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FOREIGN DIRECT INVESTMENT AND EXCHANGE RATE VOLATILITY IN NIGERIA

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Abstract

This study investigated the empirical evidence on the effect of exchange rate volatility on foreign direct investment (FDI) in Nigeria, using secondary time series data from1970 to 2004. In doing this, the study utilized the error correction model as well as OLS method of estimation. The results suggest, among others, that exchange rate volatility need not be a source of worry by foreign investors. Also, the study further reveals a significant positive relationship between real inward FDI and exchange rate. This implies that, depreciation of the Naira increases real inward FDI. Also, the results indicate that the structural adjustment programme (introduced in Nigeria in 1986) had a negative impact on real inward FDI, which could be due to the deregulation that was accompanied by exchange rate volatility. As such, a major challenge before the Central Bank of Nigeria therefore, is to attain a stable and realistic exchange rate that will boost domestic production, increase real inward FDI and maintain internal and external balance.

Keywords: Exchange rate, exchange rate volatility, real inward foreign direct investment.

JEL Codes: F0, O55

1. Introduction

The 1980s witnessed increased flows of investment around the world. Total world outflows of capital in that decade grew at an average rate of almost 30%, more than three times the rate of world

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exports at the time, with further growth experienced in the 1990s (Kosteletou and Liargovas, 2000). Despite the increased flow of investment, especially, to developing countries, Sub-Saharan Africa (SSA) countries still lag behind other regions in attracting foreign direct investment. The uneven dispersion of FDI is a cause of concern since FDI is an important source of growth for developing countries. Not only can FDI add to investment resources and capital formation, it can also serve as an engine of technological development with much of the benefits arising from positive spillover effects. Such positive spillovers include transfers of production technology, skills, innovative capacity, and organizational and managerial practices.

Given these significant roles of FDI in developing economies there have been several studies that tried to determine the factors that influence FDI inflows into these economies. One of such factors that recently have been a source of debate is exchange rate and its volatility. The existing literature has been split on this issue, with some studies finding a positive effect of exchange rate volatility on FDI, and others finding a negative effect. A positive effect can be justified with the view that FDI is export substituting. Increases in exchange rate volatility between the headquarters and the host country induce a multinational to serve the host country via a local production facility rather than exports, thereby insulating against currency risk (Foad 2005).

Justification for a negative impact of exchange rate volatility on FDI can be found in the irreversibility literature pioneered by Dixit and Pindyck (1994). A direct investment in a country with a high degree of exchange rate volatility will have a more risky stream of profits. As long as this investment is partially irreversible, there is some positive value to holding off on this investment to acquire more information. Given that there are a finite number of potential direct investments, countries with a high degree of currency risk will lose out on FDI to countries with more stable currencies (Foad 2005).

One of the countries that fall into this category (countries with a high degree of currency risk) is Nigeria. With a population of about 130 million people, vast mineral resources, and favourable climatic and vegetation features, Nigeria has the largest domestic

market in Sub-Saharan Africa. The domestic market is large and potentially attractive to domestic and foreign investment, as attested to by port folio investment inflow of over ₦1.0 trillion into Nigeria through the Nigerian Stock Exchange (NSE) in 2003 (Central Bank of Nigeria, 2004). Investment income, however, has not been encouraging, which was a reflection of the sub-optimal operating environment largely resulting from inappropriate policy initiatives. Except for some years prior to the introduction of the Structural Adjustment Programme (SAP) in 1986, gross capital formation as a proportion of the GDP was dismally low on annual basis.

It was observed that aggregate investment expenditure as a share of GDP grew from 16.9% in 1970 to a peak of 29.7% in 1976 before declining to an all-time low of 7.7% in 1985. Thereafter, the highest was 11.8% of GDP in 1990, before declining to 9.3% in 1994. Beginning from 1995, investment/GDP ratio declined significantly to 5.8% and increased marginally to 7.0% in 1997 and remained thereabout till 2004 when 7.1% was recorded. On the average, about four-fifth of Nigeria's national output was consumed annually.

The sub-optimal investment ratio in Nigeria could be traced to many factors including exchange rate instability, persistent inflationary pressure, low level of domestic savings, inadequate physical and social infrastructure, fiscal and monetary policy slippages, low level of indigenous technology as well as political instability. A major factor was exchange rate instability, especially after the discontinuation of the exchange rate control policy. The high lending rate, low and unstable exchange rate of the domestic currency and the high rate of inflation made returns on investment to be negative in some cases and discouraged investment, especially when financed with loans.

The Naira (Nigerian currency, ₦) exchange rate witnessed a continuous slide in all the segments of the foreign exchange market (that is, official, bureau de change and parallel markets). In the official market, the exchange rate depreciated progressively from ₦8.04 per US dollar in 1990 to ₦81.02 per dollar in 1995 and further to ₦129.22 in 2003 and ₦133.00 in 2004. Similarly, it depreciated from ₦9.62 and ₦9.61 per dollar in 1990 to ₦141.36

and ₦141.07 per dollar in 2003 in the bureau de change and parallel market, respectively. Consequently, the premium between the official and parallel market remained wide throughout the period.

This high exchange rate volatility in Nigeria, among others, led to a precarious operating environment which can be attributed to the reason why Nigeria was not only unable to attract foreign investment to its fullest potentials but also had a limited domestic investment. As such, despite the vast investment opportunities in agriculture, industry, oil and gas, commerce and infrastructure, very little foreign investment capital was attracted relative to other developing countries and regions competing for global investment capital.

As a result of the above, it becomes relevant for a study like this to investigate if there exist any relationship between FDI and exchange rate volatility in the Nigerian economy. It also investigates the magnitude and direction of the effect of exchange rate and its volatility on foreign direct investment.

This rest of the paper is divided into five sections. Closely following this introduction is section two which reviews the existing literature. Section three examines the trends in exchange rate and FDI in Nigeria while section four contains the methodology. Section five concludes the study.

2. Literature Review on FDI and Exchange Rates

2.1. Exchange Rate Levels

Exchange rate movements and exchange rate uncertainty appear to be important factors investors take into consideration in their decision to invest abroad. Much of the literature on exchange rate movements and FDI concentrates on two issues: the level of the exchange rate, and the volatility of the exchange rate.

Froot and Stein (1991) claimed that the level of exchange rate may influence FDI. This is because depreciation of the host country currency against the home currency increases the relative wealth of foreigners thereby increasing the attractiveness of the host country for FDI as firms are able to acquire assets in the host country relatively cheaply. Thus a depreciation of the host currency should

increase FDI into the host country, and conversely an appreciation of the host currency should decrease FDI.

