CHAPTER ONE

INTRODUCTION

1.1 Statement of the Problem

The general conclusion from the theoretical debates in the literature on exchange rate issues is that the choice of exchange rate regime has implication for economic performance. For instance, Mundel (1961) established that the choice of exchange rate regime has implication for the real sector, while the general argument of Obstifield and Rogoff (1995) is that exchange rate would be more volatile under a floating than fixed exchange rate regime with harmful effects on trade and economic activities.

The move from the Bretton Woods regime of fixed but adjustable exchange rates to the recent float had increased exchange rate volatility dramatically (Flood and Rose, 1995). The breakdown of the Bretton Woods system triggered exchange rate volatility relative to their fundamental determinants, such as import, export, money supply, income and price level. For instance, the volatility of the German mark viz-a-viz the US dollar was 14.2% on average between 1973 and 1992, while during the Bretton Woods system it was 0.7%. Globally, comparing the exchange rate volatility in pre Bretton Woods's regime to that of post Bretton Woods's regime; volatility has increased six folds (Hallwood and MacDonanld, 2000). The Bretton Woods system was a period of fixed but adjustable exchange rate; hence, less exchange rate volatility was experienced compared to the flexible exchange rate regime in the post Bretton Woods's system. Engel and Hakkio (1993) pointed out that high exchange rate volatility can have important adverse consequences for investors[1]. For instance, if investors equate volatility with risk, they may alter their investment decisions. Hence, long term capital flows may be reduced thereby retarding the efficient inflow of capital to the nation's economy.

[1] A risk averse investor would reduce the level of investment during high exchange rate volatility

Exchange rate volatility started to become a great concern in Nigeria after the introduction of the Structural Adjustment Programme (SAP) in 1986. A major component of SAP was the adoption of floating exchange rate policy[2], and it aggravated the volatility that has been associated with the value of the Naira. Also, asymmetry and uncertainty associated with the floating exchange rate regime of the economic reform programme and the existence of the parallel market increased the degree of stochastic behaviour of exchange rate in the country. Preliminary investigation in this thesis using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) indicated that the volatility of the Naira viz-a-viz US dollar was 25% between 1986 and 2012, while it was 2% in the decade preceding SAP. These indicate that exchange rate was highly volatile during and after SAP compare to the pre-SAP era. The recent increased in exchange rate volatility has largely increased the risk associated with foreign exchange transactions and trade flows by firms. The highly volatile exchange rates have become a serious concern to firms and pose policy management challenge to government.

A large number of firms in Nigeria sourced their raw materials, equipments and machineries from abroad; hence they are highly vulnerable to the risk associated with exchange rate movements. For instance, suppose a Nigeria firm wish to purchase some commodities from the U.S. with payment due after two months. If the Naira unexpectedly depreciates relative to the U.S. dollars; the Naira value of the purchase contract rises. This change imposes an additional higher cost on the importing firm, making its profit lower than anticipated.

Exchange rate volatility emanates from both the demand and supply sides of the economy. The demand for foreign exchange has been on increase in the last two decades as a result of factors namely, excessive importation of semi-finished and finished products, dependence of the industrial sector on imported raw materials and other inputs, capital flow reversals by portfolio investors[3] and high speculative demand causing uncertainty in the foreign exchange market (CBN report, August 2012). Thus, the inability to locally source the required inputs in the domestic economy exerts pressure on the foreign exchange. The

[2] During SAP, the exchange rate system was not clean floating but dirty floating.
[3] Most of the operators of multinational firms in Nigeria repatriate fund to their parent companies thereby involving actively in foreign exchange transactions, this in turn triggers greater exchange rate uncertainty.

supply side is associated with the decline in foreign exchange reserve. Nigerian government generates its foreign reserve mostly from crude oil exports; recently, crude oil output has been severely affected by increasing theft and instability in the Niger-Delta[4]. This reduces the supply of foreign exchange in the foreign exchange market[5]. The low level of foreign exchange reserve induces free movement of exchange rate. Thus, the increased foreign exchange demand in the face of unstable supply leads to exchange rate volatility.

Moreover, there is a wide gap between earnings from exports and the cost associated with imports by firms in Nigeria thereby creating a substantial foreign exchange loss in their financial account. For instance, in 2009, foreign exchange loss recorded by Unilever Plc[6] was ₦368 million, consequently Mobil oil Nigeria Plc[7] recorded a loss of ₦39 million due to fluctuation of exchange rate in 2011 (Mobil Oil Plc, annual report and account, 2012). The substantial reliance on imported inputs from abroad increases exchange rate volatility which in turn affect firms' investment and production processes.

Several efforts have been made by the Nigerian government to attract investment by multinational companies in the country in order to boost productivity, but little achievement has been recorded over the years. Much of these difficulties encountered by firms have been attributed to the stochastic behaviour of exchange rate and the poor investment climate in the country. These have increased the importation of capital goods with high demand for foreign exchange (CBN report, 2012).

The deregulation policies adopted by Nigerian government led to the floating exchange rate regime in 1986; this later changed to a pegged arrangement between 1995 and 1998. Available evidence from companies' financial reports show that most of the listed firms in Nigeria witnessed decline turnover in some of the years after the deregulation of the exchange rate. For instance, PS Mandrides, (a major firm operating in the food and beverage industry) recorded a decline in turnover from ₦277million in 1998 to ₦171million in 2000 (PS Mandrides financial report, 2000).

[4] The region where crude oil is explore in Nigeria
[5] The Nigerian Finance Minister stated in New on 15th August, 2013 that 400,000 barrels of crude oil are lost on daily basis to oil theft, vandalism and production shut-down
[6] Source from Unilever annual report and statement of account 2009
[7] A major player in Nigeria oil industry

Hence, the research questions of this thesis, given the problems highlighted are: what is the effect of exchange rate volatility on firms' investment in Nigeria? What is the impact of exchange rate volatility on the outputs of firms? What is the effect of exchange rate volatility on exports of firms? In addition, the analysis of the relationships between exchange rate volatility and firm-level economic activities in this study seek to determine whether sectoral characteristics affect the vulnerability of firms to exchange rate volatility.

1.2 Objective of the Study

The broad objective of this thesis is to examine the effect of exchange rate volatility on the economic activities of listed firms in Nigeria. The specific objectives are three folds, namely, to:

(i) examine the effect of exchange rate volatility on investment of listed firms in Nigeria;
(ii) investigate the effect of exchange rate volatility on output of listed firms;
(iii) determine the effect of exchange rate volatility on export of listed firms.

1.3 Justification for the Thesis

This study is different from previous study in several ways. First, earlier studies in Nigeria fail to examine the effect of exchange rate volatility on firm-level economic activities. Essentially, an adequate knowledge of the effect of exchange rate volatility on firms' performance is necessary in making an important decision such as the quantity of input to be imported and the volume of goods to be exported. Although several studies have been conducted using aggregate data, how exchange rate affects economic activities at the micro level could be widely different from macro level.

Second, the growth of firm's productivity and advancement has been the most important element in the successful transformation of most economies that have been seen to sustain rises in their per capita incomes, for instance, the NICs (Newly Industralized Countries) and their success in exporting manufactures. In most African economies, performance in this area has been very poor over the last two decades. Nigeria has only 5 percent of its GDP coming from manufacturing which is low among the countries of Africa compare to 20

percent levels for South Africa and 24 percent for Mauritius (UNIDO, 2011). A special attention on the performances of firms operating in the manufacturing is essential, stems from the belief that the sector is a potential engine of productivity, source of technological advancement and creator of skilled employment. A poor performance of this sector would retard aggregate growth and economic development in the country.

Third, most of the firms listed on the Nigerian Stock Exchange (NSE) market involve actively in foreign exchange transactions, apart from the fact that some of them are multinationals that engaged in the repatriation of funds, some export their products to other countries. Also, some of the firms rely mostly on imported raw materials and capital for production. Exchange rate volatility affects investment and output of such firms. An appreciation of exchange rate tends to slow down growth by making imported goods less expensive, increases the demand for foreign products and a reduction in domestic production. A depreciation of the domestic currency may stimulate economic activities through an initial increase in the price of foreign goods relative to home goods; as a result, increases international competitiveness of domestic industries. Exchange rate depreciation diverts spending from foreign goods to domestic goods, hence increases the capacity to produce of domestic firms.

Fourth, this study builds on neo-classical theory of the firm[8] to explicitly provide a value chain impact of exchange rate volatility on firms' economic activities. The transmission of exchange rate volatility through prices of import and export to other firms' economic activities would be considered. Existing theoretical model of exchange rate has shown a direct link of its effect on investment without providing a detail explanation on how it affects firms' output and export.

Fifth, this thesis contributes to the methodological literature in diverse ways. David *et al* (2010) used OLS based pooled regression model to examine the effect of exchange rate uncertainty on firms' decisions on export market entry and export intensity, however, the methodology could not account for industry heterogeneity, which, thus generated bias inferences. Other related studies used static regression (see for instance, Fuentes 2006;

[8] The thesis build on the extension made by Campa and Goldberg (1999)

Miguel and Pablo 2009; Mahagonka *et al* (2009) that could result to endogeniety problem when estimating system of equations. The system GMM adopted in this study is an improvement over the deficiencies of existing methodologies, as it takes care of consistency, heterogeneity and endogeniety and regains robust efficiency. Also, the consistency of the methodologies is enhanced in this study by adjusting the model's instruments to accommodate features that are peculiar to firms in Nigeria. This process will give more insight on the differential response of firms to exchange rate volatility.

Lastly, effect of exchange rate volatility on firm-level performance in developed countries is well documented. However, very little attention has been given to its effects on firm-level economic activities in Nigeria. Thus, the findings of this inquiry contribute to the existing empirical literature on the subject matter. Moreover, persistent decline in firms' turnover, investment and export have become worrisome to mangers, shareholders and other stakeholders; with the fear that the decrease in turnover and decline export volume may intensify in the future. Adequate knowledge of the role of exchange rate volatility and its implication on firms' performance will be immensely valuable to firms' management and government.

1.4 Scope of the Research

This study examines the relationship between exchange rate volatility and firms' economic activities. It focused on the non-financial firms listed on the Nigeria's Stock Exchange (NSE) categorized under various industries, namely, food products, beverages, conglomerates, health, household durables, industrial goods, agriculture, oil and gas, printing and publishing, automobile and tyres. Data from the annual reports of the various companies with particular respect to turnover, investment, export, number of employees, profit, cost of goods sold, value added and various international commitments of these companies are gathered. Although the exchange control was aborted after 1986, the study utilized annual data covering 1990 to 2012 since most of the annual reports of listed companies were made available in the Nigeria Stock Exchange (NSE) from 1990.

1.5 Organization of the Study

The rest of the thesis is organized into five chapters. Background to the study is presented in chapter two. Here, trends in exchange rate management are discussed. In addition, trends in output, investment and export of the listed companies are reported. Chapter three contains the literature review. The theoretical framework, methodology and sources of data are presented in chapter four. In chapter five, data analysis and interpretation are conducted. Chapter six contains the summary of the major findings and policy implications along with the suggestions for further research.

CHAPTER TWO

EXCHANGE RATE POLICES, VOLATILITY AND FIRMS' ECONOMIC ACTIVITIES IN NIGERIA

2.1 Introduction

Exchange rate policies in Nigeria have undergone several reforms since the enactment of the Exchange Control Act in 1962. It shifted from a fixed exchange rate regime in the 1960s to a pegged arrangement between 1970s and 1980s, and various episodes of floating regimes since 1986 following the adoption of Structural Adjustment Programme (SAP). The exchange rate policy adopted under the SAP was managed float system; which involves putting exchange rates within a range without defending a particular parity. Evolution of exchange rates through various regimes is not peculiar to naira as many countries also experienced similar reforms since the breakdown of the Bretton Woods system in 1973.

Before the political independence in 1960, more than 25 percent of the firms registered in Nigeria were owned by foreigners. Consequently in 1963, 70 percent of investment in the manufacturing sector was from foreign sources (Ohiorhenuan, 1990). In order to improve the operations of firms, the Federal Government of Nigeria embarked on industrialization via import substitution strategy. The manufacturing sector initially responded to the new policy but with foreign exchange and import licensing controls introduced in 1971, the progress was halted (UNCTAD, 2009).

The indigenization policy introduced in 1972 was part of the Second National Development Plan. This policy made it vital for the government to acquire by law a greater proportion of the productive assets of the economy. Accordingly, restrictions were imposed on the activities of foreign investors and greater incentives were given to local investors. The

number of activities reserved exclusively for Nigerians was expanded to include a wide range of basic manufactures. In addition, foreign firms were obliged to enter into joint ventures with local investors (UNCTAD, 2009). Some firms, namely International Business Machines (IBM), Chase, Manhattan Bank and Citigroup were unable to continue their operations in the country due to the indigenization policy. In 1974, following the third National Development Plan, exchange controls were reduced and restrictions were lifted on import payments. Towards the end of the 1970s, the Federal Government provided additional incentives for industrialization. These incentives increased output of the manufacturing firms by creating an enabling environment for investors.

The growth and performance of firms in Nigeria in the past decade have deteriorated beyond the rate at which they grew in the past three decades. A report by the Manufacturers Association of Nigeria (MAN) in 2009 indicated that 820 firms had closed down in the past 10 years. The high exit rate was attributed to tough operating environment, unstable electricity, high interest rate and exchange rates uncertainty (Sangosanya, 2011).

2.2 Overview of Exchange Rate Regimes in Nigeria

Exchange rates policies in Nigeria can be broadly classified to two distinct regimes; the fixed and flexible regimes. An appraisal of exchange rates policies in Nigeria will provide adequate insight into the extent of volatility associated with the different regimes.

2.2.1 Exchange Rate Regime Before SAP in Nigeria

The development of the foreign exchange market in Nigeria was influenced by a number of factors such as the changing pattern of international trade, institutional changes in the economy and structural shifts in production. Before the establishment of the Central Bank of Nigeria (CBN) in 1958 and the enactment of the Exchange Control Act of 1962, foreign exchange was earned by the private sector and held in balances abroad by commercial banks which acted as agents for local exporters. During this period, agricultural exports contributed to the bulk of foreign exchange receipts. The fact that the Nigerian pound was tied to the British pound sterling, with easy convertibility, delayed the development of an active foreign exchange market. Nigeria operated a fixed exchange rate regime supported by the Exchange Control Act. The fixed exchange rate regime induced an over-valuation of

the naira that engendered massive importation of finished goods with the adverse consequences for domestic production, balance of payments position and the nation's external reserves. In addition, the period was associated with sharp practices perpetrated by dealers and end-users of foreign exchange. However, with the establishment of the CBN and the subsequent centralization of foreign exchange authority in the CBN, the need to develop a local foreign exchange market became paramount (CBN Annual Report, 1965). During the Exchange Control arrangement, the naira was pegged to the British Pound Sterling, but as a result of the devaluation of the Pounds in 1967, the domestic currency was allowed to move freely independent of the Pound Sterling.

The exchange rate policy in Nigeria before 1973 was in line with the IMF fixed exchange rate system (Obadan, 2006). Nigerian currency was largely subjected to administrative management and control by the CBN. The movement in exchange rate was dictated by the U.S. dollars. On average, exchange rate volatility between 1963 and 1972 was 0.70%[9]. In 1973, Nigeria's Pound was changed to Naira, as at the time Naira was very strong in value[10]; it was also pegged to a basket of currencies comprising of the country's trading partners in 1978 (Obadan, 2006). Exchange rate volatility from 1978 to 1982, (under the pegged arrangement) was 0.19%[11]. Consequently, the CBN embarked on deliberate appreciation of naira to enable the economy source inputs cheaply from abroad mainly to implement the Import Substitution Industrialization (ISI) strategy and other development projects.

A sharp rise in the price of crude oil in the early 1970s led to a substantial increase in its exports which enhanced the official foreign exchange receipts. There was a boom in the foreign exchange market during this period and the management of foreign exchange reserve became necessary to guarantee the sustenance of the fixed exchange rate regime. However, it was not until 1982 that comprehensive exchange controls were applied as a result of the foreign exchange crisis that set in that year. The increased demand for foreign coupled with a decline in the supply encouraged the development of a flourishing parallel

[9] The period was a decade before the breakdown of Breton Woods system
[10] At the time Nigeria's Pound Sterling was changed to naira exchange rate was ₦0.66 to 1.00 U.S. dollar
[11] This value was computed by taking the standard deviation of the monthly exchange rate

market for foreign exchange (CBN Annual Report, 1985). After the oil glut of the early 1980s, it became evident that Nigeria cannot continue to operate a fixed exchange rate regime. Steps were taken by the CBN to embark on guided deregulation of the exchange rates. Figure 2.1 depicts the dynamics of exchange rate before SAP. Exchange rate movement was low between 1961 and 1971 due to the fixed arrangement, however, with the guided deregulation strategy, exchange rate dynamics increased from 1972 to 1985.

