflows to the sector.

6.4 Transportation Industry

Summary results of AR (1) for transportation industry are presented in table 4.

Table 4. AR (1) of Transportation sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	171.6682	103.388	1.660427
FDI (4) ₋₁	0.10356	0.406053	0.255041

Source: Research Study, 2010: *Results are at 95% Confidence level.

As coefficient of FDI_{1t} ($I\beta I > 1$) 0.1 is less than 1 hence this sector exhibits stationarity tendency for the period. It implies that the sector exhibits no statistically significant change in FDI inflows. The series exhibits random fluctuations around an average (α) and statistically insignificant at 5 percent level.

6.5 Fuels (Power, Petroleum, Natural Gas and Oil Refinery)

Summary results of AR (1) for fuels sector are presented in table 5.

Table 5. AR (1) of Fuels sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	432.1996	336.8796	1.28295
$FDI(5)_{-1}$	0.592576	0.344408	1.720565

Source: Research Study, 2010: *Results are at 95% Confidence level.

As coefficient of FDI_{1t} ($I\beta I > 1$) 0.59 is less than 1 hence the sector exhibits stationarity tendency. It implies that the sector exhibits no statistically significant change in FDI inflows. The series exhibits behavior that is somewhere between the random fluctuations and the strong trend of nonstationarity statistically significant at 0.025 percent level.

6.6 Chemicals (Other than Fertilizers)

Summary results of AR (1) for Chemicals Sector are presented in table 6.

Table 6. AR (1) of chemical sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	237.6554	123.0888	1.930764
$FDI(6)_{-1}$	0.213332	0.364653	0.585026

Source: Research Study, 2010: *Results are at 95% Confidence level.

As the coefficient of FDI_{1t} ($I\beta I > 1$) 0.21 is less than 1 hence this sector exhibits stationarity tendency for the period. It implies that the sector exhibits no statistically significant change in FDI inflows. The series exhibits random type of fluctuations around an average (α) and statistically insignificant.

6.7 Drugs and Pharmaceuticals

Summary results of AR (1) for drugs and pharmaceuticals are presented in table 7.

Table 7. AR (1) of Drugs and Pharmaceuticals for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	48.46893	48.97937	0.989578
$FDI(7)_{-1}$	0.495115	0.354697	1.395882

Source: Research Study, 2010: *Results are at 95% Confidence level.

For the result, coefficient of FDI_{1t} ($I\beta I > 1$) 0.495 is less than 1 hence this sector exhibits stationarity tendency for the period. The series exhibits random type of fluctuations around an average (α) and statistically insignificant. It implies that the sector exhibits no statistically significant change in FDI inflows.

6.8 Food Processing Industries

Summary results of AR (1) for food processing industries are presented in table 8.

Table 8. AR (1) of Food processing Industries for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	26.10819	19.43545	1.343328
$FDI(8)_{-1}$	0.245973	0.395706	0.621606

Source: Research Study, 2010: *Results are at 95% Confidence level.

As coefficient of FDI_{1t} ($| \beta | > 1$) 0.25 is less than 1 hence this sector exhibits stationarity tendency for the period. The series exhibits random type of fluctuations around an average (α) and statistically insignificant. It implies that the sector exhibits no statistically significant change in FDI inflows.

6.9 Cement and Gypsum Products

Summary results of AR (1) for cement and gypsum products are presented in table 9.

Table 9. AR (1) of Cement and Gypsum products for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	70.53068	70.76246	0.996725
$FDI(9)_{-1}$	0.185793	0.40114	0.463162

Source: Research Study, 2010: *Results are at 95% Confidence level.

The coefficient of FDI_{1t} ($| \beta | > 1$) 0.19 is less than 1 hence this sector exhibits stationarity tendency for the period. It implies that the sector exhibits no statistically significant change in FDI inflows.

6.10 Metallurgical Industries/Sector

Summary results of AR (1) for metallurgical sector are presented in table 10.

Table 10. AR (1) of Metallurgical sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	224.5921	185.1208	1.213219
$FDI(10)_{-1}$	0.475603	0.337884	1.407594

Source: Research Study, 2010: *Results are at 95% Confidence level.

As coefficient of FDI_{1t} ($| \beta | > 1$) 0.48 is less than 1 hence this sector exhibits stationarity tendency for the period. It implies that the sector exhibits no statistically significant change in FDI inflows.

6.11 Housing and Real Estate

Summary results of AR (1) for housing and real estate are presented in table 11.

Table 11. AR (1) of Housing and Real estate sector 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	334.8541	277.7577	1.205562
$FDI(11)_{-1}$	1.00462	0.219486	4.577146

Source: Research Study, 2010: *Results are at 95% Confidence level.

As coefficient of FDI_{1t} ($| \beta | = 1$) is equal to 1 hence the sector has nonstationarity behavior statistically significant. This implies that there is statistically significant change in FDI inflows to the sector.

6.12 Construction Activities (Including Roads and Highways)

Summary results of AR (1) for construction sector are presented in table 12.

Table 12. AR (1) of Construction Sector 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	221.1181	178.4976	1.238774
$FDI(12)_{-1}$	1.218893	0.177162	6.880099

Source: Research Study, 2010: *Results are at 95% Confidence level.

As coefficient of FDI_{1t} ($| \beta | > 1$) 1.22 is greater than 1 hence the sector exhibits explosive behavior statistically significant. This explosive behavior implies that there is statistically significant rapid change in FDI inflows to the sector

6.13 Automobile Industry Sector

Summary results of AR (1) for automobile sector are presented in table 13.