Against this argument, it is often claimed that the price of assets should not matter but only their rate of return. When the host country currency depreciates relative to the home country currency, not only the price, but also nominal return of the assets in the host country currency goes down. Since the prices of assets and returns on assets both go down exchange rate movements should not affect FDI. Froot and Stein (1991) counter this argument with the claim that when capital markets are subject to information imperfections, exchange rate movements do influence foreign investment. Information asymmetry causes a divergence between internal and external financing, making the latter more expensive than the former, since the lenders incur monitoring costs and thus lend less than the full value of the asset. In this environment should foreign investors hold their wealth in foreign currency, the depreciation of the local currency will increase the wealth position of foreign agents relative to domestic agents, thus leading foreign investors to bid more aggressively for domestic assets. Froot and Stein (1991) use industry level data on US inward FDI for the 1970s and 1980s to support their hypothesis (Jayaratnam, 2003).

Campa (1993), however, puts forward a different argument for the relationship between exchange rate level and FDI. In his model, the firm's decision whether or not to invest abroad depends on the expectations of future profitability. In such a case, the higher the level of the exchange rate (measured in units of foreign currency per host currency) and the more it is rising, the higher will be expectations of future profits from entering a foreign market. Therefore, Campa's model predicts that an appreciation of the host currency will increase FDI into the host country, ceteris paribus, which is contrary to the prediction of Froot and Stein (1991). His empirical results analyzing the number of foreign entrants entering the US provide evidence to support his model (Gorg and Wakelin 2001).

Gorg and Wakelin (2001) made a significant contribution. This is because unlike other studies that have considered either inward or outward FDI, it considered both. The paper

investigated empirically both direct investment from US to 12 countries and investment from these 12 countries to the US. The empirical estimations yielded different results for US outward and inward FDI, which appear contradictory. They found a positive relationship between US outward investment and appreciation in the host country currency while there is a negative relationship between US inward investment and appreciation in the dollar.

In another contribution, Blonigen (1997), using data on Japanese acquisitions in the US from 1975 to 1992, suggested that exchange rates can affect acquisition of FDI as this involves purchasing firm specific assets in the foreign currency that can generate returns in another currency. The argument that real dollar depreciations increase foreign acquisitions that is put forth by Blonigen differs from the argument put forth by Froot and Stein (1991), although they both have the same outcome. Froot and Stein show that exchange rate movements are important because capital markets are imperfect. On the other hand, Blonigen shows that exchange rate movements matter because while domestic and foreign firms may have the same opportunities to purchase firm specific assets in the domestic market, foreign and domestic firms do not have the same opportunities to generate returns on these assets in foreign markets. Due to the unequal level of access to markets, exchange rate movements may affect the relative level of foreign firm acquisitions.

Regarding the exchange rate, there is a statistically significant and positive relationship with Japanese acquisition activity, which is in line with Blonigen's prediction. However, despite showing such a result, it remains unclear whether the correlation between exchange rate movements and Japanese acquisition FDI is due to the presence of firm specific assets (Blonigen's claim) or due to the hypothesis put forth by Froot and Stein (1991), which is an imperfect capital market. To test this question, Blonigen separates acquisitions into those in the manufacturing industry and those in the non-manufacturing industry. The reason for this is that firm-specific assets are said to be more important in the manufacturing industry. Indeed, Blonigen finds that the co-efficient on the real exchange rate for non-manufacturing

industries is statistically insignificant while the co-efficient for the manufacturing industries is significant. Afterwards, Blonigen divides acquisitions within the manufacturing industry into those involving high R & D expenditures, as a percentage of sales, and those involving low R & D expenditures. Since Japanese firms may be particularly interested in technology related, firm specific assets, where high R & D expenditures are important, exchange rate movements should influence acquisition FDI more in industries with high R & D expenditures. The result of running regressions on high and low R & D manufacturing industries showed that the coefficient on the real exchange rate variable is insignificant for the low R & D sample and significant for the high R & D sample. Thus, it can be seen that through separating Japanese acquisitions into those in the manufacturing and non-manufacturing industries, and then further splitting the ones within manufacturing into high and low R & D samples, Blonigen is able to support his claim that exchange rate movements influence FDI due to firm specific assets.

2.2. Exchange Rate Volatility

The theoretical arguments linking volatility to FDI have been divided between production flexibility arguments and risk aversion arguments. According to production flexibility arguments, exchange rate volatility increases foreign investment because firms can adjust the use of one of their variable factors following the realization of nominal or real shocks. The production flexibility argument relies on the assumption that firms can adjust variable factors, for the argument would not hold if factors were fixed.

According to the risk aversion theory, FDI decreases as exchange rate volatility increases. This is because higher volatility in the exchange rate lowers the certainty equivalent expected exchange rate. Certainty equivalent levels are used in the expected profit functions of firms that make investment decisions today in order to realize profits in future periods (Goldberg and Kolstad, 1995). Campa (1993) extends this claim to include risk-neutral firms by using the argument of future expected profits. He hypothesizes that as investors are concerned with future expected profits, firms will postpone their decision to enter as the exchange rate becomes more volatile. Risk neutral firms will thus be deterred from

entering foreign markets in the presence of high levels of exchange rate uncertainty. The theoretical result is confirmed empirically for inward investment to the US in the wholesale industries, particularly in cases where the sunk costs of entry are high. Goldberg and Kolstad (1995) note that when evaluating risk-aversion approaches versus production flexibility approaches it is important to distinguish between short-term exchange rate volatility and long-term misalignments.

Risk-aversion arguments are more convincing under short-term volatility because firms are unlikely to be capable of adjusting factors in the short-run. In the short-run, factors of production are usually fixed, and as a result firms will only be risk-averse to volatility in their future profits. However, the production flexibility argument appears in convincing under the long-term misalignments because firms are now able to adjust their use of variable factors (Jayaratnam 2003).

No clear consensus exists in the existing literature on the effects of exchange rate volatility on FDI. A survey of past studies on this topic yields negative, positive, and indeterminate effects. A positive effect can be justified with the view that FDI is export substituting. Increases in exchange rate volatility between the headquarters and the host country induce a multinational to serve the host country via a local production facility rather than exports, thereby insulating against currency risk. Justification for a negative impact of exchange rate volatility on FDI can be found in the irreversibility literature pioneered by Dixit and Pindyck. A foreign direct investment in a country with a high degree of exchange rate volatility will have a riskier stream of profits, all else being equal. As long as this investment is partially irreversible, there is some positive value to holding off on this investment to acquire more information. Given that there are a finite number of potential direct investments; countries with a high degree of currency risk will lose out on FDI to countries with more stable currencies (Foad 2005).