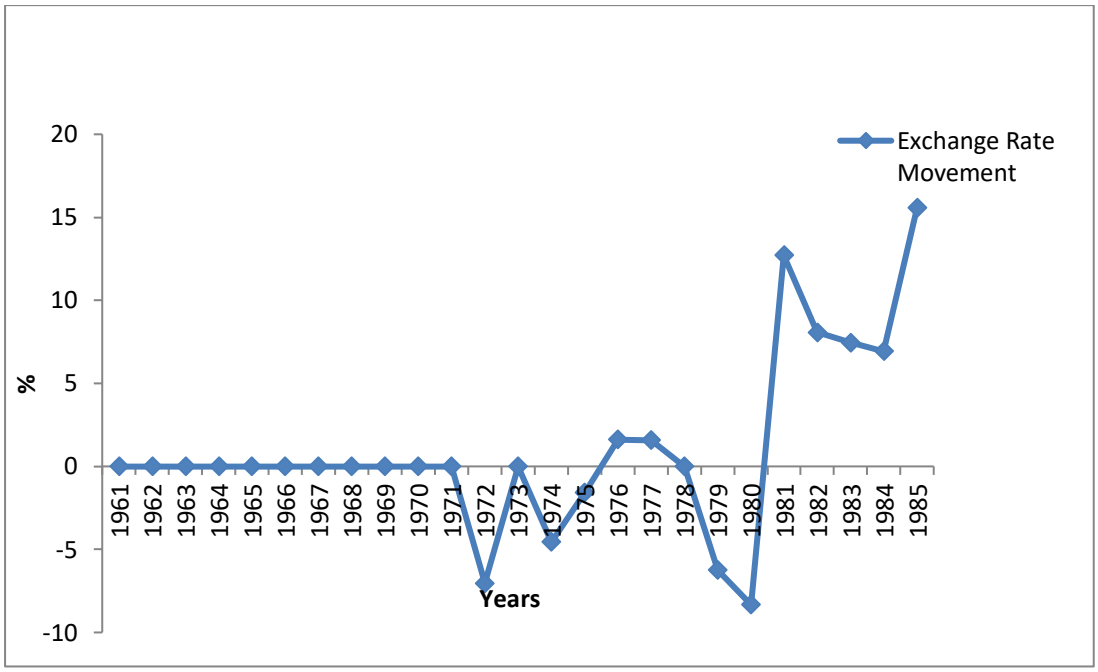

Fig. 2.1: Exchange Rate Dynamics Before SAP

2.2.2 Exchange Rate Regime During and After SAP

The two-tier[12] exchange rate system introduced in line with Structural Adjustment Programme (SAP) started in September 1986; one of the policies of the Federal Government during the SAP was to embark on a floating exchange rate system and establish structures and institutions for its operation and trading under a market determined environment (CBN, 1988). Under Second Tier Foreign Exchange Market (SFEM), the determination of the Naira exchange rate and allocation of foreign exchange were based within the framework of market auction system. The first and the second-tier market were merged on 2nd July, 1987 and was renamed Foreign Exchange Market (CBN report, 1988).

The SFEM was in operation with the official exchange rate system. The official was administratively managed and allowed to gradually depreciate. It was used for a few official and international transactions, such as debt servicing and obligations to international organization (Obadan, 2006). Accordingly, the dual exchange rates systems were operated to avoid a sizable depreciation of the naira but to allow it to depreciate in the SFEM while the CBN would continue a downward adjustment until the desirable convergence was reached.

Consequently, in the first quarter of 1987, the CBN adopted a policy of steady depreciation of the Naira exchange rate with the intention of reversing the observed overvaluation of the Naira. Yet the managerial efforts were not strong enough to wipe out the perceived overvaluation of the currency. Alongside with the introduction of Structural Adjustment Programme, new mechanisms were developed for exchange rate system. To enlarge the scope of the FEM, Bureau de Change was introduced in 1989 for dealing in privately sourced foreign exchange. The objectives of exchange rate policy under the SAP were to preserve the value of the domestic currency, maintain a favorable external reserves position and ensure external balance without compromising the need for internal balance and the overall goal of macroeconomic stability (Omojimite and Akpokodje, 2010).

Due to the depreciation of the exchange rates, some reforms were introduced in the Foreign Exchange Market in 1994. These included the formal pegging of the Naira exchange rate,

[12] First-tier and second-tier foreign exchange markets

the centralization of foreign exchange in the CBN, the restriction of Bureaux de Change to buy foreign exchange as agents of the CBN, the reaffirmation of the illegality of the parallel market and the discontinuation of open accounts and bills for collection as means of payments (CBN, 2000). The operation of the parallel market engendered greater volatility of the exchange rates; the volatility of naira viz a viz U.S. dollars between 1986 and 1995 was 25.1%. This shows that greater volatility of exchange rate was experienced during the SAP era.

Further reforms in the FEM led to its liberalization in 1995 with the introduction of an Autonomous Foreign Exchange Market (AFEM) for the sale of foreign exchange to end-users by the CBN through selected authorized dealers at market determined exchange rate. In addition, Bureau de Change was once more accorded the status of authorized buyers and sellers of foreign exchange. The FEM was further liberalized in October, 1999 with the introduction of an Inter-bank Foreign Exchange Market (IFEM). The IFEM was designed to diversify the supply of foreign exchange in the economy by encouraging the funding of the inter-bank operations from privately-earned foreign exchange. It was also aimed at assisting the naira to achieve a realistic exchange rate. Under IFEM, banks, oil companies, and the CBN could buy or sell their foreign exchange at government influenced rates. A large number of the informal economy, however, could only access foreign exchange through the parallel market. Companies were allowed to hold domiciliary accounts in private banks, and account holders had unfettered use of the funds. The operation of the IFEM, however, experienced similar problems and setbacks as the AFEM, owing to supply-side rigidities, the persistent expansionary fiscal operations of government and the attendant problem of persistent excess liquidity in the system (CBN annual report, 2002).

The Dutch Auction System (DAS) was re-introduced on 22nd July 2002 as a result of the intensification of the demand pressure in the FEM and the persistence depletion of external reserves. Under the DAS system, the CBN determined the amount of foreign exchange sold at the price buyers quoted. The marginal rate that cleared the market represented the ruling rate at the auction. The DAS was conceived as a two-way auction system in which both the CBN and authorized dealers would participate in the foreign exchange market to buy and sell foreign exchange (Omojimite and Akpokodje, 2010). In addition, DAS was to serve the

triple purposes of reducing the parallel market premium, conserve the dwindling external reserves and achieve a realistic exchange rate for the naira. The DAS helped to stabilize the naira exchange rate, reduce the widening premium, conserve external reserves, and minimize speculative tendencies of authorized dealers (Akpan and Ata, 2011).

The CBN, however, modified the exchange rate policy and announced the commencement of the Wholesale Dutch-Auction System (W-DAS) on February 20th, 2006 which lasted till the end of 2008. As a result of the reduction in the inflow of foreign exchange mainly due to a decrease in oil price and the incident of global financial crisis, the Naira witnessed a substantial depreciation. This led to the re-introduction of the Retail Dutch Auction System (R-DAS) in January, 2009. Exchange rate is one of the channels through which the recent global financial crisis affected Nigeria (CBN, 2012).

A critical appraisal of the exchange rate regimes in Nigeria clearly indicates that the severity exchange rate volatility was found under floating exchange rate regime, where to a large extent, cross country exchange rate was determined by the forces of demand and supply. The policy of the CBN after the SAP was to manage the rate of utilization and disbursement of exchange rates to the end users. Figure 2.2 shows the exchange rate dynamics during and after SAP. The liberalization of the foreign exchange market after SAP spurred exchange rate movement between 1986 and 1994; this was followed by a period of pegged arrangement from 1994 to 1998. The sharp spike in the exchange rate movement during 1998 and 2000 can be attributed to the sudden depreciation of the exchange rate after the pegged arrangement. The exchange rate was officially pegged at ₦21.89 to a dollar in 1994. However, due to the depletion of the external reserves, the CBN allowed the naira to depreciate afterwards. Also, excessive importation of finished goods and raw materials by industries occurred during the pegged period, thereby putting pressure on the foreign exchange. In 1999, exchange rate stood at ₦92.69 to a dollar. The mild fluctuation between 2001 and 2012 was because the monetary authority operated a managed float exchange rate system.

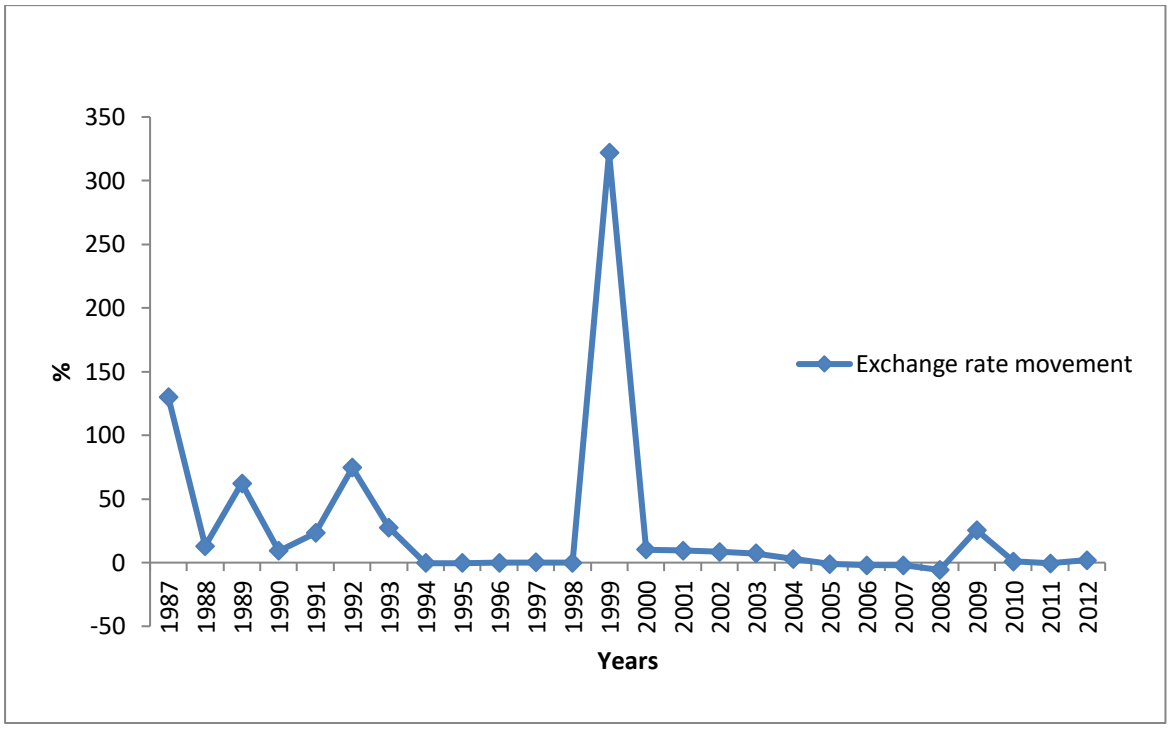

Fig 2.2: Exchange rate Dynamics During and After SAP

2.3 Nominal Exchange Rate and Real Exchange Rate Dynamics

Figure 2.4 depicts the relationship between nominal exchange rate (NER) and real exchange rate (RER). Several episodes of the simultaneous movement of the variables were observed during the period under study. Between 1990 and 1993, both nominal and real exchange rates moved in the same direction. However, from first quarter of 1994 to the last quarter in 1996, there were divergences in the movements of the two variables which could be attributed to the pegged of the nominal exchange rate but the real exchange rate fluctuated due to changes in the consumer price indexes. In 1998, the exchange rate was devalued by the Central Bank following the pegged arrangement. As a result of the devaluation of Naira, nominal exchange rate and the real exchange rate trends had high spike between 1998 and 2000. The CBN embarked on the devaluation to reduce the demand for foreign exchange and importation. The trends of the two variables were in opposite direction between 2008 and 2010, a period that was associated to the event of the global financial crisis. During these periods, the inflation rate contributed to the divergence movement of the two variables. Consequently, from 2010 to 2012, the NER and RER exhibited close relationship.

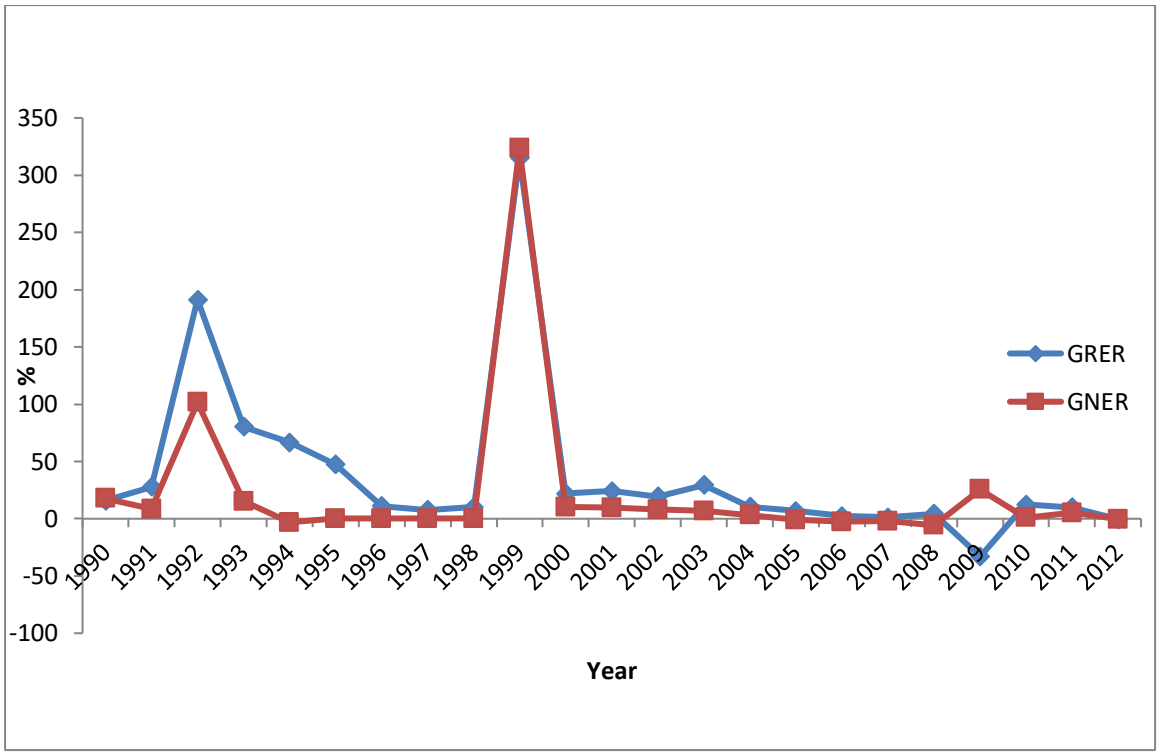

Fig 2.3: Trends in Nominal and Real Exchange Rates

2.4 Sectoral Utilization of Foreign Exchange

Table 2.1 shows the sectoral utilization of foreign exchange. The extent of foreign exchange utilization by firms in different sectors depends on their international commitment. Firms operating in the food products and industrial goods sub-sectors of the manufacturing in Nigeria involve more actively in importation of raw materials for production hence they demand for more foreign exchange compare with other sub-sectors. On average, foreign exchange utilization in the food product sub-sector from 2001 to 2005 was $6867.42 million. The levels of basic food importation accounted for the high amount of foreign exchange demand. In addition, the high population growth rate contributed immensely to the increase in the importation of food items (for example, rice and vegetable oil).

Available statistics from the CBN indicate that the industrial goods sub-sector recorded the highest amount of foreign exchange utilization in most of the years considered in this study. For instance, in 2000, industrial goods sub-sector operated with $3078.96 million where health care sub-sector utilized $207.15 million (See table 2.1). The degrees of foreign exchange utilization in the two sub-sectors were conditioned on the level of importation of basic raw materials and semi-finished products. In Nigeria, the industrial goods sub-sector required a large quantity of imported raw materials and intermediate inputs compare to the health care sub-sector; since the country is not well developed in its manufacturing and processing sector, major chemicals and components needed by industries are imported from abroad.