Table 13. AR (1) of Automobile Sector for 2002-10

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	125.6979	102.7553	1.223274
FDI(13) ₋₁	1.001625	0.213167	4.698775

Source: Research Study, 2010: *Results are at 95% Confidence level.

Since coefficient of FDI₋₁ ($I\beta I = 1$) is equal to 1 hence the sector has nonstationarity behavior and statistically significant. This implies that there is statistically significant change in FDI inflows to the sector.

The results of the descriptive analysis for sectors which received FDI inflows during the period of study could be summarized and presented in table 14 below.

Table 14. Showing summary of the descriptive results on sectoral FDI inflows for 2002-2010

Sectors	Descriptive Results		
	Stationarity	Nonstationarity	Explosive
Electrical and Computer	√	-	-
Service Sector	√	-	-
Telecommunications	-	-	√
Transport	√	-	-
Fuel	√	-	-
Chemicals	√	-	-
Drugs and Pharmaceuticals	√	-	-
Food processing industries	√	-	-
Cement and Gypsum	√	-	-
Metallurgicals	√	-	-
Housing and Real Estate	-	√	-
Construction Activities	-	-	√
Automobile Sector	-	√	-

Source: Research Study, 2010.

Summary of descriptive results of 13 sectors of economy which received FDI inflows answers: *what, which, and how much* FDI inflows in different sectors of the economy (see Taylor III, 2008). That, the main purpose of the study in testing for AR (1) was to establish characteristics of FDI inflows overtime across sectors in Indian economy. The study revealed that: Telecommunication and Construction activities exhibited explosive behavior, Housing and Real Estate and Automobile sectors are nonstationary whereas the rest of sectors exhibited stationary behavior.

From these results, it seems foreign investors have been pooling there funds in at least 4 sectors, namely Telecommunication, Construction activities, Housing and Real Estate and Automobile sectors. The rest of sectors have been receiving fewer funds during the period of study.

7. Summary and Conclusion of the Study

The study has underscored the stationarity and non-stationarity of the FDI inflows in the 13 sectors of the Indian economy for 2002-2010. Among the thirteen sectors of the economy, 2 sectors exhibited explosive behavior, i.e. Telecommunications (Radio paging, cellular mobile, basic telephone services) and Construction activities (including roads and highways). The practical evidence abounds on the fact that the Indian economy is going through drastic changes in these sectors in both development and policy issues. The construction of the highways, International terminal (T3) at IGI and Metros are practical examples which support these findings. Also the auction of 3G for Telecommunication sector is again validating reality.

Service sector, Housing and Real Estate and Automobile sectors exhibit nonstationarity tendency during the period. The statistical findings corroborate with practical evidence. For example, the evidences reveal that numbers of registered vehicles in Indian increased stupendously from 2002-06. There were 67,007,000 registered vehicles in 2002-03; 72,718,000 registered vehicles in 2003-04; 79,473,000 registered vehicles in 2004-05; and 85,896,000 registered vehicles in 2005-06. India also experienced increase in the length of the National Highways, it increased from 58,100 km in 2002-03 to 65,600 km in 2003-04. This increasing tendency was recorded also with State Highways (Government of India, 2010) (Note 3). Also, Service sector and Fuels sector have exhibited strong trend of non-stationarity.

However, the rest of the sectors viz Electrical equipment including Computer software and Electronics; Transportation industry; Chemicals (other than fertilizers); Drugs and pharmaceuticals; Food processing industries; Cement and gypsum products and Metallurgical industries exhibited stationarity. Though these sectors are stationary, they exhibit positive kurtosis and skewed to the right.

It may be concluded that the sectors which exhibited nonstationarity belonged to Infrastructure category. It is also logical to say that developing infrastructure leads to economic growth and in that order brings economic development. This conclusion has also been asserted by (Jonnes, 1998) that fundamental changes in infrastructure can then generate growth miracles or growth disasters. The study results are also confirmed by the findings of Kundra (2009:43) which states that there is an uptrend in FDI inflows to India since 2006, however inflows are mainly for exploring the domestic market in the financial and infrastructure sectors. And, two sectors, namely Telecommunication and Construction activities exhibited explosive behavior in the period of study.

Whereas, Telecommunication can be classified in the services sector in which its growth can be increased infinitely, Construction activities are finite. It is paramount to policy makers as well as investors to have different investment policies towards these sectors. Moreover, Construction activities which include highways construction need huge capital investment which means public sector (i.e. to derive public good) may finance. The 13 sectors attracting different FDI volume indicated volatile pattern basing on scope of development, policy reforms and sector performance. It could also be interpreted that sectors which exhibited stationarity are in dire need of investment funding.

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Notes

Note 1. See Kundra (2009) for country of origin sources of FDI inflows to India. In nutshell, top ten origin sources FDI inflows to India are: Mauritius, U.S.A, Japan, Netherlands, U.K., Germany, Singapore, France, Korea (South), and Switzerland.

Note 2. Refer Kasidi et al., (2010) Detecting Data Error and Inaccuracy: A Case Study of India FDI Inflow, Margin: The Journal of Applied Economic Research, Vol. 4 No. 4, pp. 405-425.

Note 3. Refer Economic Surveys 2009-10, Schedule A30 for further records on the increase of the construction sector activities.