Markusen's (1995) argument is in line with export substituting FDI. He argues that firms will engage in FDI to avoid the costs of international trade, which include currency risk. As exchange rate becomes more volatile, more firms will choose to

serve foreign markets through a local production facility rather than exports. Numerous empirical studies have supported this view. Cushman (1988) and Stokman and Vlar (1996) find a significantly positive relationship between exchange rate volatility and FDI flows into and out of the US and the Netherlands. De Menil (1999) examines the issue across the EU and finds that a sustained 10% increase in exchange rate volatility (as measured by the standard deviation of real exchange rate) will eventually increase the level of FDI by 15%. Pain and Van Welsum (2003) find evidence supporting this result for industrialized countries. They find a positive effect for inflows of FDI into the UK, Germany, Canada, and the US (Foad 2005).

There are several studies supporting the irreversibility literature pioneered by Dixit and Pindyck, finding a negative relationship between currency risk (volatility) and FDI. As FDI is a capital investment, we may also consider studies examining the impact on investment. Darby et al (1999) use a threshold model and find a negative long run relationship between exchange rate volatility and investment in France, Germany, and the US; and a negative short run relationship with investment in the UK and Italy. Bryne and Davis (2003) find that a sustained 10% increase in the monthly volatility of the real effective exchange rate lowers the total volume of investment by 1.5%. Several studies focusing on FDI have also found a negative relation. Benassy-Quere et al (2001) find a negative impact of exchange rate volatility on flows of FDI to developing countries. Another study looking at flow of FDI to developing countries is Hubert and Pain (1999), who find that currency risk reduces flows of FDI from Germany to developing countries. It may be the case that in these studies, a volatile exchange rate is just a symptom of deeper institutional and structural problems in developing countries. However, other studies have noted this negative relationship for developed countries.

As can be seen, the effects of both the exchange rate level and exchange rate volatility on FDI are ambiguous. A recent study by Gorg and Wakelin (2001) on both outward US foreign investment in 12 developed countries and inward investment to the US from those same countries for the period 1983 to 1995

provides further evidence on the issue. The level of the real exchange rate (partner currency per US dollar) is calculated as the log of the annual mean of the monthly exchange rates for a given year. Exchange rate volatility is measured by the standard deviation of the exchange rate and is calculated as the annual standard deviation of the log of the monthly changes in the exchange rate. Controlling for labour costs, relative interest rates, partner country GDP, US GDP, freight cost, distance between the partner country and the US, and finally language, which is a dummy variable that is equal to 1 if the official language is English and 0 if otherwise, Gorg and Wakelin find that exchange rate volatility has no effect on US outward FDI. Such a finding runs contrary to past studies, including Cushman's model of the choice between FDI and exports under exchange rate volatility and Campa's extension of the standard model, where there is no choice between exports and FDI, to include risk-neutral firms.

Regarding inward FDI to the US, Gorg and Wakelin (2002) find that exchange rate volatility has no statistically significant effect on inward FDI, which is consistent with the finding regarding outward US FDI.

A study by Alaba (2003) on inward FDI to Nigeria confirms the lingering controversy in the literature on the direction of the effects of exchange rate volatility. His empirical analysis focuses on inward FDI to two main sectors in Nigerian economy – the agricultural sector and the manufacturing sector. This is because they are the two most important which are considered very significant in diversifying the Nigerian economy from the dominance of oil trade as suggested under SAP. He also adopted both black market and official/IFEM exchange rates because the market handles substantial proportion of the Nigerian foreign exchange trading. His empirical process determines the relationships between both systematic movement and volatility of exchange rate, output, economic performance and foreign direct investment. Alaba's finding reveals that exchange rate movement in the official market is significant at 1% for FDI to agricultural sector while the same is insignificant for the manufacturing sector. Also, the co-efficient of exchange volatility at the official/IFEM market is not significant at all for FDI to both sectors. The result obtained using the parallel market

exchange rate suggests that both systematic movement of exchange rate and its volatility is significant at 1% for flow of FDI to agriculture in Nigeria. For the manufacturing sector both movement in parallel market exchange rate and its volatility are significant at 10%.

Looking at the parallel market rates, he obtained both negative and positive signs for exchange rate volatility in the two different sectors. The negative co-efficient obtained for parallel market exchange volatility in the manufacturing sector suggests that volatility tends to reduce investment to the sector, while the same ironically attracts investment to agriculture.

In summary, because of the fundamental heterogeneity of these empirical analyses, there is no definitive study to date that settles the theoretical and practical disputes of the effect of movement in exchange rate and its volatility on FDI. The main drawbacks of these empirical works is that they do not consider the latest and most comprehensive data available and the number of countries considered is too small to be able to provide clear-cut results.

3. The Behavioral Pattern of Foreign Direct Investment and Exchange Rate in Nigeria

3.1. The Nature and Importance of Foreign Direct Investment in Nigeria.

Medupin (2002) has stated that at independence in 1960, private foreign investment in Nigeria accounted for 70% of the total industrial investment and over 90% of investment in such basic industries as chemical production, and vehicle assembly plants and no less than 90% of other manufacturing sub-sectors. Foreign Private Direct Investment (FPDI) dominated banking, insurance and mining before the indigenisation programme (through the Nigerian Enterprises Promotion Decree, 1972). Presently, FDPI controls the Oil and Gas Investment in Nigeria, in the up stream sector.

Nigeria is not a major destination of FDI. Meier (1995) showed that of the US $35,895 million FDI to developing countries in 1991, 66.7% went to ten countries and Nigeria was not one of them.

In fact, Nigeria's share was 1.8% of the total FDI to all developing countries (IMF, 1992). In the same year net foreign private capital into Nigeria was ₦1,808m (or US $182.5m, using average annual exchange rate of ₦9.9095/ US $1.00) and equivalent to 0.51% of the FDI that went to all developing countries. By year 2000, the flow of FDI increased and Nigeria was still not among the top ten recipients though her share of the FDI relative to other developing countries increased marginally to 1.9% (World Bank, 2002).

Also, table 3.1 shows that private foreign investment constitutes a high proportion of total investment in Nigeria.

Table 3.1: Cumulative Private, Domestic And Foreign Investment

Years	(1)	(2)	(3)	(4)	(5) = (1) + (3)	6)= (1)/(5)	(7) = (3/5)
1986	7,734	-	9,313.6	-	17,047.6	0.8	0.5
1987	9,605	24.2	9993.6	7.3	19,598.6	0.96	0.5
1988	9,391	(2.2)	11,339.2	13.5	20,730.2	0.81	0.5
1989	18,424	96.2	10,899.6	(3.9)	29,323.6	1.7	0.4
1990	31,127	69.0	10,435.5	(4.3)	41,562.5	3.0	0.3
1991	35,624	14.5	12,244.0	17.3	47,868	3.0	0.3
1992	58,940	65.5	20,513.1	67.5	79,453.1	2.9	0.3
1993	81,398	38.1	66,807.4	225.7	148,205.4	1.2	0.5
1994	85,314	4.8	70,714.6	5.8	156,028.6	1.2	0.5
1995	114,827	34.6	119,391.6	40.8	234,218.6	0.96	0.5
1996	172,492	50.2	122,600.9	2.7	295,092.9	1.4	0.4
1997	206,000	19.4	128,331.9	4.7	334,331.9	1.6	0.4
1998	193,498	(6.1)	152,409.0	18.8	345,907.0	1.3	0.4
1999	176,314	(8.9)	154,188.6	1.2	330,502.6	1.1	0.5
2000	269,516	52.9					
2001	392,933	45.8					

Source: CBN Statistical Bulletin, FOS & World Bank Staff Estimates

Notes: (1) Private domestic investment. current prices ₦M, (2) growth rate (%), (3) private foreign investment. current prices ₦M, (4) growth rate (%), (5) total private investment, (6) ratio of domestic to total private investment, (7) ratio of foreign total private investment.