A close look at table 2.1 shows that foreign exchange utilization in the agricultural sub-sector was low in most of the years considered in this study. A plausible explanation for this is that the sector utilized primitive methods; hence most of the raw materials and equipments used in this sector were sourced locally. In addition, since the discovery of crude oil in Nigeria, little attention has been given to the commercialization of the agricultural sector; this has resulted to substantial reduction in the amount of foreign exchange utilization in the sector. For instance, in 2010, agricultural sub-sector utilized 309 million U.S. Dollars whereas the oil and gas sub-sector used 1496.75 U.S. Dollars for their international transactions.

Table 2.1: Foreign Exchange Utilization by Selected Sub-Sectors (U.S. Dollars Million)

Year	Food Product	Industrial Goods	Agriculture	Health Care	Printing and Publishing	Automobile and Tyres	Oil and Gas
2000	776.95	3078.96	194.21	207.15	172.40	150.16	NA
2001	1246.79	4388.22	185.00	198.63	98.23	193.37	NA
2002	1425.89	4149.12	178.30	114.94	95.82	188.47	NA
2002	1375.48	4836.84	106.80	126.25	59.36	367.98	NA
2004	1420.71	4841.19	121.29	147.41	48.23	408.10	NA
2005	1398.55	6928.11	116.24	157.48	49.74	525.69	NA
2006	1674.02	7814.93	169.79	176.54	56.85	404.16	NA
2007	751.25	9454.97	209.37	161.99	73.31	792.30	NA
2008	3944.50	10552.5	364.04	170.58	714.2	810.25	6473.14
2009	3433.80	7378.08	271.722	432.27	192.73	851.50	1232.78
2010	4372.30	6165.12	309.42	927.5	157.91	745.20	1496.75
2011	3903.05	6771.6	290.57	679.89	175.3	798.35	NA
2012	4137.68	6468.36	299.99	803.7	166.61	771.78	NA

Source: CBN Statistical Bulletin, Various Issues

2.5 Capacity Utilization in the Manufacturing Sector

The rate of capacity utilization in food product sub-sector from 1990 to 1995 was on average of 37.71%. Factors such as unstable power supply, poor infrastructural facilities and political instability contributed to the low level of capacity utilization recorded. During the same period, the extent of capacity utilization in the oil and gas sub-sector was at the highest with an average of 44.98%. The structure of Nigerian economy and strong investors' attraction strategies resulted to the degree of capacity utilization in the oil and gas sub-sector. Agricultural sub-sector recorded the highest capacity utilization rate between 2005 and 2011 (see table 2.2). Several activities of the federal government to improve productivity in the agricultural sub-sector led to increase in capacity utilization in the sector. On average, the printing and publishing sub-sector recorded relatively high capacity utilization from 2000 to 2012 due to the fact that operators in the industry are very sensitive to the business environment and utilize their potentials to achieve desirable outcome for their companies.

Table 2.2: Average Capacity Utilization of Firms in Nigeria by Sub-sectors (%)

Year	Food Product	Agric	Beverages	Printing and Publishing	Industrial Goods	Household Durable	Health Care	Automobile and Tyres	Oil and Gas	Packaging and Containers
1990	40.23	24.55	43.10	44.20	60.50	34.00	44.10	42.55	49.40	28.75
1991	54.47	35.30	50.50	54.50	38.60	30.10	45.60	19.6	41.50	32.30
1992	39.40	24.90	35.40	35.00	32.00	44.50	34.90	27.15	53.20	25.20
1993	48.07	43.90	51.10	50.60	40.90	48.05	55.00	47.05	65.70	45.60
1994	25.40	34.05	32.37	28.40	27.30	27.90	35.60	31.25	30.70	30.40
1995	18.70	26.55	36.70	37.80	31.70	33.40	39.90	35.10	29.40	33.00
1996	26.85	30.85	40.45	43.80	38.50	38.50	36.40	51.00	32.10	30.40
1997	17.75	22.70	34.70	40.80	39.10	39.10	35.10	73.90	37.70	40.50
1998	26.97	25.80	42.55	32.60	40.30	40.30	16.60	30.30	43.60	32.00
1999	28.50	27.65	35.07	35.30	43.40	41.30	36.10	36.45	41.00	41.00
2000	33.43	30.00	37.33	38.00	47.00	43.40	38.60	36.85	46.80	42.30
2001	45.03	45.30	47.40	45.60	51.80	49.20	40.80	37.10	47.60	44.90
2002	45.30	48.75	0.35	47.40	67.50	36.60	39.20	35.60	54.40	48.30
2003	41.80	57.47	49.08	45.80	44.10	33.68	44.38	31.21	50.02	62.25
2004	43.96	58.25	51.09	48.21	46.81	32.80	43.62	22.76	51.27	60.13
2005	54.67	76.00	50.50	53.00	68.00	35.00	68.00	75.00	30.00	80.00
2006	39.01	51.20	46.25	47.75	49.25	54.00	51.88	40.00	90.50	51.00
2007	65.00	60.50	65.00	64.00	58.63	32.00	61.00	68.00	82.00	65.50
2008	52.96	55.00	51.17	51.75	40.00	60.25	32.00	16.25	20.25	56.25
2009	48.20	62.19	65.09	44.82	61.88	53.28	46.83	46.83	51.13	64.08
2010	50.58	58.60	58.13	48.29	50.94	56.77	39.42	31.54	35.69	60.17
2011	49.39	60.40	61.61	46.54	56.41	55.03	43.13	39.19	43.41	62.13
2012	9.98	59.50	59.87	47.42	53.68	55.90	41.28	35.37	39.55	61.15

Source: Computed by the author, data were obtained from CBN bulletin

2.6 Characteristics and Performance of Firms in Nigeria

Most of the firms listed on the NSE witnessed tremendous growth in their turnover[13] in the 1990s due to a substantial improvement in the supply of inputs and favorable business climate. Also, a peaceful transition from military to civilian administration in 1999 increased investors' confidence in the economy. The turnovers of listed firms' during 1990s are shown in Table 2.4. In addition, during the same period the weighted average capacity utilization rate of firms rose from 30.3% in 1996 to 34.3% in 1999 (NSE Fact Book, 2001). However, the total cost of operation among listed firms also increased by 14.2% on average between 1996 and 1999 due to the high costs of imported raw materials. The value of imported raw materials rose significantly by 34.7% and accounted for about 47.5% of the total value of raw materials used while the value of locally sourced raw materials, accounting for 52.5% of total, increased by 5.8% (Companies financial statement, 2004). Some of the sub-sectors namely; food products, industrial goods and oil and gas experienced substantial declined in their turnover in the early period of 2000. This was as a result of increased cost of imported inputs needed for production. Depreciation of Naira contributed to the high cost of imported raw materials in this period (CBN, 2006). The impact of the financial crisis on the stock market operation and performances reduced the turnover of most firms between 2009 and 2011. For instance, average turnover growth in the food product sub-sector fell from 22.32% in 2007 to 13.30% in 2010

2.6.1 Average Output Growth of Listed Firms by Sub-sector, 1991-2012

Table 2.3 shows the output growth of firms listed on the NSE by sectoral classification. The growth of output in the food product sub-sector was low between 1991 and 1995 compared to the manufacturing sector average. Evidence from Table 2.3 indicates that firms in the manufacturing sector witnessed a substantial decline in the real output in 1994. On average, the manufacturing sector output had a negative growth of 15.5%. Some factors namely; inadequate supply of inputs, exchange rate depreciation in the previous years, unfavorable business and political climates were responsible for the decline experienced in the period. In 1996, there was a remarkable improvement in the output growth across all sub-sectors

[13] Turnover (sales) is use as a proxy for firms' output in this study

except for the industrial goods sub-sector whose output dropped. On average, the growth of manufacturing sector output rose from -15.5% in 1994 to 15.2% in 1996.

During 2000, there was a substantial increase in output of firms in the various sub-sectors due to the increased accessibility to funds following public offer placement by the firms. Some notable achievements were recorded in the agricultural and printing sub-sectors in 2002; average output of firms operating in the two sub-sectors grew by 20.5% and 25.9% respectively. The improvement recorded could be attributed to the listing of additional firms in the sub-sectors. Consequently, in 2005, most of the manufacturing firms experienced decline in output growth; this period coincided with sudden exchange rate appreciation which increased the cost of imported inputs in various industry. The years of 2007 and 2008 had substantial increased in turnover occasioned by the public offers of shares by firms in virtually all the sub-sectors of the manufacturing. On average, output grew in these periods by 17.5% and 19.6% respectively. The performance of listed firms output was affected by the global financial crisis, at the period, some of the sub-sectors namely; conglomerates, healthcare, industrial goods and printing recorded substantial decline in output growth. Available statistics from the output performance in table 2.3 indicate that most of the firms were not quick to recover from the financial crisis. The financial crisis reduced investor confidence in the stock market which led to a significant decline in the prices of stocks.

Table 2.3: Output Growth of Listed Firms by Sub-sector (%)

Year	Food Product	Beverages	Conglomerate	Health care	Agriculture	Household Durable	Industrial Goods	Oil and Gas	Printing	Auto-mobile and Tyres	Average
1991	6.4	54.38	36.65	27.96	20.49	27.15	15.89	20.57	45.06	20.76	27.53
1992	-5.55	47.63	1.94	-0.36	9.23	12.35	9.84	9.15	-15.83	9.09	7.75
1993	-2.16	62.30	3.32	52.35	5.38	4.14	0.62	5.42	1.96	5.41	13.87
1994	-17.74	7.39	-31.61	-7.51	-18.64	-21.81	-7.71	-18.22	-21.21	-18.22	-15.53
1995	-15.15	55.67	-9.93	-13.79	-12.84	-5.59	-5.51	-13.13	-14.72	-13.13	-4.81
1996	18.07	29.99	0.56	15.81	6.25	7.89	-16.31	6.12	77.55	6.25	15.22
1997	-8.74	0.61	-7.30	17.08	-5.66	-8.09	-8.51	-5.66	-4.47	-5.66	-3.64
1998	-5.74	3.07	-6.29	-9.51	-11.08	-3.23	7.35	-10.7	19.5	-10.6	-2.72
1999	3.25	5.67	-0.90	-11.62	8.46	25.87	0.28	8.71	42.27	8.85	9.08
2000	3.75	8.71	1.65	10.02	14.75	10.51	-3.26	16.46	9.2	16.42	8.82
2001	1.26	22.52	3.07	-15.6	-0.78	17.94	11.54	-1.52	-11.38	-1.57	2.55
2002	8.37	16.39	3.11	0.22	20.47	-9.14	-6.57	19.11	25.92	19.41	9.73
2003	-4.34	15.41	1.21	29.03	2.79	-15.08	16.49	30.6	-61.96	3.14	1.73
2004	7.44	4.10	-9.47	10.27	2.62	-3.32	20.96	2.83	10.44	2.85	4.87
2005	-2.44	7.17	-9.08	-2.21	0.19	-20.8	-4.81	-0.29	-4.29	-0.3	-3.69
2006	5.04	-25.82	-31.47	-0.03	-0.7	23.4	41.96	0.22	19.19	0.27	3.21
2007	16.07	18.00	11.97	11.82	10.58	41.58	11.5	10.85	31.2	10.92	17.45
2008	5.59	45.50	30.41	11.17	7.25	4.44	29.33	7.9	45.93	8.04	19.56
2009	9.59	4.80	-6.73	-12.88	4.96	3.2	-12.31	4.36	-9.98	4.29	-1.07
2010	4.53	4.05	-4.00	-1.78	4.41	-0.01	3.99	4.35	-4.91	4.31	1.49
2011	5.75	-20.69	-26.39	-2	1.96	27.43	-1.95	2.04	-8.17	2	-2.00
2012	4.12	31.60	22.78	-4.14	3.16	-0.59	-17.59	2.55	1.73	2.55	4.62

Source: Computed by the author, data were based on companies' annual report

2.6.2 Average Investment Profiles of the listed Firms in Nigeria

Expenditures on capital goods among firms listed on Nigeria Stock Exchange were influenced by factors such as size, source of capital, ownership structure and nature of products. The percentage growth of investment in 1991 was overwhelming except for the food products, industrial goods and automobile and tyres sub-sectors that witnessed capital decumulation. However, some of the sub-sectors, namely food products, conglomerates, oil and gas and printing witnessed decline in the rate of investment in 1993; the average growth in the capital expenditure was negative. The beverages sub-sector recorded the highest growth in capital accumulation in 1994 with an annual average growth of 158.6%. Available record from companies' annual reports reveals that this sub-sector embarked on importation of several capital goods to raise production level. During 1996, following the pegged of naira against U.S. dollars, the manufacturing sector was spurred by the stable exchange rate to procure capital goods from abroad. The oil and gas as well as the printing and publishing sub-sectors invested heavily in capital stocks, the growth recorded were 88.4% and 158.9% respectively. In 1998, the beverages and industrial goods sub-sectors recorded remarkable growth in their capital expenditure compare to the manufacturing sectors average. The improvement in their share price contributed to the increased access to finance which in turn was invested in capital accumulation during the period.

Available statistics revealed that in 2000, the agricultural sub-sector's capital grew by 129.4%. The improvement was due to the support of government through tax incentives and the reduction of tariffs on most of the equipments and machineries used in the sub-sector. Consequently, in 2001 and 2002, virtually all the sub-sectors witnessed increased capital expenditure growth. However, in the healthcare sub-sector, negative growth was recorded following an intensified regulation by National Food and Drugs Agency and Control (NAFDAC) and Standard Organization of Nigeria (SON). On average, capital expenditure growth in 2003 was negative; this could be attributed to the shutdown of operations of some firms in Nigeria as a result of sporadic electricity supply and frequent changes in policies by the government.

Additionally, in 2005, healthcare, agricultural, household durable, industrial goods and automobile and tyres sub-sectors witnessed capital decumulation which led to a detrimental

effect on the average level of investment in the manufacturing sector (see table 2.4). Noteworthy improvements in the manufacturing sector's capital accumulation were recorded from 2006 to 2008 before the financial crisis. During the period many firms listed on the NSE embarked on public offer of share which increased their accessibility to funds for the procurement of capital goods. The effect of the global financial crisis on capital expenditure growth was reflected in 2009 owing to the negative growth of capital stock recorded in most of the sub-sectors. Some of the sub-sectors were able to recover very quickly from the crisis as they had substantial growth from 2010 to 2012.

Table 2.4: Average Capital Growth of Listed Firms by Sub-sector (%)

Years	Food Products	Beverages	Conglomerates	Health care	Agric	Household Durables	Industrial Goods	Oil and Gas	Printing	Automobile	Average
1991	-2.13	35.12	19.6	54.58	7.46	21.94	-16.41	30.43	2.09	-68.5	8.42
1992	3.82	52.61	5.38	9.34	-18.84	16.25	44.51	-27.92	17.44	36.12	13.87
1993	-2.65	39.78	-11.01	2.36	28.59	5.21	29.78	-17.44	-3.44	24.84	9.60
1994	29.44	158.63	64.7	-68.18	42.6	-30.93	-38.61	19.63	-69.51	-30.64	7.71
1995	-7.78	31.78	-23.75	-11.93	-77.19	-19.04	26.6	-19.21	-62.19	53.62	-10.91
1996	-54.21	43.20	10.78	63.58	0.21	-25.73	9.65	88.44	158.92	17.95	31.28
1997	4.58	0.15	-7.71	9.00	11.59	13.91	62.68	-3.42	-36.17	21.37	7.60
1998	0.27	27.06	15.52	8.55	3.54	-8.16	43.02	-42.26	88.94	-53.54	8.29
1999	-17.06	-4.40	-10.33	9.72	-30.48	55.36	-71.72	101.45	109.77	-17.4	12.49
2000	9.24	23.64	15.61	6.61	129.39	10.55	69.59	-18.87	-52.33	-6.81	18.66
2001	21.16	68.53	41.77	-7.97	59.37	13.06	14.7	35.74	2.45	83.62	33.24
2002	42.92	13.53	0.58	-6.05	-20.56	3.73	105.71	54.98	-39.63	-4.08	15.11
2003	12.5	-10.89	-21.86	48.65	2.22	-16.01	-74.28	-1.06	33.76	-27.43	-5.44
2004	96.94	-18.52	-29.14	89.32	-36.1	-12.62	76.04	-37.39	0.83	-12.75	11.66
2005	0.52	30.36	10.59	-45.29	-50.96	-49.55	-45.01	27.44	87.28	-4.82	-3.94
2006	-23.99	-15.83	-22.24	23.15	63.37	32.16	7.13	52.58	44.19	0.68	16.12
2007	92.38	194.38	179.33	-9.21	34.04	93.97	-20.66	126.75	-57.36	-7.82	62.58
2008	-19.79	-47.39	-52.85	155.17	-42.79	5.13	70.03	79.43	68.48	50.38	26.58
2009	-7.78	-19.89	-28.7	-44.79	16.15	-19.74	-51.42	-56.96	46.3	-40.82	-20.76
2010	34.74	-31.96	-37.23	-2.00	-8.91	-3.47	29.25	-22.67	61.4	-72.66	-5.35
2011	4.78	-26.89	-32.15	-4.27	23.7	12.13	-0.87	40.97	-61.6	103.02	5.88
2012	2.99	8.33	57.05	-28.07	48.5	-12.47	67.57	-41.59	-32.39	-32.03	3.79

Source: Computed by the author, data were based on companies' annual report

2.6.3 Average Export Growth of Listed Firms

It was observed that some sub-sectors namely; household durable, industrial goods and packaging sectors were not exporting during the period of study, this could be attributed to lack of competitiveness of their products in the foreign markets. The agricultural sub-sector's export grew by 15.1% in 1991. The federal government support to boost agricultural production and exports through the provision of subsidies inputs increased the growth of export in the period. However, the agricultural sub-sector witnessed decline export growth between 1992 and 1994, while the food product sub-sector had a tremendous growth in export in 1992 (see table 2.5). The exportation of refined petroleum product by the oil marketing firms decreased between 1994 and 1998. This period coincided with the pegged of naira to U.S dollars. The reasons for the decline in exports were the high level of vandalization of oil pipe line and several episodes of crisis in the Niger-Delta region of the country.