Table 3.2: Cumulative Foreign Private Investment in Nigeria Analyzed by Type of Activity, 1970-2004: Values

Year	Total	Min	Manuf	Agri	TC	Build	Trade	Misc
70	1003	515.4	224.8	11.2	13.8	13.8	206.6	17.6
75	2287	959.6	506.2	19.2	22.8	111.2	572.4	96.1
80	3602	677.4	1503.9	120.5	62.2	307.8	693.2	255.1
85	6804	744.0	2278.1	126.0	85.9	453.5	2698	418.9
86	9314	2510	2810.2	128.2	80.4	501.8	2752	529.8
87	9994	2260	3122.3	117.3	75.6	462.6	3396	559.1
88	11339	2403	3637.0	128.9	100.6	492.7	3134	383.3
89	10899	636.7	5406.4	134.8	158.2	481.8	2497	584.7
90	10436	1092	6339.0	334.7	240.5	742.6	1710	-23.7
91	12243	810	8692.4	382.8	373.2	1471.6	1452	682.0
92	20513	6417	9746.3	386.4	391.5	1406.6	1482	682.2
93	66787	27687	12885.1	1214.9	426.4	71.2	1864	22638
94	70715	26800	14059.9	1208.5	429.6	1707.8	2248	24381
95	119392	56747	27668.8	1209.0	374.8	1553.0	2991	28848
96	122601	56792	2914.3	1209.0	488.6	1864.3	3669	28767
97	128332	59221	31297.2	1209.0	672.6	1259.8	3626	31046
98	152411	59970	34503.9	1209.0	689.2	3888.3	10460	41689
99	154190	58855	36282.1	1209.0	820.3	3995.3	10927	42100
00	157537	60711	37333.6	1209.0	820.3	3995.9	11201	42238
01	160892	61612	37779.6	1209.0	955.3	4211.9	12016	43658
02	166632	61612	39953.6	1209.0	1736.3	4293.1	12317	45510
03	178479	61809.1	45719.1	1209.0	2890.5	4545.8	14457	49056
04	249221	62146	102995.8	1209.0	4281.1	5194.1	20242	53571

Source: CBN Statistical Bulletin Vol. 15 (December 2004). Note: Values in (₦M). Notes: Min=Mining and Quarrying, Manuf= Manufacturing & processing, Agri = Agriculture, Forestry & fisheries, TC = Transport & Communication, Build = Building & Construction, Trade = Trading & Business Service, Misc = Miscellaneous Services

In terms of sectoral analysis table 3.2 shows that in 1970, Mining and Quarrying and Manufacturing sectors absorbed 73.8% of total private investments in Nigeria while the trading and business services sector top up 20.6 of the balance of 26.2%. This pattern was maintained in 1980 and 1990 when the two sectors – Mining and Quarrying and Manufacturing absorbed 60.2% and 71.2% respectively of the Cumulative private foreign investment. However,

manufacturing overtook mining and quarrying as preferred activities: in 1970, manufacturing was 22.4%, in 1980, it was 41.5% and by 1990, it further increased to 60.7%.

Cumulative Foreign Private Investment in Nigeria Analyzed by Type of Activity, 1970-2004: % of Total

Year	Min	Manuf	Agri	TC	Build	Trade	*Misc*
1970	51.4	22.4	1.1	1.4	1.4	20.6	1.8
1975	41.9	22.1	0.8	1.0	4.9	25.0	4.2
1980	18.7	41.5	3.3	1.7	8.5	19.1	7.0
1985	10.9	23.5	1.9	1.3	6.7	39.1	6.2
1986	26.9	30.2	1.4	0.86	5.44	29.6	5.68
1987	22.6	31.2	1.2	0.76	4.63	33.9	5.56
1988	30.0	32.1	1.1	1.42	4.35	27.6	33.8
1989	5.84	49.6	1.2	1.45	4.42	32.1	5.36
1990	10.5	60.7	3.2	2.3	7.13	16.4	20.22
1991	6.62	70.9	3.1	31.	12.0	11.9	5.57
1992	31.3	78.8	1.9	1.91	6.9	7.23	3.33
1993	41.5	19.3	1.8	0.64	0.16	2.79	33.90
1994	37.7	19.9	1.7	0.61	2.42	3.18	39.5
1995	47.5	23.2	1.0	0.3	1.3	2.5	24.2
1996	46.3	24.3	1.0	0.4	1.5	3.0	23.5
1997	46.2	24.4	0.9	0.5	1.0	2.8	24.2
1998	39.3	22.6	0.8	0.5	2.6	6.9	27.4
1999	38.2	23.5	0.8	0.5	2.6	7.1	27.3
2000	38.5	23.7	0.8	0.5	2.5	7.1	26.8
2001	38.3	23.5	0.8	0.6	2.6	7.5	27.1
2002	37.0	24.0	0.7	1.0	2.6	7.4	27.3
2003	34.6	25.0	0.7	1.6	2.5	8.1	27.5
2004	24.9	41.3	0.5	1.7	2.1	8.1	21.5

Source: CBN Statistical Bulletin Vol. 15 (December 2004). Note: Values in (₦M). Notes: Min=Mining and Quarrying, Manuf= Manufacturing & processing, Agri = Agriculture, Forestry & fisheries, TC = Transport & Communication, Build = Building & Construction, Trade = Trading & Business Service, Misc = Miscellaneous Services

It is observed that in the 1990s, the results are reversed but the two activities together still account for more than 50% of Cumulative private foreign investment. Before the structural adjustment and subsequent reform programmes, the two sectors had policies that encouraged private foreign investment. This was not the case with the agricultural sector (which is not significantly entrepreneurial) and transport and communication, which were state monopolies.

3.1.2: Analysis of the Trends and Behavioral Pattern of the Naira Exchange Rate and Foreign Direct Investment in Nigeria

Nigeria has a great potential for attracting foreign investments. It has a large market, represented by a large and virile population and it is richly endowed with natural resources - mineral deposits, especially oil and gas, vegetation, arable agricultural land, etc. She also has cheap trained labour force. Available statistics show that the country has not benefited much from foreign investment flows. The World Bank data shows that while net foreign direct investment flows to developing countries have been growing steadily since 1990, the relative share of the increasing flow attracted into the Nigerian economy has been fluctuating and declining. For example, out of the US $25.0 billion investment inflow into all developing countries in 1990, Nigeria accounted for US $0.6 billion or 2.4 percent. But by 1993 when the flow to all LDCs increased to US $67.6 billion, Nigeria's share declined to US $1.3 billion or only 1.9 per cent. The share was only 0.9 per cent in 1997.

The low level of FDI in Nigeria has been attributed to a large number of factors, among which is macroeconomic instability, as evidenced by rising inflation, interest and exchange rate volatility, arising from fiscal dominance (CBN, 2001). Other notable constraints on FDI inflows into the country include poor infrastructural facilities, inadequate and costly telecommunications services, and frequent disruptions in power supply, inadequate water supply and a poorly maintained network of roads. Besides, the high external debt burden influences adversely foreign investors' perception of the health of the economy (Obadan, 2004).

With respect to FDI and exchange rate movements, three exchange rate regimes in Nigeria were examined.

Trends under the Exchange Control Era

During the fixed exchange rate regime, the naira exchange rate relative to the dollar fluctuated progressively between the first quarter of 1970 and the third quarter of 1986. The exchange rate which persisted at $1.00 to ₦0.7143 in the first quarter of 1970 to second quarter of 1971 appreciated to ₦0.6579 in the third quarter of 1971 and remained at that until the first quarter of 1974. It appreciated to an average of ₦0.6159 at the end of 1975. It however depreciated to ₦0.6265 and ₦0.6466 in 1976 and 1977 respectively. Thereafter, it appreciated to ₦0.6060 in 1978 all through 1980 to ₦0.5464 before a persistent depreciation to ₦2.0206 in 1986.

On the other hand, real foreign direct investment in Nigeria was also unstable during this period. From $351.4 million in 1970, it rose to $868.2 million in 1973. By end of 1974, FDI fell by 7.28 per cent from the previous year's level to $805million. It however, rose by 52.77 per cent to $1229.8million in 1975 before declining to $831.8million in 1976. FDI increased by 33.28 per cent to $1108.6million in 1977, but fall to $1096.8million in 1979. In 1980, Nigeria recorded an increase of 21.77 per cent in FDI to $1439.2 before a decrease to $958.8 in 1981. Between 1981 and 1982, there was a massive increase of 230.09 per cent which made FDI to stand at $3259.7. Thereafter, it declined continuously through 1985.

Trends under the Flexible Exchange Rate

The direction of exchange rate movement during the introduction of the flexible market based exchange rate regime resembles that which emerged when the administered mechanism was in place. However, the magnitudes of fluctuations were different in the two periods. While the rates depreciated massively under the flexible regimes, they were relatively less volatile in the last phase of the administered exchange rate regime. Thus, the fact those exchange rates were allowed to find their appropriate levels has only resulted in reducing most of the frivolous demand for foreign exchange. While foreign exchange was more rationally priced, during the above period, its genuine or frivolous demand however was still excessive, leading to persistent depreciation. For example, the naira exchange rate, which stood at $1.00 to ₦1.3248 in the third quarters of 1986

depreciated to ₦3.6114 in the fourth quarter of the same year by a whopping ₦2.2866.

The depreciation of the naira continued consistently, with low margins up to the fourth quarter of 1988 when the naira exchange rate reached $1.00 to ₦5.0920. Further still, the exchange rate depreciated massively in the first quarter of 1989 to ₦7.2292 as a result of the merger of the autonomous and official foreign exchange markets, which gave birth to the inter-bank foreign exchange market. To further remove exchange rate instability, the CBN again had to modify the inter-bank procedures in December 1990 when the Dutch Auction System (DAS) was re-introduced, while in August 1991, the Bank introduced the model weighted average system of exchange rate determination. The move behind these ideas was still to reduce the wide fluctuations in the exchange rate system.

On the other hand, between 1985 and 1986, FDI fell by 65.8 per cent, reflecting the decline in world oil prices, which fell from over $20.00 a barrel to about $9.00 a barrel. Following the adoption of Structural Adjustment Programme (SAP) in 1986 and the subsequent liberalization of some aspects of the Nigerian economy, FDI in the country has been on an increasing trend, with the exception of 1990 when a decline of 69.5 per cent was recorded. For instance, the FDI rose to $1374.6 million in 1988, the second year of SAP operations in Nigeria, but declined by 54 per cent to $634.8 million in the succeeding year, in 1989. Between 1990 and 1993, the FDI exhibited a winding trend, reaching their levels of $565.6 million in 1991, $678.2 million in 1992 and $1933.1 million in 1993.

Trends under the Deregulated, Fixed and Dual Exchange Rate Regimes

In spite of all the efforts made to stabilize the naira exchange rate, the fluctuation in the rate continued in 1992. As a result of this instability, the CBN had to adopt a completely deregulated system of trading in March 1992, with a view of meeting all requests for foreign exchange by the users. In an attempt to meet this main objective, however, the rate adjusted further upward from $1 to ₦18.4740 during the second quarter of 1992 to ₦19.4964 in the fourth quarter of the same year.

In 1993, rate stabilized at ₦21.8861 in the third quarter and remained the same throughout the period and even to 1994 when it was finally pegged. The policy stance of pegging the rate during the period was mainly to further instill sanity into the foreign exchange market, and to encourage increased activities in the productive sectors of the economy. In order to stem the negative performance of the naira in the foreign exchange market, the Autonomous Foreign Exchange Market (AFEM) was introduced. The naira exchange rate which stood at $1.00 to ₦21.8861 in the third quarter of 1993 was also retained for 1995 and even beyond, following fair performance in maintaining stability for the naira. It depreciated to N92.6934 in 1999 and continuously depreciated to ₦133.5004. It stood at ₦120.9702, ₦129.3565 and ₦133.5004 in 2002, 2003 and 2004 respectively.

The reversal of the SAP policies by government resulted in a drastic decline in the FDI in 1994. Indeed, the 1994 level of $245.4 million was a decline of 87.3 per cent from the preceding year's level, there after it has been on a persistent decline up to 1996. On the average, FDI declined by 27.1 per cent between 1994 and 1996. In 1997, however, an increase of 38.45 per cent from the previous year's level was recorded. Empirical studies have confirmed that the decline in the FDI in Nigeria has been as a result of economic crisis, exchange rate volatility, declining productivity, reduced capacity utilization and other factors, mainly policy reversal which tended to send uncertainty signals to potential investors (Ekpo, 1997). And between 1997 and 2000, and average annual increase of 30.24 percent was recorded.