Accordingly, in 2000, the oil and gas sub-sector recorded a 106% growth in export and its contribution to the manufacturing sector average was the highest. A substantial increase in price of crude oil in the international market led to the increase in its export in the reference period. In addition, between 2003 and 2006 the average growth in the agricultural sub-sector's export was significant. The extensive support through tax incentives encouraged the tremendous growth recorded. Similarly, from 2006 to 2011, the oil and gas sub-sector had a remarkable growth; this was occasioned by increased demand and escalation of oil price in the international market. On the other hand, in 2012, the manufacturing sector recorded a negative growth in export on average.

Table 2.5: Average Export Growth by Sub-sectors (%)

Years	Food Products	Conglomerates	Healthcare	Agriculture	Oil and Gas	Printing	Automobile	Average
1991	-36.58	N/A	9.21	15.10	3.68	N/A	N/A	-2.15
1992	98.27	N/A	-12.35	-12.49	-33.95	N/A	23.78	12.65
1993	-65.68	N/A	-87.30	-41.39	47.14	N/A	84.60	-12.53
1994	-3.57	N/A	-50.11	-49.83	-43.60	N/A	-6.39	-30.70
1995	69.19	N/A	0.06	41.98	-64.10	N/A	15.80	12.59
1996	24.21	N/A	-9.95	-33.81	-11.57	N/A	33.92	0.56
1997	-12.25	N/A	12.80	-21.71	-61.04	N/A	-35.86	-23.61
1998	126.06	N/A	-65.19	-50.77	-68.22	N/A	11.99	-9.23
1999	-37.34	-27.48	111.06	-75.53	102.35	8.19	-5.64	10.80
2000	42.77	48.37	70.12	0.98	106.80	32.36	-7.05	42.05
2001	-22.46	12.05	-90.99	-6.96	72.02	2.47	-18.10	-7.43
2002	39.48	-0.20	4.31	-6.34	147.00	-65.60	-76.37	6.04
2003	7.06	-31.99	101.67	88.54	8.74	-58.16	-41.73	10.59
2004	3.02	-64.91	7.01	79.07	-33.69	1.82	-69.51	-11.03
2005	6.02	-51.52	65.26	62.94	18.36	160.22	150.00	58.76
2006	-0.54	-21.68	-33.00	64.42	236.19	147.76	111.68	72.12
2007	6.33	-28.35	88.55	-17.82	166.02	-49.68	-19.04	20.86
2008	-4.13	13.27	133.15	51.13	75.25	9.68	-24.18	36.31
2009	7.93	-4.00	-50.73	60.33	50.17	-44.53	-23.68	-0.64
2010	2.55	-16.19	47.49	-14.59	106.69	37.08	-14.96	21.15
2011	11.08	30.34	161.87	0.49	138.42	92.78	-28.05	58.13
2012	-82.23	-38.26	-6.23	-3.42	-35.19	-54.40	28.21	-27.36

Source: Computed by the author, based on data from companies' annual report

2.7 Trends of Exchange Rate and Economic Activities of Firms

2.7.1 Real Effective Exchange Rate and Output

Figure 2.4 shows the relationship between real effective exchange rate volatility[14] and output growth in the manufacturing sector of the NSE. The liberalization of the foreign exchange market after the adoption of SAP led to several episodes of exchange rate appreciation and depreciation. For instance, in 1991 and 1992, an average appreciation of 15% was obtained. Consequently, a depreciation of 47.5% on average occurred during 1993 and 1994. The average output fell from 13.87% to -15.53% during the depreciation of naira that was witnessed between 1993 and 1994. A plausible explanation for the decline in output recorded was the increased cost of imported inputs. The depreciation of local currency made imported inputs more expensive relative to the locally sourced inputs. As a result, the dependence of some manufacturing sub-sectors on imported inputs led to a substantial reduction in their productions. Some reforms were introduced in the Foreign Exchange Market in 1994; these include pegging of the Naira exchange rate to US dollars, the centralization of foreign exchange in the CBN and the announcement of the illegality of the parallel market. Consequently, between 1996 and 1998, exchange rate movement coincided with the output growth in the manufacturing sector. After the pegged arrangement of the nominal exchange rate in 1998, exchange rate depreciation re-occurred. However, the intervention of the Federal Government to increase foreign direct investment inflows increased the average output growth among the listed firms in 1999 and 2000 (see fig. 2.4).

Accordingly, during the depreciation of naira in 2001, average output fell mainly in healthcare and printing sub-sectors due to the high cost of production in addition to increase in tariff and sporadic electricity supply in the country (NSE Factbooks, 2004). Real effective exchange rate and output moved in opposite direction between 2002 and 2008, which implies that in the period of depreciation, output increased; this could also be attributed to the increased access to funds by most firms operating in the sector. Some of

[14] Here, exchange rate volatility is measure by the standard deviation of monthly exchange rate as an index for a year

the firms were able to place public offer which increased their capacity to produce. In addition, the rise in the share price of firms spurred investors' purchase of stocks. However, substantial decline in output growth was recorded after the global financial crisis in 2009. Thus, the effect of the financial crisis was detrimental on the stock exchange market and the production level of firms.

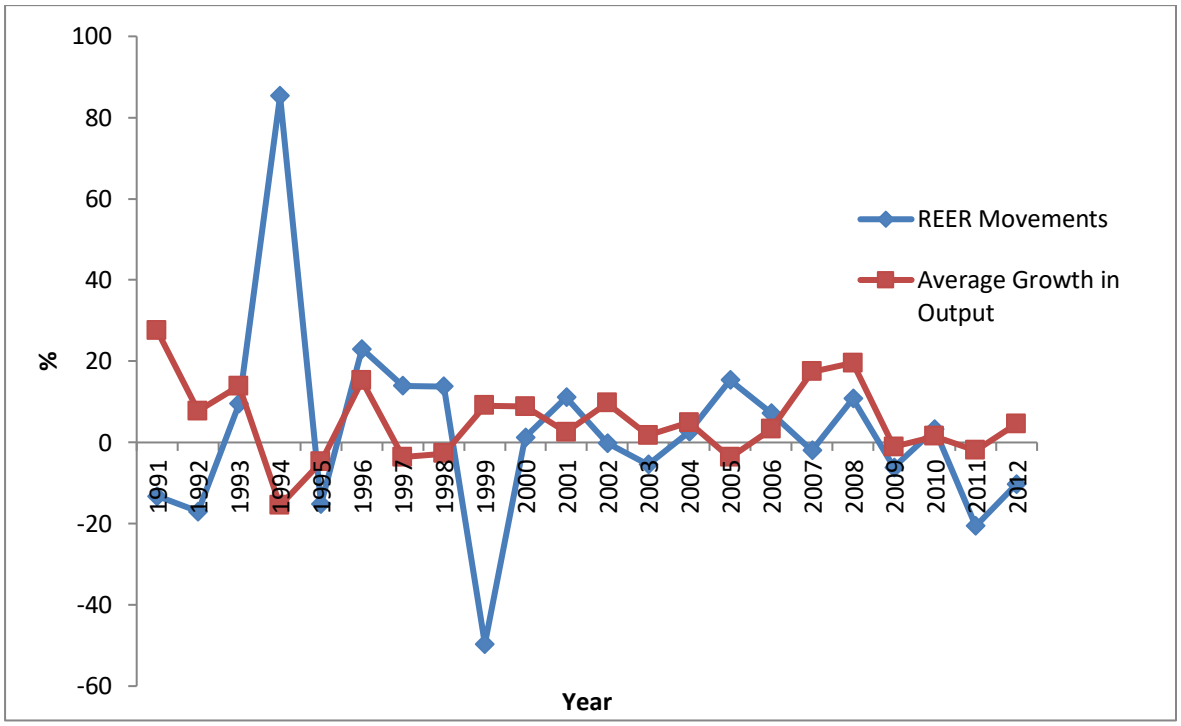

Fig. 2.4: Real Effective Exchange Rate Dynamics and Average Growth in Output

2.7.2 Real Effective Exchange Rate and Investment

In 1992, listed firms witnessed a significant growth in capital stocks which coincided with the period of exchange rate depreciation; average capital accumulation was 13.87%. Most of the firms increased their capacity to produce in order to keep abreast with demand. A close look at Figure 2.5 indicates that real effective exchange rate changes and investment had a close relationship between 1995 and 1998. This suggests that the pegged arrangement of the official exchange rate in the reference period encouraged a substantial increase in the procurement of capital goods. Additionally, the depreciation of the REER boosted the level of investment in between 2000 and 2002. Another episode of a concurrence movement of investment and changes in REER was evident between 2000 and 2004. A substantial increased in capital expenditure were recorded during the period, most of the firms listed on the NSE embarked on the placement of public offer of share. The increased funds were used particularly to increase their production capacities. However, the incident of the global financial crisis in 2009 reduced the accumulation of capital among firms listed on the NSE (see Fig. 2.5). There was gradual recovery from the shortfall in capital growth in 2010, following naira depreciation and government efforts to reduce the impact of the financial crisis.

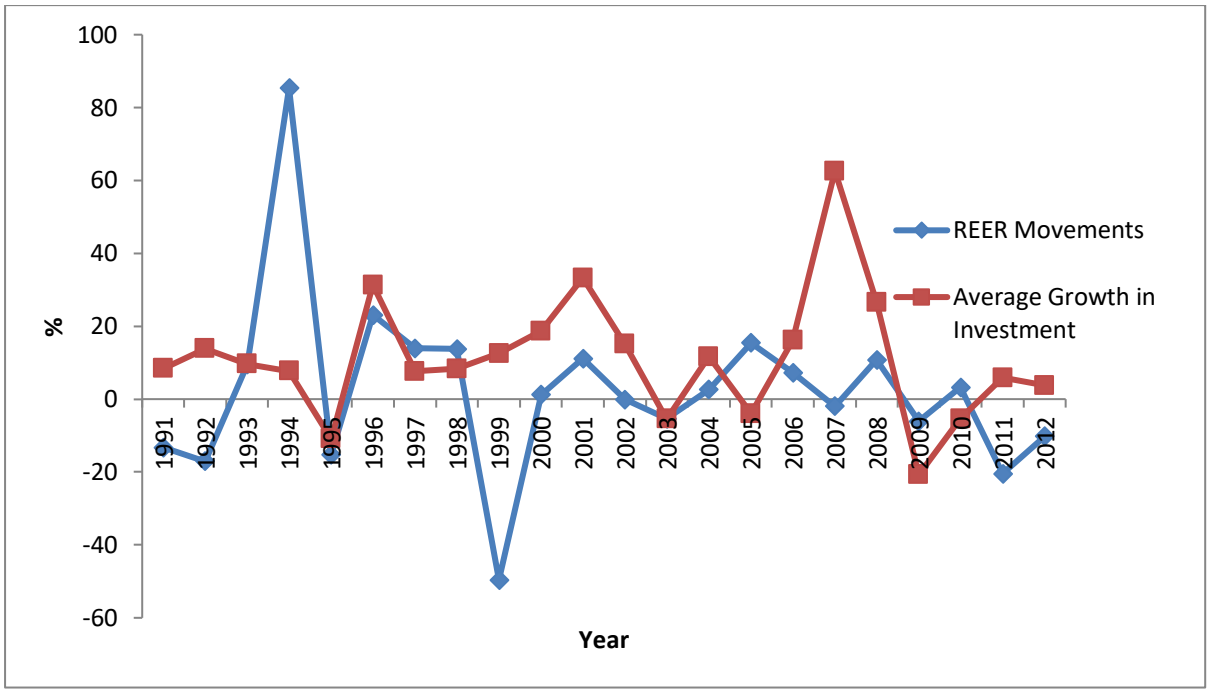

Fig. 2.5: Real Effective Exchange Rate Dynamics and Average Growth in Investment

2.7.3 Real Effective Exchange Rate and Export

The growth of listed firms exports were largely contributed by the agriculture, health care and oil and gas sub-sectors in the early period of 1990. At that time, exchange rate gradually depreciated which encouraged domestic production by firms and increased the quantity of goods exported. On average, the growth in export was 30% lower than the previous year in 1994, before the peg of naira to dollar. During the period most of the firms were operating below optimal production capacity due to sporadic electricity supply and inadequate supply of imported inputs. In addition, export rose in 1995 by 12.6% following naira depreciation in the foreign exchange market. However, the growth was not sustainable due to unstable exchange rate and the close down of some firms in the manufacturing sector. Consequently, between 2001 and 2004, exchange rate became more unstable and the growth in export became lower since most of the investors are risk averse. Before the incident of the global financial crisis in 2006, export grew by 72.1%; the large increased can be attributed to a greater level of investment in the manufacturing sector and government effort of creating investors confidence in the domestic economy. However, the incidence of the global financial crisis reduced the rate of exportation in the manufacturing industry (see Fig.2.6). It was discovered that the recovery of export growth witnessed in 2010 was followed by an episode of shortfall occasioned by unstable business environment and problems of insecurity that discourage foreign direct investment.

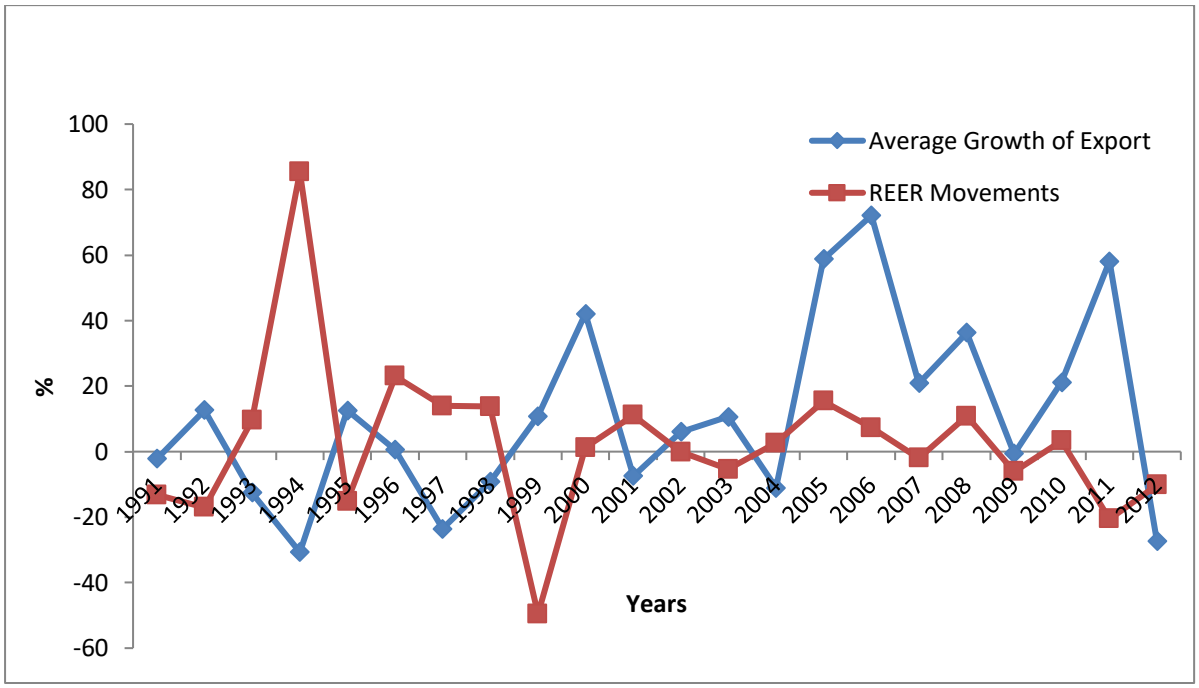

Fig. 2.6: Real Effective Exchange Rate Dynamics and Average Growth of Export

2.8 Average Growth in Value Added by Sub-sector

Value added represents a firm financial performance. The distribution of wealth across each sub-sector is based on the contributions of employees, government and shareholders. Although the oil and gas sub-sector's stocks were actively traded on Nigeria Stock Exchange, food products sub-sector generated the highest value added in terms of wealth generation and the spillover effect of such wealth to shareholders, government (taxes) and employees. Agricultural, household durables and industrial goods sub-sectors' value added were very low during the period under consideration. Factors such as low patronage of traded stocks and inadequate investment could be attributed to the low value added recorded. Table 2.6 shows the value added of the sub-sectors.