In all, it can be implied that for the period 1970 to 1986, exchange rate fluctuation influenced FDI flows as they both showed similar trends and it was observed that in 1982 when the exchange rate was least with respect to the dollar (US$1 to ₦0.6729), Nigeria had the highest inflow of FDI ($3259.7). But from 1987 a combination of factors, which includes exchange rate movements, accounted for the fluctuations in the foreign domestic inflow in Nigeria.

4.1: Methodology

4.1.1: The Model

To analyze the effect of exchange rate movement on FDI, we adopted and modified the methodology used by Gorg and Wakelin (2001). The methodology estimated the following equations:

$$FDI = \alpha_0 + \alpha_1 EXR + \alpha_2 EXRV + \alpha_3 INT + \alpha_4 RGDP + U \quad ..$$

Where:

FDI is the Real Inward Foreign Direct Investment; the size of this variable is a good indicator of the relative attractiveness of an economy to foreign investment. It is also a vehicle for the economic growth of developing countries. It was calculated by dividing the Inward FDI at current prices by the GDP Deflator.

EXR is the Exchange Rate. This measures the worth of a domestic currency in terms of another currency. It is necessary in order to show how the strength of a nation's currency affects her inward FDI.

EXRV is the Exchange Rate Volatility. This was measured by the standard deviation of the exchange rate defined as the mean-adjusted relative change in exchange rate squared (Gujarati).

INT is the interest rate.

RGDP is the real GDP. It measures the size of the home economy and it is included in order to control for the supply of FDI, as in Blonigen (1997). The assumption is that growth in the host country is likely to generate a greater supply of FDI.

The second equation examines the impact of exchange rate volatility and the Structural Adjustment Programme (SAP) on real inward foreign direct investment. The equation is stated as follows:

$$FDI = \beta_0 + \beta_1 EXRV + \beta_2 SAPdum + U$$

Where: FDI and EXRV are as defined above while SAPdum is the structural adjustment programme dummy. SAP was introduced in 1986 and it marked the beginning of deregulation in Nigeria especially with respect to exchange rate.

Also, we employed a Co-Integration, Error Correction Model (ECM). The theory of co-integration arises out of the need to integrate short-run dynamics with long-run equilibrium. In cases where the data series exhibit the presence of unit roots, short-run dynamic properties of the model can only be captured in an error correct model when the existence of co-integration has been demonstrated. If Y_t and X_t are found to be co-integrated, then there must exist an associated Error-Correction Mechanism (ECM), according to Engle and Granger (1987). The usual ECM may take the following form.

$$\Delta Y_t = \alpha_0 ECM_{t-1} + \sum_{j=1}^{T} \alpha_j \Delta Y_{t-j} + \sum_{j=1}^{T} \alpha_j \Delta Y_{t-j} + v_t$$

Where: Δ denotes first difference operator; ECM_{t-1} is the error correction term; T is the number of lags necessary to obtain "white noise" and V_t is the random disturbance term. Using the ECM, the estimates of the parameters are generally consistent and efficient (Henry and Richard 1983). As such the model is estimated under different assumptions of the error term. First, we assume that the error term is white noise and we estimate the equations using simple OLS. The estimation was done using annual data for the period 1970 to 2004.

4.1.2: Sources of Data

Date for the study was sourced secondarily from the publications of the Central bank of Nigeria (CBN) like the Satistical Bulletin, Bullions, Occasional Papers, Economic and Financial Review, Annual Report and Statistics. Also the IMF data base was also used as a data source.

4.2: Econometric Result

In the Annex we present the results of Unit Root test, Cointegration test, Granger´s causality test and correlation matrix. These test are interesting but they should be interpreted with flexibility having into account the analyses in this regard by Guisan(2001) and (2003).

The highest positive correlation of RGDP is with EXR (0.8622) followeg by INT (0.4776). GDI shows negative correlation with all

the variables, particularly with RGDP (-0.5820) and with EXR (-0.5504).

The following table shows the relationships with empirical evidence favorable to the acceptance of the causality relationships, accordingly to the Granger´s test, at a 10% level of significance (probability column) or below.

Sample: 1970 – 2004. Lags: 1			
Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
EXR does not Granger Cause RGDP	34	5.17677	0.02996
RGDP does not Granger Cause EXR		3.46349	0.07225
RGDP does not Granger Cause FDI		15.2873	0.00047
EXR does not Granger Cause FDI		6.05549	0.01963

4.2.5: Error Correction Model

The most important aspect of this study is the analysis of the short run model of equation (1), which represents dynamic error correction representations of the series. The unrestricted over-parameterized equations with an inclusion of one-lag error correction term are shown in Table 4.6 in the Annex. From the over-parameterized model, which usually deals with problems of mis-specification, the parsimonious model is derived through stepwise reduction of relatively insignificant parameters until parsimony is obtained (Alaba, 2003). The results of the parsimony are shown in Table 4.7.

The main results of interest are the co-efficients of the error correction variable (ECM), in the parsimonious error correction model. The table shows that the coefficient of the ECM is significant with the appropriate (negative) sign (see Table 4.7). It shows that 73 per cent disequilibrium in real inward FDI in the previous year is corrected in the current year. The strong significance of the ECM is an indication of the existence of a long run equilibrium relationship between real inward FDI and the factors affecting it (Adebiyi, 2002).

TABLE 4.7: Parsimonious Error Correction Model

Dependent Variable: ΔFDI
Method: Least Squares
Sample (adjusted): 1972 – 2004
Included observations: 33 after adjusting endpoints

Variable	**Coefficient**	**Std. Error**	**T-statistic**	**Prob.**
ΔINTRT	108.7860	43.2081	2.5177	0.0176
ΔEXCHRTVOL	-649.7253	447.3299	-1.4525	0.1571
ECM_1	-0.9544	0.1699	-5.6177	0.0000
C	-199.1860	184.8813	-1.0774	0.2902
R–Squared	0.6254	Adjusted R–Squared	0.5866	
Durbin–Watson Stat	2.2121	Schwarz criterion	17.0614	
F–Statistic	16.1382	Prob. (F–Statistic)	0.0000	

4.2.6: Interpretation of Regression Results

From the over-parameterized regression results (equation 1), it can be seen that previous real inward FDI had negative effect on current real inward FDI. ΔFDI_1 has the coefficient of -0.5086 while Δ FDI_2 has the coefficient of -0.1754. Also, the relationship between exchange rate and real inward FDI is negative for ΔEXR_1 (-38.3339) while it is positive for ΔEXR_2 (130.7812). In accordance to a priori expectations real GDP has a positive impact on real inward FDI which is depicted by the co-efficient of ΔRGDP (0.003). On the other hand, contrary to a priori expectation, the coefficients of interest rate in all the periods are positively signed. ΔINT, ΔINT_1 and ΔINT_2 have the coefficients 129.9960, 135.3040 and 43.6721 respectively.

Exchange rate volatility's coefficients are also positively signed in all the periods. ΔEXRV, ΔEXRV_1 and ΔEXRV_2 have the coefficients 2883.154, 5090.991 and 376.8614 respectively. Also,

the constant term also known as the intercept of the equation has a negative sign. This implies that at the point where all the explanatory variables assume the value of zero, real inward FDI will be negative (- 430. 2581). In other words, where all the explanatory variables assume the value of zero, there will be real outward FDI.

Real inward FDI in the first and the second lag showed negative relationship with current real inward FDI, even though it was only significant in the first lag. This is depicted by the coefficients of ΔFDI_1 and ΔFDI_2 which are -0.5086 and -0.1754 respectively. This may be due to the loss of investor's confidence in the country owing to numerous factors, such as macroeconomic and political instability.

Exchange rate in the second lag showed a significant positive relationship with real inward FDI. This is revealed by the coefficient of ΔEXR_2 which is 130.7812. This shows that real inward FDI does not respond to change in exchange rate immediately, but until after two years. The implication of this is that, real inward FDI in Nigeria increases with depreciation in exchange rate.

Another determinant of real inward FDI in Nigeria is interest rate. They have positive relationship with real inward FDI in all the periods examined. The current interest rate and the interest rate in the first lag are highly significant both in the over parameterized and the parsimonious model. Their coefficients in the over parameterized are 129.996 and 135.3040 respectively. This shows the great relevance of this variable to the Nigerian economy. Though the sign is contrary to a priori expectation, it is not surprising. This is because the data used as real inward FDI is private capital inflow which includes both inward FDI and portfolio capital. A priori, it is expected that high interest rate leads to foreign capital inflow into a country as foreign investors will like to take advantage of high returns on capital.

The independent variable which is the main focus of this research work, exchange rate volatility, is significant only in the first lag and it has a positive relationship with real inward FDI in the over parameterized model whereas, it has a negative relationship in the parsimonious model (see Table 4.6 and Table 4.7). This is a conflicting result and it goes further to confirm the

lingering controversy in literature on the effect of exchange rate volatility on FDI.

Real GDP, though highly insignificant has a positive relationship with real inward FDI. This is depicted by the coefficient of ΔRGDP which is 0.0026. The insignificance of real GDP might be due to the fact that the real GDP in Nigeria is not a true proxy of the size of the domestic market. Low demand occasioned by rising unemployment experienced in the country as well as trade liberalization may be construed by foreign investors as shrinking domestic market if production is not for export.

Lastly, the coefficient of the error correction model is highly significant with the appropriate sign at -0.95. This demonstrates the importance of all the variables, especially the interest rate in explaining real inward FDI into Nigeria. It is an indication of the existence of a long-run equilibrium relationship between real inward FDI and the variables that influence its short term movements which were used in the model. Thus, real inward foreign direct investment, exchange rate, exchange rate volatility, interest rate and real gross domestic product are cointegrated.

From the estimation in equation 2, the constant term, otherwise known as the intercept of the equation is positively signed. This implies that at the point where all the explanatory variables are zero, real inward FDI will be equal to β_0 (2365.7). The coefficient of exchange rate volatility is negatively signed, showing that the higher the exchange rate volatility the lower the real inward FDI. So, a one percent increase in exchange rate volatility will lead to 453.559 per cent decrease in real inward FDI. The dummy variable has a negative coefficient. This contradicts the apriori expectation and it shows that SAP did not actually bring about any real increase in inward FDI as popularly believed. This might not be unconnected to the fact that the nominal inward FDI has been taken into consideration, thereby giving a false impression as a result of the high nominal value of inward FDI after SAP. Another reason might be due to the high volatility of exchange rate brought about by the deregulation regime under SAP.

Exchange rate volatility shows a negative relationship with real inward FDI which negates the sign in the over-parameterized

model. This further confirms the controversy in literature concerning the impact of exchange rate volatility on FDI. The negative sign of the coefficient SAP shows that SAP did not actually bring about any increase in real inward FDI as popularly believed. This might not be unconnected to the fact that the nominal inward FDI has been taken into consideration, thereby giving a false impression as a result of the high nominal value of inward FDI after SAP. Another reason might be due to the high volatility of exchange rate brought about by the deregulation regime under SAP.

5.1: Summary of Findings

The examined the direction and the magnitude of real inward FDI and exchange rate movement and its volatility from 1970 to 2004. The results show that the impact of exchange rate on real inward FDI is positive. This implies that the depreciation of the naira leads to increase in real inward FDI. This result, however, was in line with the result agrees with those of Gorg and Wakelin (2001), Froot and Stein (1991), and Blonigen (1997). On the other hand, the impact of exchange rate volatility on real inward FDI gives a divergent result, while it was positive in the over-parameterized model, it was negative in the parsimonious model. Also, of all the other variables included in the model namely interest rate, real gross domestic product and SAP dummy, the result from the SAP dummy showed a negative impact while others were positive. Additionally, only interest rate had a highly significant impact on real inward FDI. Bearing these results, the Nigerian government and/or the Central Bank of Nigeria, now has a major challenge of helping the economy through her polices to attain a stable and realistic exchange rate that will boost domestic production, increase real inward FDI and maintain internal and external balance.

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Annex on line at the journal Website: http://www.usc.es/economet/ijaeqs.htm

Annex

4.2.1: Unit Root Test

The results of the Augmented Dickey Fuller (ADF) class of unit root test are shown in Table 4.1. A test of the time series properties of the data shows that all but one of the variables has unit roots. These findings suggest that the variables are 1(1) variables, as confirmed by a test on the difference of the variables except exchange rate volatility which is 1(0) variable. That is, Autoregressive Distributed Lag (ADL) functions of the variables are 1(1) series while only one of them exhibits 1(0) series. This is done to assess the possibility of cointegration in the data and to ensure consistency in subsequent stationary econometric modeling. However, when the variables are of order (1), it implies that the variables are non-stationary.

Table 4.1: Unit Root Test on Annual Time Series Data on Variables (1970 – 2004)

Variables	At level	1st difference	Order of Integration
FDI	- 2.08	- 6.39*	1 (1)
EXR	- 0.57	- 4.04**	1 (1)
INT	- 2.17	- 6.23*	1 (1)
RGDP	- 0.77	-3.46***	1 (1)
SAPdum	0.00	- 3.87*	1 (1)
EXCHRTVOL	-3.65*		1 (0)

*, **, ***Significant at 1%, 5% and 10% level respectively.