Table 2.6: Value Added of Some Selected Listed Firms Categorized by Sectors (₦'Million)

Years	Food Products	Conglomerates	Healthcare	Agriculture	Oil and Gas
1990-1994	11,949.64	9,659.33	1,910.11	398.68	14,596.23
1995	4,572.57	6,165.46	1,000.50	430.07	7,048.73
1996	11,341.89	6,376.64	1,557.87	494.56	6,533.82
1997	8,030.46	6,054.73	1,721.19	498.70	3,697.54
1998	8,073.20	6,240.03	1,643.00	397.70	5,850.89
1999	8,652.64	5,515.64	1,437.71	428.92	21,722.88
2000	10,811.76	6,930.83	1,433.64	816.26	26,864.56
2001	17,209.16	8,223.17	1,547.29	931.62	18,407.99
2002	30,087.15	11,007.07	1,900.98	1,490.47	24,587.76
2003	36,011.65	12,522.02	3,162.63	2,671.48	25,093.89
2004	45,689.47	11,007.92	3,581.05	2,959.61	69,046.80
2005	56,624.83	13,185.46	4,119.83	3,040.84	30,303.07
2006	59,310.41	14,217.98	4,973.81	3,768.90	38,232.02
2007	72,405.68	14,408.83	4,730.10	2,494.56	37,723.95
2008	82,627.72	19,942.14	8,360.11	3,921.03	71,887.06
2009	101,804.85	20,156.14	7,564.07	3,401.42	70,575.26
2010	120,685.71	23,767.91	8,009.51	6,424.50	67,742.89
2011	144,369.75	23,072.59	9,234.85	7,305.60	63,728.04
2012	189,916.45	26,927.78	8,988.70	9,064.53	18,428.58

Source: Computed by the author based on data from listed firms' financial statement

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This chapter presents the literature review for the research. Specifically, it is divided into four major sub-headings. The first part focuses on the concept and measurement of exchange rate volatility. The second is the review of theories on exchange rate volatility and firms' economic activities. Further, the transmission channels between exchange rate and firms' economic activities are explored. Part three concentrates on empirical literature of the relationship between exchange rate volatility and firm-level economic activities in both developed and developing countries. The last part of this chapter is the review of related empirical studies that have used aggregate data.

3.2 Concepts and Measurement of Exchange Rate Volatility

Exchange rate volatility refers to the swings in the exchange rate over a period of time or the deviations from a benchmark or equilibrium exchange rate. Volatility is defined as instability, fickleness or uncertainty and is a measure of risk in foreign exchange transaction. Exchange rate volatility is the risk associated with unexpected movements in the exchange rate (Ozturk, 2006). Caporale and Khosrow (1994) indicated that unanticipated exchange rate changes have negative implications on the volume of international trade and investment; high variability of current exchange rate leads to greater uncertainty about future exchange rate which reduces the level of trade flows and investment.

The central argument of Maskus (1986) was that exchange rates volatility reduces firms' export by creating uncertainty about the profits to be made from international transactions. Additionally, persistent volatility can be detrimental to international capital flow by

reducing both direct investment and portfolio investment. High degree of exchange rate volatility could discourage risk averse investors. Exchange rate volatility might result to higher prices for internationally traded goods by causing traders to add to risk premium to cover unanticipated exchange rate changes. Adequate information of the degree of exchange rate volatility is important because of the uncertainty it creates for prices of exports and imports which in turn affects firms' production and investment. In the short run, the degree of exchange rates volatility is determined by political events, monetary policy and changes in expectations. The extent of exchange rates volatility in the long run is determined by the relative prices of goods in different countries (Samuelson and Nordhaus, 2001).

Exchange rate volatility needs to be differentiated from exchange rate misalignment. Exchange rate volatility is the measurement of the amount that exchange rate changes and the frequencies of the changes (Arize *et al*, 2000). The volatility might be expected to decline if the spot exchange rates and the expected forward exchange rates become closer to one another. On the other hand, exchange rate misalignment occurs in the presence of parallel and official market. Exchange rate misalignment is the persistent departure of exchange rate from its long run competitive level (Rey, 2006). It implies a situation in which the actual exchange rate differs from the long run equilibrium value.

Edward (1986) argued that flexible exchange rate regime was usually characterized with excessive volatility but a stable international reserve. He stressed that the volatility can also arises from "overshooting" behaviour which occurs when the current spot rate does not equal a measure of the long-run equilibrium calculated from a long-run model. Obstefield and Rogoff (1995) argued that fixed exchange rates are not all that fixed; only a few of countries in the world today have continuously maintained tightly fixed exchange rates against any currency for five years. On the other hand, Klein and Shambaug, (2008) indicated that floating exchange rates do not really float, rather government that claim to allow market forces to determine the value of their currencies actually act to minimize exchange rate fluctuations.

Accordingly, Clark *et al* (2004) pointed out that an exchange rate regime that is classified as pegged does not necessarily have lower overall exchange rate volatility than an

arrangement that permits some degree of flexibility. Thus, pegging to an anchor currency still leaves a country exposed to fluctuations in the anchor against other currencies, and a peg that becomes misaligned can subsequently generate foreign exchange market pressures and large discrete changes in currency values, and hence volatility.

The discussion of exchange rate volatility must be in reference to the time horizon under consideration. At short horizons, in a world of integrated financial markets, greater volatility of the nominal exchange rate may be associated with greater volatility of the real exchange rate. However, in the long run, if the nominal exchange rate adjusts to inflation differentials the real exchange rate volatility would be reduced (Rey, 2006).

Several measures of exchange rate volatility are often employed in the literature. The measurement of exchange rate volatility depends on several factors namely whether the exchange rate being addressed is real or nominal, bilateral or effective and the measurement of risk associated with exchange rate uncertainty. Exchange rate volatility is a measure of the degree of uncertainty and dispersion market participants attached to exchange rate. Exchange rates are modeled as forward looking relative asset prices that reflect unanticipated change in relative demand and supply of domestic and foreign currencies. Exchange rate volatility reflects agents' expectation of changes in its determinant (Muhammad *et al*, 2005).

Nominal exchange rate refers to the exchange rate that prevails at a given date; it is the amount of domestic currency that will be obtained for one unit of foreign currency in the foreign exchange market. However, the real exchange rate is the nominal exchange rate adjusted for relative prices between the countries under consideration. Additionally, it is important to differentiate between nominal effective exchange rate (NEER) and real effective exchange rate (REER). The NEER measures the average change of a country's exchange rate against all other currencies. When the NEER is adjusted for price changes it becomes REER. The NEER is computed by using either bilateral or multilateral trade-weighted index. This procedure involves assigning weights to foreign currencies which would represent the comparative importance of these currencies to the home country. The REER is measured by using a bilateral or multilateral trade-weighted index for real

exchange rates; REER index indicates the relative competitiveness of a domestic currency compared to the rest of the world.

In measuring exchange rate volatility, De Grauwe (1994) concluded that the real exchange rate is the more relevant measure because the effect of uncertainty on a firm's revenues and cost that arise from fluctuation in the nominal exchange rate are likely to be offset in large part by the movement in the cost and prices. Several measures of exchange rate volatility have been used in the literature which include percentage change in exchange rate, variance and standard deviations of the exchange rate. The choice is driven by a number of factors including the time horizon considered (short-run vs. long-run). Often, the volatility measure incorporates some variant of the standard deviation of the difference in the annual or monthly exchange rate. Jasen (1989) stated that these approaches ignore information on the stochastic process by which exchange rate are generated. They constitute an unconditional measure. In addition, some studies have employed the moving sample standard deviation approach (see for instance, Cushman (1983) and Hassan and Tufte (1998)). This approach is use to take account for periods of high and low exchange rate uncertainty and captures the temporal variation in the absolute magnitude of changes in real exchange rates (Aqeel and Nishat, 2006). After the study by Engle (1982), the exchange rate volatility is essentially defined by Autoregressive Conditional Heteroskedasticity (ARCH) models and subsequent generalizations (GARCH, IGARCH, TGARCH e.t.c). A high ARCH order is needed to capture the dynamic behaviour of conditional variance. The Generalized ARCH model of Bollerslev (1986) fulfills this requirement as it is based on an infinite ARCH specification which reduces the number of estimated parameters from infinity to two. The GARCH models capture volatility clustering and leptokurtosis.

In other to measure volatility, Pozo (1992) used two separate measurement of exchange rate volatility to proxy for exchange rate uncertainty. The first measure was obtained by computing the standard deviation of monthly percentage changes in the real exchange rate. This is an unconditional approach to volatility measurement. The second approach employed in the paper referred to as conditional volatility was computed by estimating the real exchange rate series as a GARCH process. This alternative measure of volatility is reputed to better capture exchange rate uncertainty because it uses more information about

exchange rate behaviour than other method. However, the GARCH approach has been argued by De Grauwe (1994) to be suitable in a long-run time horizon.

Cady and Gonzalez-Garcia (2007) employed standard deviation of the first difference of the natural logarithm of daily bilateral nominal exchange rate in measuring volatility. Over short horizons, nominal and real exchange rates are highly correlated because nominal volatility is the main determinants of real exchange rate volatility.

3.3 Theoretical Review

3.3.1 Theories of Investment, Production and International Trade

Since the focus of this study is on the effect of exchange rate volatility on firms' economic activities, the reviews of theories are centered on investment, production and trade. The Keynesian theory shows that investment depends on the cost of capital asset, the expected return from it during its lifetime and the market interest rate which are summarized in the marginal efficiency of capital (MEC). According to Keynes, the prospective yield of an investment is affected by business expectations. These business expectations are very uncertain which could be influenced by news of technical developments, political events and external exposure. The central feature of the Neo-classical theory of investment is the response of the demand for capital to the changes in relative factor prices. It involves instantaneous capital adjustment in response to changes in exogenous prices by assuming internal adjustment costs at the firm-level. Mussa (1977) argued that adjustment cost affect investment and it comes in two forms internal and external. This model does not identify any mechanism through which expectations affect investment demand. A model of investment with adjustment cost was developed by Abel (1982), the model is known as q theory of investment. The q refers to the value a firm attaches to a unit of capital stock. In addition, the traditional theories of investment have been modified to account for uncertainty and external exposure. For instance, the theoretical proposition of Goldberg and Kolstad (1995) and Campa and Goldberg (1999) and Nucci and Pozzolo (2001) show a negative effect of exchange rate changes on investment.

The debates on the theory of production emanated from the Neo-classical theory of the firm. This theory deals with the technical relationship between inputs and outputs. The

inputs-outputs relationship of the firm is within the context of its production possibility set. It was assumed that the single goal of the firm is profit maximization and the goal is attained by the application of the marginalist principle. The main flaw of the theory is that uncertainty was not allowed to influence the decisions of the firm. The firm proceeded to maximize its profit after it had acquired the relevant information on costs and revenues. Gordon (1948) criticized the traditional Neo-classical assumption of perfect knowledge and argued that the complexity of the industrial world caused uncertainty. In average-cost pricing theory, it is assumed that the goal of the firm is long-run profit maximization. It was recognized that the short-run profit maximization proposed by the Neo-classical by equating marginal revenue to marginal cost in each period does not lead to profit maximization in the long run. A limit-price theory of an oligopoly was developed by Bain (1949). The conclusion was that traditional theory was unable to explain empirical fact due to the omission from the pricing decision of the threat of potential entry. The limit-price theory was modified by Sylos-Labini (1957) who concentrated his analysis on the case of homogenous oligopoly whose technology is characterized by technical discontinuities and economies of scales.

In the Classical theory of trade, the argument is that each country should specialize in the manufacturing and export of only the goods that it can make with the fewest resources. This makes each trading country to have a greater quantity of goods than before. This theory is largely attributed to David Ricardo theory of comparative advantage. The assumption of full employment helps the theory to explain trade within the concept of opportunity cost. However, the reality is far from full employment. Further, the Heckscher-Ohlin (HO) theory assumes that each country will export the good that uses its abundant factor intensively. Although, HO model does not allow for some technological differences across countries, it has precise implications for who gains and who loses from trade: the abundant factor in each country gains from trade, and scarce factor loses (Feenstra, 2004). The key contributions of the Neo-classical economists led to the Heckscher-Ohlin-Vanek model which allows for some technological differences across countries. Krugman (1979) model gave insight on the channel by which producers can realize productivity growth from trade openness. The model shows how trade liberalization reduces the number of domestic firms and increases the scale of production of surviving firms. This reduction of average costs

resulting from expansion of firm's production serves as an additional source of efficiency gains from trade. The scale efficiency can be defined as scale effect. However, despite the argument of Krugman, few studies have shown empirical validation of the scale effect hypothesis.

3.3.2 Relationship between Exchange Rate Volatility and Firms' Economic Activities

Some extensions had been made to the earlier theories of investment, production and international trade to show the effect of exchange rate. The general conclusion of the theoretical model developed by Clark (1973) indicate that exchange rate movements lead to uncertainty in the prices which exporters ought to pay or receive in the future. The model reached the conclusion of a clear negative relationship between exchange rate volatility and the level of trade. However, theoretical development suggested that there are situations in which exchange rates volatility could be expected to have positive effects on trade volume. For instance, De Grauwe (1988) has emphasized that the dominance of income effects over substitution effect can lead to a positive relationship between trade and exchange rate volatility. This could occur if exporters are sufficiently risk-averse, an increase in the volatility raises the expected marginal utility of export revenue and therefore induces them to increase export. This implies that the effect of exchange rate volatility on export should depend on the degree of risk aversion. A risk-averse exporter may export more when risk is higher to reduce decline in revenue. Conversely, a less risk-averse individual may not be concerned with substantial decline in revenue, considering return on export less attractive. Such an exporter may decide to export less when risks are higher (Arize, 1997).

The theoretical argument of Hooper and Kohlhagen (1978) indicates that high volatility in exchange rates could have important adverse consequence on firm's activities. For instance, if investors equate volatility with risk, they may alter their investment decision in other to accommodate the risk of excessive volatility. Thus, long-term capital flows may be reduced, thereby retarding the efficient flow of capital in the world economies. In addition, if the exchange rate of a country's trading partner becomes more volatile; firms may be reluctant to engage in international trade. Hodrick and Flood (1984) and Fung (2008) show that exchange rate movements lead to uncertainty in the prices of inputs and exporters.

However, these do not provide standard theoretical relationship on the effects of exchange rate volatility on firms' investment, outputs and exports.

Dellas and Zilbetarb (1993) argued that the predictions of Clark (1973) were based on restrictive assumption about the type of utility function. If the restriction of risk aversion is relaxed, the effect of exchange rate volatility becomes ambiguous. Similarly, it is assumed that there are no hedging possibilities either through the forward exchange market or through offsetting transactions. However, for advanced economies where there are well developed forward markets, some transactions can be easily hedged hence reducing exposure to unforeseen movements in exchange rates. This is not the case for market of most developing countries. Additionally, when a firm trades with a large number of countries, the tendency for some exchange rates to move in offsetting directions will provide a degree of protection to its overall exposure to exchange rate risk (Clark et al, 2004).

Either (1973) model focused on the decisions the firm makes at the time of ordering, regarding the volume of goods to be imported and the amount of forward exchange rate cover to obtain in making such decision. The model assumed a firm that is influenced by exchange rates uncertainty both through the domestic cost of its import and the size of its import. The size of the firms' imports depends on some factors namely; the market structure, policies of its competitors, the sensitivity of demand for its product to the exchange rate; the length of time between borders and the extent to which consumers anticipate price changes. The model shows that exchange rate uncertainty influences only the degree of forward cover and not the level of trade. In addition, uncertainty as to how the firms' revenue depends upon the future exchange rate will cause the level of trade to be more sensitive

A noteworthy argument of Hooper and Kohlagen (1978) is that if exporters and importers are risk averse, an increase in exchange rate volatility will reduce the volume of trade and have ambiguous effect on price. Quantitative evidence from the article indicated that the more elastic is importers' demand for tradable goods, the greater is the impact of exchange risk on quantity and the lesser on price. However, the more elastic is the demand for tradable the greater will be the effect of exchange risk on price and lesser on quantity.

Volatility affects the portion of trade that is not hedged. The theoretical argument of Arize *et al* (2000) is in line with Hooper and Kohlagen (1978) which implies that higher exchange rate volatility leads to higher cost for risk-averse traders and to less foreign trade. This is because the exchange rate is agreed on at the time of trade contract but payment is not made until the future delivery actually takes place. If changes in exchange rates become unpredictable this creates uncertainty about the profits to be made by firms and hence reduces the benefits of international trade. The increased risk associated with volatility is likely to induce risk averse agent to direct their resource to less risky economic activities. Hence, exchange rates movement affects the variability of firms' profit. In a situation where the objective of the firm is to maximize the expected utility of profit, an increase in exchange rate volatility will imply a large reduction in export in order to hedge against the risk associated with high volatility.

For instance, Itagaki (1981) analyzed a model of the monopolistic multinational firm which engages in production, financial transaction and international trade under the circumstances of exchange rate risk, international taxation, and anticipation of depreciation of home currency. The study stressed that production and exports of multinational firms depend on the degree of exchange rate uncertainty. High exchange rate volatility discourages international financial transactions and exports of multinational firms.

The theoretical proposition of Broll and Eckwert (1999) allows firms to adjust the export volume to the level of the exchange rates. The model assumes a risk-averse firm that produces a commodity to be sold to the domestic market and one foreign market. It also assumes that the firms are price taker; hence their actions do not affect the prices of the goods at home and abroad. Exchange rates variations are reflected in the degree of pass-through and differ across country and industry sectors. Kim (1990) and Marsten (1990) opined that the magnitude of exchange rate pass-through by exporters is less than a proportionate amount of exchange rate depreciation.

Goldberg and Kolstad (1995) explained that higher volatility in the exchange rate lowers the expected profit functions of firms that make investment decisions in the current period in order to realize profits in future periods. Campa and Goldberg (1999) extended the study

to risk neutral firms by using the approach of future expected profits. The article finally summarized that risk neutral firms tend to postpone their decision to enter the foreign markets in case of high exchange rate volatility. The importance of exchange rate volatility for marginal productivity and investment explicitly depends on the firms' international orientation both through export markets and through the fraction of its productive inputs.

Yang (1997) extended Dixit and Stiglitz (1977) model of product differentiation to examine exchange rate pass-through in U.S. manufacturing industries. The model shows that product substitutability determines demand elasticity, exchange rate pass through is larger the more differentiated is a firm products in an industry. The extensions made to Dixit-Stiglitz (1977) model are in two major areas; first, marginal cost is assumed to be variable rather than constant so that the effects of both the variability of marginal cost and variability of demand elasticity on exchange rate pass-through can be examined. Second, the model provides an equilibrium solution to Dixit-Stiglitz model.

A modified Krugman's (1979) model was developed by Fung (2008). This model indicates how exchange rate uncertainty will affect a firm's decision concerning exports and domestic sales for explaining the impact of these decisions on productivity by changing a firm's scale of production. The theoretical model shows that there are two countervailing effects of exchange rate movements on the sales of firm. It follows that an appreciation of home currency, for instance, increases the relative costs of domestic firms to the foreign competitors, hence intensifies competition faced by domestic firms. The cost disadvantage as a result cause each domestic firm to sell less, the intensified competition results in the exit of some firms and it may lead to an increase in the market shares and revenue of surviving firms. The effect of exchange rate fluctuations on the scale of production of firms depends on the relative importance of sales reduction resulting from higher costs and market share increases arising from exit.

The theoretical proposition of Goldberg (1993) indicated a standard negative relationship between exchange rate risk and firms' export volumes. It assumes a representative firm operating either in the export sector or the non traded goods sector which faces both product demand and supply curves. The study concluded that exchange rate depreciation

might have the greatest effects on sectors of the economy which goods are tradable with high price elasticity of demand. In case of non tradable products exchange rate depreciation decreases profits. The negative relationship that exist between exchange rate volatility and firms' export depends on a number of restrictive assumptions relaxing the underlined assumptions tend to weaken the negative relationship and may even result in a positive relationship. Some of the assumptions that make the relationship negative concerns risk aversion, the extent to which transactions can be hedged, other sources of risk to the firms besides exchange rate volatility and the potential to make profit from changes in exchange rates (Hodge, 2005).

A striking argument of Serenis and Serenis (2008) is that most trade contracts incorporate payment lags to allow time for delivery or to provide trade credit; hence, they produce uncertainty over the future price of foreign currency and the importers' own profits. Therefore, producers may prefer the possibility of more certain profits to the possibility of uncertain once. As a result uncertain revenue will encourage producers to switch away from foreign market to domestic once, which in turn will cause a reduction in the level of exports.

Baggs *et al* (2009) developed a model following the theoretical prediction of Fung (2008), on the reaction of firms to exchange rate movements with the assumptions of an open economy with heterogenous firms. The intuition of these models is that an increase in competition resulting from trade liberalization leads to the exit of low productivity firms and an expansion in the market share of higher productivity firms. Hence, the competitive pressure from lower trade barriers is similar to the increased competition arising from a domestic currency appreciation.

Nucci (2001) utilized Campa and Golberg (1999) theoretical model which argued that exchange rate shocks influence labour demand by affecting the marginal revenue product of labour. This effect arises from changes in a producer's domestic and foreign sales and in his or her costs of imported inputs. Therefore, the employment effect of exchange rate movements is increasing in industry export orientation and home market import penetration. This is ambiguous with industry use of imported productive inputs, as a result domestic labour and imported inputs may be either substitutes or complements in the

production function. This suggests that the importance of exchange rate in labour demand is strengthening in industries in which firms have pricing power and when production is less labour intensive.

Diallo (2007) examined the theoretical link between exchange rate volatility and investment in a small open economy. A theoretical model of a small open economy in which investment is subject to adjustment cost was developed. The production function followed the neo-classical type. It was assumed that capital goods are homogenous and can be produced domestically or imported from abroad. In order to determine the effect of exchange rate volatility the study drew from the assumptions of Campa and Goldberg (1995) that exchange rate is log normally distributed with mean μ and variance δ^2. It further assumed that the distribution of exchange rate is exogenous to the firm. The study demonstrated that the effect of exchange rate volatility on investment is ambiguous. Exchange rate volatility reduces profit of firms that heavily depend on imported capital goods. This argument strengthen the theory presented by Serven (2003) which emphasized that exchange rate volatility creates uncertain climate for foreign investors by making profit and cost of investment activities harder to predict. It was summarized that the impact of exchange rate volatility on investment depends on the degree of economy openness and financial system.

On the aggregate level, an open economy model was developed by Dornbusch (1976) to analyze the determination of the equilibrium real exchange rate. The model assumed a two goods economy with a tradable and non-tradable sector. It further assumed that the production of tradables depends positively on the real exchange rate. However, the production of non-tradables depends negatively on the relative price. The demand functions for tradables and non-tradables were assumed to depend on real exchange rate and real expenditure. Dornbusch (1980) analyzed, under the assumptions of complete price flexibility and full employment, how different disturbances will affect the equilibrium real exchange rate.

Hodrick and Flood (1984) developed a theoretical model of exchange rate and price dynamics following Dornbusch (1976). The model presented an open economy which is

assumed to be small in the world capital market but large in the market for the domestically produced goods. By predetermined domestic currency prices of domestic goods, the model forces asset market equilibrium to occur through fluctuations in interest rates and exchange rates producing overshooting. A major shortcoming of the model is that it abstract from variations in levels of national outputs and do not consider the effect of changes in assets that occur through investment and productivity in the disaggregated form.

An integrated model of price and exchange rate dynamics was developed by Musa (1982). The model treated exchange rate as an asset price that depends on expectation concerning exogenous real and monetary factors that influence relative prices and absolute price levels in the future periods. In the model, exchange rate changes reflected both expected changes in exogenous factors and changes in expectations occasioned by new information. The relevance of the random component in the exchange rate behaviour was emphasized. The explanations were based on the sources of divergences from purchasing power parity, the anticipating response of exchange rates to future expected disturbances and the causes of exchange rate overshooting. The model formulation drew from the assumptions of rational expectation and unanticipated exchange rate of Dornbusch (1976). However, the concept of exchange rate volatility and its consequences were not conceptualized in the mathematical model.

A theoretical model developed by Edward (1989) reproduced the process of output determination in a small open economy with tradables, non-tradables and sector-specific capital. World prices of tradable are assumed fixed. Exportable and importable items utilized domestic labour and capital, non tradable used imported inputs as well. The model had been modified by Miteza (2006) to a reduced form approach relating exchange rate with output. Baum *et al* (2009) developed a theoretical model for managerial decision making under exchange rate uncertainty. This model shows how imperfect information on the performance of observed changes in the exchange rate affects the relationship between exchange rate volatility and the behaviour of firm profitability.

The theoretical relationship between exchange rate movement and export was analyzed by Berman and Martin (2011). This model involves an intertemporal utility function in the

consumption side and Cobb-Douglas production function in the production side. The simple model comprises of heterogeneous firms from home country that export to N foreign countries; exchange rate movement affects export behaviour. The paper of Meltiz (2005) is similar to this, but focused on the transmission of exchange rate movement to productivity shocks. Berman and Martin (2009) were able to explain the weak reaction of aggregate exports to exchange rate movement. The theory established that high exporters react differently to exchange movements and high performance firms react to exchange rate depreciation by increasing their producer price. Hence, they absorb exchange rate movements in their mark-up. High performance firms choose this strategy rather than letting the import price fall and increase their export sales. Low performance firms choose the opposite strategy.

Most of the earlier theories, focused on the relationship between exchange rate and firm's investment. This study intends to provide a theoretical link between exchange rate volatility and firms' economic activities. Emphasis will be imposed on the effect of exchange rate volatility on firms' output, export and investment.

3.3.3 Transmission Channels between Exchange Rate Volatility and Firms' Economic Activities

Exchange rate volatility affects firms' economic activities through a number of channels depending on whether the firm is producing a tradable or non tradable products as well as the dependence of such firm on imported raw materials or intermediate inputs. In line with the theoretical proposition of Leslie (1988), Rahman and Hossain (2003) identified two major channels namely; changing sectoral profitability and changing location of production which exchange rates movement affects investment. In the case of changing sectoral profitability, an immediate effect of exchange rate depreciation is a change in relative price of the tradable leading to an increased demand for the exportable and import competing goods. Hence, the foreign currency price of exportable falls with positive impact on demand and the domestic price of imports rise. Additionally, the view that exchange rates movement change the location of firms implies that an exchange rate depreciation lowers the relative cost of producing in the domestic economy; the attractiveness of domestic

product increases which inform and additional location of production facilities by both domestic and foreign firms. However, an appreciation decreased the attractiveness of domestic economy.

The general conclusion of Atella *et al* (2003) was that a stable exchange rate may have a positive effect on the level of investment. The study suggested that the effect of exchange rate volatility on firms' investment and profit earned depends on firms' specific characteristics which include the degree of market power and the kind of sector the firm operates. In case of supplier-dominated sector, high market power firms are less sensitive to exchange rate variability than others on the revenue side. On the other hand, low market power firms are more sensitive on the cost side. Hodge (2005) central argument indicated that an increase in exchange rate volatility is assumed to result in an increased uncertainty by firms about future profitability. The greater such uncertainty is, the less the supply of exports of the demand for imports; thus leading to negative relationship between exchange rate volatility and volume of firms' export. However, models that include the possibility of hedging transactions in the forward exchange market generally show little effect of exchange rate volatility on trade.

Fuentes (2006) shows how exchange rate volatility affects firms' investment decisions through the exports and imports channels. The model developed assumed a producer who sells in both the domestic and foreign market and imports a proportion of intermediate inputs. Certain factors namely; the proportion of imported materials in production, the degree of market power and the adjustment cost contribute to the negative effect of exchange rate volatility on firms' profit. However, contrary to the conclusion of Atella *et al* (2003) the study indicated that the negative effect of exchange rate volatility increases the higher the degree of market power of the firm.

Kandilov and Leblebicioglu (2009) argued that exchange rate volatility affect firms' investment through its external exposure. The external exposure depends on firms' reliance on foreign market for exporting output (export exposure) and for importing inputs (import exposure). Accordingly, extent to which both export exposure and import exposure affect marginal profitability determines whether openness alleviate or aggravate the effect of exchange rate volatility on investment. Additionally, Sanderson (2009) indicated that

exchange rate movements can have substantial impacts on the incentive of firms to engage in international trade through exports and imports channels. The model shows that firms can be affected by exchange rate volatility through the cost of imported inputs and the prices that the firms receive from their export goods. The central argument of the study is that the impact of exchange rate on firms depends on whether it appreciates or depreciates. An appreciation of domestic currency raises the relative price of domestic goods for foreign consumers, reducing the demand by foreigner and discouraging exports opportunities. On the other hand, a long term depreciation of domestic currency raises the real cost of imported inputs and increases production costs.

Similar to the model of Fuentes (2006), Nucci and Pozzolo (2001) identified two major channels in which exchange rates volatility affects firms' economic activities namely; the cost and the revenue channels. The cost side depends on a number of firm-specific characteristics such as reliance upon imported inputs and the elasticity of substitution between these inputs and domestically produced substitutes. However, the effects on the revenue side depends primarily on the share of export revenues with respect to total revenue, the degree of the firms; market power in the product market and the extent of exchange rate pass-through into export prices expressed in the foreign currency. The study further shows that exchange rate depreciation can have an opposing effect depending on the sector. Real exchange rate depreciation can have an expansionary effect by increasing the profits of firms in the export dominated sector, but a contractionary effect can emerge from the import dominated sector. This study presented more elabourate characteristics of firms and the degree in which exchange rate affect their performances.

A model that shows how firms' economic activities transmitted to exchange rate volatility was developed by Lubik and Russ (2012). This study provided an insightful argument on how the behaviour of multinational firms would generate excess exchange rate volatility when FDI is abundant in sectors with higher industry concentration, higher value-added and higher barriers to foreign participation relative to domestic production. The study concluded that fluctuations in net profits repatriated by multinational firms can generate real and nominal exchange rate volatility. Anubha 2013 argued that exchange rate movements can affect firms by raising the cost of imported inputs relative to other factors of production,

providing exporters with a relative cost advantage relative to foreign competitors and generating higher borrowing costs and a contraction in lending.

3.4 Empirical Literature

3.4.1 Evidence from Developed Countries

Several studies had examined the relationship between exchange rate volatility and firms' economic activities in the developed countries. Most of the countries in the developed region have access to micro-based data which enhanced detail analysis of the subject. Employing Japanese firm-level data, Dekle and Ryoo (2002) found that export volumes are significantly affected by exchange rate volatility. The results revealed that financial constraints play an important role in affecting the sensitivity of firms' export to exchange rate volatility. Firms that have less financial constraint respond less to exchange rates elasticities. In addition, the findings show higher elasticities of export compare to the one obtained by Baba and Fukao (2000) for Japan.

Aizenman (2003) explores the implications of the deepening presence of multinationals in emerging markets on the cost of macroeconomic volatility. It was discovered that macroeconomic volatility has a potentially large impact on employment and investment decision of multinationals producing intermediate inputs in developing countries. The study shows that multinationals would tend to invest in the more stable emerging markets. A higher volatility of productivity shocks in emerging market economies, producing intermediate inputs reduces the multinationals' expected profits.

Atella *et al* (2003) investigated the relationship between exchange rates uncertainty and firms' investment in Italy. Exchange rate variability was calculated as the annual average standard deviation of quarterly real exchange rate. A dynamic Error Correction Model was utilized to determine the short run effects of real exchange rate volatility, output and profit on investment. The study revealed that an increase of exchange rate volatility reduces firms' investment spending. The impact of exchange rate on a firm depends on the sector it operates and the market power. Firms with high market power are less concern with high exchange rate volatility since they are able to cushion the effect by making forward exchange rate transaction and hedge against exchange rate risk. The study used micro data

of India firms; hence, adoption of Error Correction Model primarily developed for macro data could produce misleading results. An econometric technique that allows for estimating panel study would have been more appropriate in this type of study.