Critical value:

1%	is – 3.65	1% is – 4.27	1% is – 2.64
5%	is – 2.96	5% is – 3.56	5% is – 1.95
10%	is – 2.62	10% is – 3.21	10% is – 1.62

Intercept: FDI SAPdum Trend and Intercept: EXR, INT, RGDP None: EXRV,

4.2.2: Co-integration Test

Applying Ordinary Least Square (OLS) to estimate equation 1 yields the long run regression results reported in Table 4.2. A dynamic modeling using the variables at their levels such as the partial adjustment model would result in spurious regression as it is confirmed by the test in the static regression shown in Table 4.2. The table indicates DW statistics of 1.87 at 5% and a low adjusted R^2 in static regression does not indicate the existence of non-cointegration. In testing for cointegration, we take the residuals from the static regressions as valid error correction terms if they are stationary and hence, conclude that the variables are cointegrated (Adebiyi, 2002). Table 4.3 shows that there is no unit root in the residuals. Thus, the variables are all cointegrated.

Table 4.2 Results of Static Regression of Equation
Dependent Variable: Foreign Direct Investment (FDI)

Variables	**Coefficient**	**Std Error**	**T-statistic**	**Prob.**
EXR	- 4.68	9.89	- 0.47	0.64
EXRV	- 444.98	748.94	- 0.59	0.56
RGDP	- 0.04	0.02	- 2.15	0.04
INT	67.19	30.73	2.19	0.04
C	5128.92	1562.84	3.28	0.00
R–Squared			0.44	
Adjusted R–Squared			0.37	
Durbin–Watson Stat			1.87	
Schwarz criterion			17.38	
F–Statistic			5.74	
Prob (F–Statistic)			0.00	

Table 4.3: Residual Stationary Test

Variable	ADF Max. Lag = 1	*Order*
ECM	- 3.61	*1 (0)*
Note:	*Significant at 5% Level Critical Value at 5% is – 2.96*	

4.2.3: Pair-wise Granger Causality Test

Pair-wise Granger Causality Test between real inward foreign direct investment, exchange rate, exchange rate volatility, interest rate, and GDP at 5 per cent level of significance is shown in Table 4.4. The table reveals that exchange rate Granger causes GDP. It further shows that GDP Granger cause real inward FDI and exchange rate Granger cause real inward FDI. Other causality result can be viewed from the table.

Table 4.4: Pairwise Granger Causality Tests

Sample: 1970 – 2004			
Lags: 1			
Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
EXR does not Granger Cause RGDP	34	5.17677	0.02996
RGDP does not Granger Cause EXR		3.46349	0.07225
EXRV does not Granger Cause RGDP	33	0.06266	0.80405
RGDP does not Granger Cause EXRV		0.32776	0.57124
FDI does not Granger Cause RGDP	34	0.00154	0.96891
RGDP does not Granger Cause FDI		15.2873	0.00047
INT does not Granger Cause RGDP	34	1.42691	0.24133
RGDP does not Granger Cause INT		0.07857	0.78111
EXRV does not Granger Cause EXR	33	0.00097	0.97541
EXR does not Granger Cause EXRV		0.10587	0.74716
FDI does not Granger Cause EXR	34	0.39067	0.53652
EXR does not Granger Cause FDI		6.05549	0.01963
INT does not Granger Cause EXR	34	0.38335	0.54034
EXR does not Granger Cause INT		0.01824	0.89344
FDI does not Granger Cause EXRV	33	0.09182	0.76397
EXRV does not Granger Cause FDI		0.00045	0.98329
INT does not Granger Cause EXRV	33	0.02451	0.87665
EXRV does not Granger Cause INT		0.02493	0.87560
INT does not Granger Cause FDI	34	0.92208	0.34436
FDI does not Granger Cause INT		1.50990	0.22840

4.2.4: Correlation Matrix

The correlation matrix is shown in Table 4.5. In this table, the entries on the main diagonal (those running from the upper left-hand corner to the lower right-hand corner) give the correlation of one variable with itself, which is always 1 by definition, and the entries off the main diagonal, are the pair-wise correlations among the variables.

TABLE 4.5: Correlation Matrix

	INT	**RGDP**	**FDI**	**EXRV**	**EXR**
INT	1.0000	0.4776	-0.0160	0.1452	0.3988
RGDP	0.4776	1.0000	-0.5820	0.1021	0.8622
FDI	-0.0160	-0.5820	1.0000	-0.1261	-0.5504
EXRV	0.1452	0.1021	-0.1261	1.0000	0.2038
EXR	0.3988	0.8622	-0.5504	0.2038	1.0000

The first row of this table gives the correlation of interest rate with itself and other variables. For example, 0.477656 is the correlation between interest rate and real GDP while -0.016028 is the correlation between interest rate and real inward foreign direct investment, and so on. The table indicates that real inward FDI has a negative relationship with all the other variables – interest rate, real GDP, exchange rate volatility and exchange rate.

Recall that in table 4.4, we observed that exchange rate Granger causes real GDP. This combined with the findings in table 4.5, implies that that increase (or depreciation) in exchange rate increases real GDP. We also observe that there is a high positive correlation between exchange rate and real GDP (0.862287). This implies that increase (or depreciation) in exchange rate by one percentage point will increase real GDP by about 86 per cent. Also, based on table 4.4 which shows that exchange rate Granger causes real inward FDI and the findings in table 4.5, we can infer that increase (or depreciation) in exchange rate decreases real inward FDI (- 0.550489). This implies that increase (or depreciation) in exchange rate by one percentage point will reduce real inward FDI by about 55 per cent.

TABLE 4.6: Overparameterized Error Correction Model
Dependent Variable: ΔFDI Method: Least Squares Sample (adjusted): 1974 – 2004 Included observations: 31 after adjusting endpoints

Variable	**Coefficient**	**Std. Error**	**T-statistic**	**Prob.**
ΔFDI_1	-0.5086	0.2554	-1.9915	0.0627
ΔFDI_2	-0.1754	0.1957	-0.8962	0.3827
ΔEXR	-81.7879	56.4197	-1.4496	0.1654
ΔEXR_1	-38.3339	72.8826	-0.5260	0.6057
ΔEXR_2	130.7812	58.8286	2.2231	0.0401
ΔRGDP	0.0026	0.0306	0.0857	0.9327
ΔINT	129.9960	47.1478	2.7572	0.0135
ΔINT_1	135.3040	59.9448	2.2571	0.0374
ΔINT_2	43.6721	62.8591	0.6948	0.4966
ΔEXRV	2883.154	2243.502	1.2851	0.2160
ΔEXRV_1	5090.991	2168.045	2.3482	0.0312
ΔEXRV_2	376.8614	567.2672	0.6643	0.5154
ECM_1	-0.7251	0.2793	-2.5960	0.0188
C	-430.2581	231.5881	-1.8579	0.0806
Notes:R–Squared 0.6392		0.7955Adjusted R–Squared		
Durbin–Watson Stat 17.6408		2.3800	Schwarz criterion	
F–Statistic 0.0012		5.0884	Prob. (F–Statistic)	