Based on industry level data for 22 manufacturing industries, Tarek *et al* (2005) examined the relationship between exchange rates and investment between 1985 and 1997 in Canadian manufacturing industries. A GARCH model was adopted to measure exchange rate volatility, and for comparison, the coefficients of variation in monthly exchange rate level as well as the standard deviation of the monthly growth rate of exchange rate were computed. In order to provide comprehensive estimate, two stage least squares and GMM estimation were conducted. The empirical findings indicate that the overall effect of exchange rate on investment in Canadian manufacturing industries is statistically insignificant. The analysis provides different evidences among investment in different sectors. When exchange rate volatility is high, industries tend to reduce investment. In a low volatility regime, investments in manufacturing increases. The procedures of Arellano and Bond (1991) GMM estimation technique are more efficient than 2SLS estimation in large samples.

Davis and Kahn (2008) examined volatility behaviour at micro and macro level for clues about the sources and consequence of aggregate volatility changes. The study demonstrated this by plotting the volatility graph using standard deviation method, the growth contribution of firms were grouped according to sectors namely; durable, residential and inventory sector based on data during Korean War period. Adequate information regarding the effects of exchange rate volatility on Korean firms during the War was derived from the study. It was discovered that exchange rate was more volatile in the period of War and this volatility has detrimental effect on firms' performances.

The preoccupation of Guillou (2008) was to determine the relationship between export behaviour and exchange rate at firm-level using data set of French manufacturing firms from 1994 to 2004. Exchange rate volatility was measured using a two-year standard deviation of the first difference of quarterly exchange rate. The study shows that for most manufacturing firms in France, exchange rate has an influence on export entry, but the effect of changes in the exchange rates on export intensity is fairly neutral. The probability

of entering an export market is increased by depreciation. The paper suggests that currency appreciation is a cause of concern since it increases import penetration implying higher levels of foreign competition for domestic firms. However, the study did not provide a clear description of the type of exchange rate used in the analysis. Also, Darby *et al* (1999) and Tenreyro (2007) indicate that standard deviation measurement is only valid for short term volatility.

Temin (2008) investigates the effect of real exchange rate fluctuations on plant entry and exit decisions in the Canadian agricultural implements industry, and how this, in turn affect aggregate product. The parameters of the model are estimated in two stages. The profit parameters and the per-period fixed cost of operation are estimated first using Nested Pseudo Likelihood algorithm. Further, the parameter characterizing the distribution of unobserved potential entrant productivity along with the cost of entry is estimated in a second stage using the Method of Simulated Moments. This model captures the heterogeneity of firms and how each firm responses to exchange rate movements.

Compiling panel data on exports, exchange rates and research and development (R&D) expenditures of 14 OECD countries, Mahagonka *et al* (2009) analyzed the impact of macroeconomic volatility on R&D in manufacturing and services sectors. The study adopted GARCH approach to measure exchange rate volatility. The argument for using GARCH is that it captures persistency in exchange rate data. Also, conditional variance approach uses more available information than the simple standard deviation method of generating volatility. This study adopted unbalanced panel random effect regression of total manufacturing and total services sectors of 14 OECD countries from 1987 to 2003. The study indicated that real exchange rate volatility negatively affects research and development (R&D) intensity in the manufacturing but not in the service sector. In manufacturing sector, the alternative specification testing the hypothesis about an indirect effect of volatility on innovation confirms the importance of export activities. The impact of real exchange rate volatility on export activities reveals a strong indirect effect. This implies that volatility negatively affects export activity.

The model of Aghion *et al* (2009) tested whether a country level of financial development matters in choosing the degree of flexibility of an exchange rate system in order maximize

long run growth. The study utilized GMM dynamic panel data estimator developed in Arellano and Bond (1991), which has been extended in the study by Arellano and Bover (1995), Blundell and Bond (1998) and Windmejer (2004). These methods reduce the problem arising from joint endogeneity of all explanatory variables in a dynamic formulation and addresses potential biases induces by country-specific effects. The study reveals that the more financially developed a country is, the faster it will grow with a more flexible exchange rate. In addition, exchange rate volatility will be harmful to firms that have high liquidity needs in countries with low degree of financial development.

Employing data from UK manufacturing firms, David *et al* (2010) examined the effects of exchange rate uncertainty on firm decisions on export market entry and export intensity. Two stage sample selection model was adopted which involve two regression to capture export intensity and export participation. The maximum likelihood estimation of pooled selection model include lagged of dependent variable, time and industry dummies. The panel estimation was conducted using fixed effect regression. Empirical findings show that exchange rate uncertainty has little effect on firms' export participation but a significant impact on export intensity. The study could not account for industry heterogeneity by using pooling data.

Tang (2011) examined the impact of intra-Asia exchange rate volatility on intra-Asia trade in primary goods, intermediate goods, equipment goods and consumption goods from 1980 to 2009. Following the methodology adopted by Thorbecke (2008), the study conducted panel unit root and panel cointegration tests on all the variables of interest. The models were analyzed using random and fixed effects regression technique. Hausman test provide the basis for adoption of either fixed or random effect, however this was not reported in the study. Estimation of panel unit root and cointegration tests enables to determine the long run relationship among the variables under investigation. The study pointed out that for Asia, as intra-regional exchange rate volatility increases, intra-regional exports in these goods fall. The negative impact is stronger in the sub-region of Association of Southeast Asian Nation (ASEAN), comprising ASEAN member countries plus the People's Republic of China, Hong Kong, Japan, the Republic of Korea and Taipei. These results emphasize

significant impact of exchange rate volatility on region's production networks. In the case of South Asia, exchange rate volatility has positive impact on exports.

Using firm-level data, Hotei (2012) examined the effects of exchange rates movement on Japanese firms' investment. A two steps system GMM was adopted to analyze the variables employed in the study. The variables utilized include investment, sales, import, export and real exchange rates. It was found that exchange rate appreciation has negative effect on firms' investment with higher export ratio. However, it has a positive effect on firms' investment with higher import ratio. The results suggest that Japanese firms' investments are likely to be affected by the exchange rate fluctuation and its export ratio or import ratio. It was also shown that the effects of an exchange rate appreciation on investment are greater in firms with lower market power and in firms confronted with the financial constrains. The findings of the study is similar to the one obtained by Nucci and Pozzolo (2001).

Hericourt and Poncet (2012) investigated how firm-level export performance is affected by real exchange rate volatility and the way financial constraint together with financial development shapes this relationship at firm-level. This study used data obtained from more than 100,000 Chinese exporters between the periods of 2000 and 2006. A panel regression was estimated capturing firm-country fixed effect and year dummies. Firms-fixed effect captures the impact of local endowment and of sector specific characteristics. This methodology allows to circumvent a number of endogeneity problems. The firm-level financial vulnerability was computed as the weighted average of the financial vulnerability of its activities with the weights being sectors' share of the firm export from 2000 to 2006. The paper provides a micro founded investigation of Aghion *et al* (2009)'s approach.

To explain the dynamics of investment in China, Geng and N'Daiye (2012) utilized both firm-level data and cross country data. The dependent variable is corporate capital expenditure (in relation to sales). The explanatory variables include past capital expenditure, capital output ratio squared, stock market capitalization in relation to GDP, real interest rates, the change in real effective exchange rate, real GDP growth, current account balance in relation to GDP, foreign debt to GDP ratio, the relative price of capital to output and the volatility of output. The model was estimated using dynamic panel data

estimator with both unbalanced panel of 27,997 firms across 53 economies and an unbalanced panel of 1908 firms in China from 1990 to 2009. To address simultaneity lagged values of the contemporaneous, the explanatory variables were used as instruments and correlation was applied. It was found that financial variables such as interest rates, the exchange rate and the depth of the domestic capital market are important determinants of corporate investment. Further evidence reveal that financial sector reform, including that which raises real interest rates and appreciates the real effective exchange rate would lower investment and help rebalance growth away from exports and investment toward private consumption.

The study by Cheng and Sengupta (2012) applied baseline regression approach to determine the effect of real effective exchange rate (REER) on the share of exports of Indian non-financial sector firms between the periods of 2000 and 2010. Export share to sales ratio is specified as the dependent variable which was regressed on explanatory variables such as REER, a measure of volatility used was standard deviation of monthly REER indices for a year. The fixed effect variable was included to capture firms' specific characteristics that are time invariant and have implication for exporting behaviour. The empirical analysis reveals that, on average, there has been a strong and significant negative impact of currency appreciation as well as currency volatility on Indian firms' export shares. Further evidences show that Indian firms that have smaller export shares tend to have stronger response to both REER change. It was argued that, the firms that export services are more affected by exchange rate fluctuations.

Anubha (2013) explored the impact of real exchange rates changes on the performance of Indian's manufacturing firms over the period of 2000 to 2012. A datasets of 3000 Indian manufacturing firms were used. A panel regression model was specified and estimated using random effect estimator. In other to test for robustness, a new equation was estimated by replacing output growth with income and sales growth. The results clearly indicate that real exchange rate movements have a significant impact on Indian firms' performance through the cost as well as revenue channel. The impact depends upon the share of imports and exports along with the degree of market power. Further evidences show that the presence of overvaluation negates the beneficial effects of exchange rate appreciation

operation through the lower input cost channel. This study provides a robust estimation of the effect of exchange rate on firm-level performance.

3.4.2 Evidence from Developing Countries

The relationships between exchange rate volatility and firm-level economic activities had been investigated in many insightful studies in the developing countries. The compositions of products in the imports and exports baskets of firms in developing countries are quite different from the developed countries. Most firms in developing countries import capital intensive machinery and equipment and export consumable products, whereas, firms in developed countries export capital intensive products and import cheaper consumable products. The rate of foreign exchange utilization and disbursement for various international transactions between developed and developing countries could vary significantly. Consequently, the presence of shallow or parallel market in developing countries increases the volatility of exchange rates. Hence, the effect and extent of exchange rate volatility in the developing countries could be widely different from the developed ones.

Carranza *et al* (2003) used financial information from 163 non-financial listed firms to analyze the impact of the exchange rate volatility on the performance of firms in the Peruvian economy between 1994 and 2001. Instead of Generalized Method of Moment (GMM) system estimator proposed by Arellano and Bond (1991), the first difference GMM was used. The system GMM is usually prefer when the lagged level of variables employ in a model are use as instruments. Essentially, the study found that currency depreciation negatively affects the performance of firms in Peruvian economy. The study identified some notable channels in which exchange rate negatively affect firms namely, the interaction effect of dollar denominated debt times the real exchange rate depreciation, firms' debt ratio and the real exchange rate depreciation itself.

The impact of exchange rate volatility on firms' investment is an area that has been given considerable attention in the economic literature. Most of the studies along this line drew from the one conducted by Campa and Goldberg (1999). Fuentes (2006) analyzed empirically the effect of exchange rate uncertainty on capital accumulation under the

presence of irreversibility in investment process. The volatility investment nexus was examined for Chile, by combining industry-specific real exchange rate data with a panel of manufacturing plants between 1979 and 2000. The GARCH technique was used to measure volatility movement. The dependent variable is the investment rate while total sales and cash flows, normalized by the capital stock were used as control variables. The study also included time, industry, location, size and business type dummies to control for unobserved heterogeneity in market structure, technology and aggregate shock to investment. The study revealed that at the plant- level in Chile, several episodes of zero investment were experienced which argue in favor of irreversibility. The estimated reduced form equation for investment indicated a significant and negative effect of exchange rate uncertainty on investment. It was discovered that one standard deviation increase in uncertainty reduces the investment rate by almost 10%. This result is in line with the theoretical prediction of investment under uncertainty. However, this study did not examine the various channels in which exchange rate affect firms' investment.

Additionally, Mustafa and Rebecca (2008) explored the linkages between exchange rates volatility and firms' capital investment behaviour in Mexico using sectoral data from 1994 to1999. The econometric model is a variant of Campa and Goldberg (1995, 1999) model. The variables of interest in this study include investment in manufacturing sector, sales, real exchange rate, volatility of exchange rate and annual interest rate. An ARCH model was specified to measure exchange rate volatility. Panel regression with fixed effect was conducted to analyze the model. The study emphasized the role of firm's external exposure, market structure and product characteristics in Mexican manufacturing sector as a major determinants. It was also pointed out that exchange rate depreciation affects capital investment positively through the export channel, and depresses expected profits if there is a high reliance on imported inputs. Another regression conducted shows a negative effect of exchange rate volatility on investment for firms that are export oriented. The results gave an elaborate explanation on the effect of both internal and external characteristics of firms in influencing its investment.

Using plant level data from 1984 to 1992, Miguel and Pablo (2009) investigated the responsiveness of Mexican economy to real exchange rate shocks. A balanced panel

regression analysis was employed which covered data of real exchange rate, and several shocks episodes which include employment, sales and expenses in new investment. Ownership structure (Foreign or local) was considered in the analysis. An insightful result was obtained on the responsiveness of Mexican economy to real exchange rate shocks. Evidence from the regression analysis indicates that after the passage of NAFTA, exporting firms exhibited higher growth rates of employment, sales and investment compare to non-exporters. The results confirmation was based on the behaviour of a control group of firms, which had completed access to the US market during devaluation. The paper omitted discussion on the choice of panel regression. The Hausman (1978) test was not conducted to choose between fixed effect and random effect regressions analysis. The random effect is preferred under the null hypothesis due to higher efficiency; while under the alternative fixed effect is consistent. The results support the view that NAFTA has increased producers response to real exchange rate shocks.

Mustafa and Demir (2011) investigated the effects of exchange rates levels and volatility on the productivity growth of manufacturing firms with heterogeneous access to debt, domestic and foreign equity in Turkey. A dynamic Generalized Method of Moment (GMM) estimation technique was adopted for the model. Exchange rate volatility was measured using GARCH (1,1) model. In addition, for robustness check, standard deviation of the first difference of the logarithm of monthly exchange rate was used. They found that while exchange rate volatility affects productivity negatively, having access to foreign or domestic equity, or debt market does not alleviate these effects in Turkey. Also, foreign owned or publicly traded companies do not appear to perform significantly than the local private ones. Further evidences revealed that firms productivity are positively related to having access to external credit. This result indicates that while export oriented firms are affected less by exchange rate appreciation, they are more sensitive to exchange rate volatility.

Some studies have shown that the degree of exchange rate exposure influences firms' performances. For instance, Solakoglu (2011) focused on the effect of exchange rate exposure on firm specific factors namely, firm size, maturity, level of international activity, a measure of natural hedging in a panel data regression approach. Exchange rate exposure

was calculated as the sensitivity of firm returns to exchange rate movements. The information derived from Hausman test was used as a criterion for adopting random effect technique to analyze the model. The results indicated that the size of the firm and the share of export revenue in the total revenue have negative effect on the exposure level. This implies that larger firms and firms with a larger dependence on export revenue have exposure to exchange rate risk. It then suggests that these firms may have the inventories and resources to lower or eliminate exposure level. In a similar study relating to exchange rate exposure, Wang (2011) studied the impact of exchange rate fluctuation on stock returns and unexpected profits of the multinational companies (MNCs). The exchange rate variable was specified as Autoregressive Integrated Moving Average Model (ARIMA) and the derived residual was estimated for ARCH. The result indicated that exchange rate fluctuations only affect unexpected operating profits for all firms in the industries. This suggests that all industries may use related derived financial instruments to avert exchange rate exposure which influences sales revenues and purchase cost of the MNCs. It was discovered that exchange rate variation are negatively correlated to the unexpected operating profits of the firms. The extents of effects are higher for the export-oriented Texile and Glass industries which depended on the imported petrochemical raw materials from America.

Additionally, the findings of Varga (2012) show a strong negative exposure of Taiwanese firms to an appreciation of the domestic currency. The empirical result indicated that the exchange rate exposure across firms is non-linear. Also, asymmetric profiles of the firms modify significantly their exposure. A high percentage of monthly samples are affected by a positive coefficient of volatility of the stock returns associated with exchange rates but conversely for daily sample. This implies that the leverage of positive and negative shocks changes with the time horizon.

Using a cross-country firm-level data set, Alberto and Mark (2009) examined the relationship between volatility and firm growth. A comprehensive survey of around 10,000 firms was utilized with a standard core enterprise questionnaire method. The process involves an extensive questionnaire undertaken via face to face interview with either firm managers or firm owners of each company. The questionnaire was directed to measure

firms' perceptions about the investment climate as shaped by economic policy; governance and corruption; regulation and taxes; infrastructures, financial constraint, firm size growth and other characteristics. The explanatory variables are divided into firm-level and country-level variables. The dependent variable (firm growth) refers to the percentage change in firm sales in the preceding 3 years. The study established an adverse effect of volatility on firm's growth in a sample of about 10,000 firms across both developing and developed countries. Additional evidence revealed that weak institutions magnify the detrimental growth effect of volatility.

Using a firm-level data set Mustafa and Firat (2011) explored the effects of exchange rate uncertainty on growth performances of domestic versus foreign and publicly traded versus non-traded firms in Turkey. The study employed dynamic panel estimation technique specifically GMM method following Bundell and Bond (1998). The system GMM method has been argued to be suitable for controlling endogeneity, state dependence and simultaneity bias. The empirical findings indicated that exchange rate uncertainty and currency crises have significant employment growth reducing effects. Nevertheless, domestic equity market was found to reduce these negative effects at a significant level. These results continue to hold after controlling for firm heterogeneity due to differences in size, export orientation, external indebtedness, industrial characteristics, profitability and productivity rates.

Kandilov and Leblebicioglu (2011) investigated the impact of exchange rate volatility on firms' investment decision in Colombian manufacturing firms using a variant of the methodology adopted by Mustafa and Firat (2011). The study employed plant-level data of manufacturing firms, and estimated a dynamic investment equation using the system GMM technique. To estimate volatility, GARCH technique and simple standard deviation of exchange rate were adopted to compare the results. The study found a significant and negative effect of exchange rate volatility, measuring either using GARCH model or standard deviation on firms' investment in Colombia. The findings show that the negative effect is mitigated for firms with higher mark-up of exports, and exacerbated for plants with larger volume of imported intermediates.

Analyzing firms' growth dynamics in Nigeria's manufacturing industry, Sangosanya (2011) employed financial information from 45 manufacturing firms quoted under the NSE. The model employed was based on neoclassical, managerial and optimum firm's size theories. A fixed effect technique was used to estimate the panel regression model. Data on sales, profit after tax, net profit after tax, total asset, market value of equity, book value of debt, gross fixed asset, retained profit and depreciation between 1989 and 2008 for each of the manufacturing firm was employed in the study. The major weakness of this study is that it did not consider endogeniety problem that could emanate from the model by using static regression technique. The results obtained indicated that operating efficiency, capital reserve and government policies are significant determinants of manufacturing firms' growth dynamics in Nigeria. Additional evidence from the study reveals that previous growth rate has a significant effect on current growth rate and it fosters the adjustment of manufacturing firms' growth in Nigeria. Exchange rate was not considered as a factor influencing firms' operation performance.

Chang and Hsu (2013) examined the size effects of exchange rate volatility spill over for firm performance in Taiwan tourism industry. The estimation was based on two conditional multivariate models, BEKK-GARCH and VARMA-AGARCH in the volatility specification. The study utilized daily data from 1 July 2008 to 29 June 2012 for 999 firms which cover the period of global financial crisis. It was found that there are size effects of volatility spillovers from the exchange rate to firm performance. Specifically, the risk for firm size has different effects from the three leading tourism sources to Taiwan, namely, USA, Japan and China. A negative correlation was also obtained between exchange rate and stock returns. McAleer *et al* (2009) argued that the model of conditional variance simultaneously captures the properties of asymmetric effects and volatility spill-over in variables.

Concentrating on sectoral data, Varela (2007) and Wang and Barret (2007) have analyzed the effect of exchange rate volatility on exports. For instance, Varela (2007) examined the impact of real effective exchange rate volatility on domestic sectoral output among some Latin American countries namely Argentina, Brazil and Uruguay between 1970 and 2005. The study employed both GARCH technique and Autoregressive Integrated Moving

Average (ARIMA) to measure the degree of real effective exchange rate volatility. The ARIMA model was derived from the rolling variance of the forecast error from the best fit series of the growth rate of REER. An augmented supply function was estimated using instrumental variable technique to correct for endogeneity problem in the model. The study reported a negative non-negligible effect of exchange rate volatility on output. A threshold effect of volatility was visible in the model indicating that it is high volatility that affects output the most. Furthermore, it was shown that the effect of volatility on output is heterogeneous across sectors.

In addition, Wang and Barret (2007) investigated the effect of exchange rate volatility on international trade flows of Taiwan's export to the United States between 1989 and 1998. The study employed multivariate generalized autoregressive conditional heteroskcedasticity in mean model (MGARCH-mean) which accommodates non-normality in regression residuals. In order to determine differences in sectoral responses to exchange rate, monthly export data were explored based on the standard classification of various commodities, the variables were analyzed in an autoregressive moving average framework. It was found that change in exchange rate and importing country industrial production influenced trade volumes. In particular, exchange rate volatility affected trade in agricultural sector; however mild effect were experienced in other sectors. This result implies that primary products exports can be more affected by excessive exchange rate volatility.

Futhermore, Sato *et al* (2013) used industry specific bilateral real exchange rate and finished goods exports of Asian trading partners by taking into consideration the import demand of countries outside the Asian continent. Two measures of exchange rate volatility were constructed. First, is the standard deviation of the log difference of the industry-specific bilateral real exchange rate, second is the conditional volatility of industry-specific real exchange rate estimated by GARCH (1,1) model. Using a pooled OLS estimator, the study takes into account time varying country and the time fixed effects from the period 2003 to 2010. It was found that exchange rate impact on intra-region trade differs across industries. Exchange rate volatility has negative and significant effect only on general machinery industry and a part of the electric machinery industry with more differentiated products. The result does not change when taking into account the world's demand for the

final processed exports. These findings suggest that the different impact of the exchange rate volatilities across industries has to do with the characteristics of traded goods in the respective industries.

3.5 Effect of Exchange Rate Volatility on Economic Activities on the Aggregate

In a macroeconomic context, many studies have examined the relationship between exchange rate volatility and economic activities. Negative effects of exchange rate volatility on trade were reported by many authors namely, Odusola and Akinlo (2001), Arize *et al* (2005), Azid *et al* (2005), Aqeel and Nishat (2006), Bahmani-Oskooee and Wang (2007), Udo and Egwaikhide (2008), Thorbecke (2011), Olugbenga (2012) and Goudarzi *et al* (2012).

The focus of Baum *et al* (2004) was on the impact of exchange rate volatility on real international trade flows using data from 13 countries. A flexible distributed lags model was adopted to analyze the model. The general conclusion of the study is that the effect of exchange rate volatility on trade flows is non linear; it depends on its interaction with importing country's volatility of economic activities and that it varies considerably over the set of country's considered.

The preoccupation of Rey (2006) was on the impact of nominal and real effective exchange rate volatility on exports of six Middle Eastern and North Africa (MENA) countries to 15 member countries of the European Union from 1970Q1 to 2002Q4. To estimate exchange rate volatility, the study adopted two methods namely, moving average standard deviation and conditional standard deviation. Johasen cointegration and Error correction models were used to determine the long and the short run dynamics respectively. The results based on coitegration show that real exports are cointegrated with REER, European GDP and exchange rate volatility. In some of the empirical models, exchange rate volatility was significant, but the signs of the coefficients are either positive or negative depending on whether real or nominal exchange rate was used and the country.

Vinh and Fujita (2007) analyzed the effect of changes in the real exchange rate on output and inflation in Vietnam. Impulse response function revealed that devaluation shock on the

real exchange rate leads to an increase in output as well as in price level. In addition, results derived from the analysis of forecast variance decomposition show that change in real exchange rate is not the main source of variation in output and price level. The main source of variation in output and price level is internal shock, devaluation account for a higher proportion in the variation of output than that of price level.

Empirical findings by Kandil (2008) suggests that a positive shock to the exchange rate, an unanticipated depreciation of the domestic currency, increases net exports and money demand and decreases output supplied. A negative shock to the exchange rate, an unanticipated appreciation of the domestic currency, decreases net exports and money demand and increases the output supplies. The implication of the findings is that the combined effects of demand and supply channels may establish asymmetry in the face of positive and negative shocks to the exchange rate. Similarly, the study by Rahman and Serletis (2008) revealed that exchange rate uncertainty has a negative and significant effect on US export. Exchange rate uncertainty tends to strengthen the dynamic response of exports to shocks in the exchange rate and that export respond asymmetrically to positive and negative exchange rate shocks of equal magnitude. The study conducted by Udoh and Egwaikhide (2008) established a negative relationship between exchange rate volatility and FDI in Nigeria.

Bahmani-Oskooee and Hegerty (2009) examined the effects of exchange rate volatility on commodity trade between the United States and Mexico using annual export and import data for 102 industries from 1962 to 2004. The study used ARDL bound testing approach to determine the long run effect and Error Correction Model to estimate the short run dynamics. The results obtained were mixed. There were 61 industries in which exchange rate volatility have a significant short-term effect. While in some industries, the effects were negative, in others, the effects were positive. On average, exchange rate volatility has short-term effect on 61 industries, a long term effects were found for 32 industries. This suggests that at the period where trade contracts are temporal, exchange rate volatility can be detrimental to exports.

The short run and long run effects of real effective exchange rate volatility on the Mauritian export performance were investigated by Verena and Iawsheer (2011). Exchange rate volatility was derived from the moving average standard deviation method since no GARCH effect was obtained due to the short period covered which was between 1975 and 2007. An autoregressive Distributed Lags Model was specified to analyze the variables employed. It was found that exchange rate volatility has a positive and significant short run effect on exports. However, exchange rate volatility adversely affects export in the long run. The results imply that excessive volatility for a long time can be detrimental to Mauritian export.

Azeez *et al* (2012) study revealed that exchange rate movement has negative effect on outputs in the short run in Nigeria. Further findings show that oil revenue and balance of payment exerted negative effect while exchange rate volatility contribute positively to output in the long run. This study provided evidence of mixed result regarding the effect of exchange rate on GDP in Nigeria. While negative effect was observed in the short run, positive impact was found in the long run. Olugbenga (2012) found that exchange rate as a factor exerts significant impact on Nigeria stock market both in the short run and long run. In the short run, exchange rate has a positive significant impact on stock market performance in Nigeria. However, the results also show that the relationship is significantly negative in the long run. A major weakness of this study is that it computed fluctuation in exchange rate movement instead of computing volatility in exchange rate.

From the literature reviewed, it is obvious that there is no study that has critically addressed the effects of exchange rate volatility on firm-level economic activities in Nigeria. A few studies have examined the relationship between exchange rate volatility and aggregate economic variables. The inference drawn from studies based on aggregate data cannot be used for micro-based decisions. Hence, there is need to fill the gap in the literature.

CHAPTER FOUR

THEORETICAL FRAMEWORK AND METHODOLOGY

4.1 Introduction

This chapter covers the theoretical framework and methodology for the thesis. The theoretical relationship of the effect of exchange rate volatility on firms' investment, output and export is examined. In addition, the empirical model, model estimation procedure and technique are explored. Finally, the chapter presents the nature, measurement and sources of data used for the study.

4.2 Theoretical Framework

The theoretical analysis of the relationship between higher exchange rate volatility and firm's performance has been discussed in the paper by Clark (1973) which was extended by Hooper and Kohlagen (1978). The argument is that higher exchange rate volatility leads to higher cost for risk-averse traders and less foreign trade. If exchange rate becomes unpredictable, it creates uncertainty about the profit to be made and reduces the marginal benefit to the firm of involving in international transactions. Campa and Goldberg (1999) developed a model that shows how exchange rate volatility affects investment decisions of firms. These models are modified and extended for this study.

The model adopted in this study follows the basic Neo-classical model of the firm which was extended by Campa and Goldberg (1999). The model assumes a representative firm that chooses investment (I) to maximize the present value of its profit (π). The capital employed in the production process is subject to capital accumulation equation with an increasing and convex cost of increasing capital. The value function of the firm at time t is expressed as:

$$U_t(K_t, e_t) = \max_{I_t} E\left[\sum_{\tau=0}^{\infty} \beta^{\tau}\left[\pi\left(K_{t+\tau}, e_{t+\tau}\right) - c\left(I_{t+}\right) - I_{t+\tau}\right] | \omega_{\tau}\right]$$

Subject to $K_{t+1} = (1-\delta)K_t + I_t$ (4.1)

In equation (4.1), K_t is the initial capital stock at period t, π is the profit function, δ is the rate of depreciation of capital stock, β is the discount rate, I_t is the investment expenditure in period t, c is the capital adjustment cost function, e_t is the period t exchange rate and $E[.|\omega_t]$ is the expectations operator conditional on the time t information set. Here, it is assumed that the only source of uncertainty about the future is the exchange rate. The first order condition for maximizing the firm's value function subject to its constraint is given by:

$$E\left[U_t^k \mid \omega_t\right] = 1 + \frac{\partial c\left(I_t\right)}{\partial I_t};$$

$$U_t^k = \sum_{\tau=1}^{\infty}\left[\beta(1-\delta)\right]^{\tau}\left[\frac{\partial \pi\left(K_{t+\tau}, e_{t+\tau}\right)}{\partial K_{t+\tau}}\right] \quad (4.2)$$

The expression in equation (4.2) shows that the firm should invest up to the point where the marginal cost of an additional unit of capital equals the expected present value of future profit generated by the marginal increase in capital. Assuming the adjustment cost of capital takes a quadratic form:

$$c(I_t) = \frac{\theta}{2}\left(I_t - \upsilon\right)^2 \quad (4.3)$$

By substituting $c(I_t)$ in the capital adjustment cost in equation (4.2) and expressing the resulting equation in terms of I_t, the first order condition of the firm's profit maximization function gives

$$I_t = \upsilon' + \frac{1}{\theta} E\left[U_t^k \mid \omega_t\right] = \upsilon' + \sum_{\tau=1}^{\infty} \lambda^{\tau} E\left[\pi_{t+\tau}^k \mid \omega_{\tau}\right] \quad (4.4)$$

where $\upsilon' = \upsilon - \frac{1}{\theta}$ *and* $\lambda = \frac{\beta(1-\delta)}{\theta^{1/\tau}}$, $\pi^{k}_{t+\tau}$ is an expression for the marginal productivity of capital.

It is further assumed that the firm's production technology is a function of capital and labour, and its total sales can be divided into domestic and export sales. This can be expressed as:

$$\begin{aligned} Q_t^s &= f(K_t, L_t, L_t^*) \\ Q_t^s &= q_t + q^* \end{aligned} \qquad (4.5)$$

Where Q_t^s represents good produced that can be sold in domestic and foreign market, K_t L_t *and* L_t^* are capital and labour skills employed from both domestic and foreign factor market. Exchange rate affects goods produced for domestic sales through the procurement of inputs from abroad (import channel), while it affects commodity export through the import and export channels[15]. At the beginning of each period, the firm takes exchange rate e_t as given and chooses its output sales in the foreign and domestic markets using domestic and foreign variable inputs in order to maximize the per-period profits. The producer profit for the representative firm is given as:

$$\begin{aligned} &\pi(q_t, q_t^*\ K_t\ e_t) = \max_{q_t\ q_t^*\ L_t\ L_t^*} p(q_t, e_t)q_t + e_t p^*(q_t^*, e_t)q_t^* - w_t L_t - e_t w_t^* L_t^* \\ &\textit{Subject to} \qquad q_t + q^* = f(K_t, L_t, L_t^*) \end{aligned} \qquad (4.6)$$

Where q_t *and* q_t^* are the quantities supplied by the firm to the domestic and foreign markets, L_t *and* L_t^* are quantities of domestic and foreign variable inputs, w *and* w^* are unit cost of the domestic and foreign variable inputs, $p(q_t, e_t)$ *and* $p^*(q_t, e_t)$ are the demands faced by the firm and $f(K_t, L_t, L_t^*)$ exhibits constant returns to scale. Both the domestic and foreign demand functions of the firm depend on the quantities supply by the producer to each market and the exchange rate. Exchange rate is assumed to follow a log-

[15] Export channel relates to the impact of exchange rate on the sales of goods in the foreign market.

normal distribution with mean μ and variance δ^2. Hence, exchange rate can be expressed as $e = \exp\left(\mu + \frac{\delta^2}{2}\right)$

Assuming capital is constant, the profit maximization function for the firm can be expressed as:

$$\pi = p(q_t, e_t)q_t + e_t p^*\left(q_t^{*}{}'e_t\right)q_t^* - w_t L_t - e_t w_t^* L_t^* - \lambda\left(q_t + q_t^*\right) \tag{4.7}$$

4.2.1 The Effect of Exchange Rate Volatility on Firm's Investment

Understanding the effect of exchange rate on investment requires knowing how it affects the marginal profitability of capital. The first order condition for the maximization problem in equation (4.6) can be expressed as:

$$\left(1 + \eta_t^{-1}\right) p(q_t, e_t) = \left(1 + \eta_t^{*-1}\right) e_t\, p^*\left(q_t^*, e_t\right) \tag{4.8}$$

Equation (4.8) shows that the marginal revenue from the domestic market must be equal to the marginal revenue from the foreign market. Similarly, the first order condition for the marginal productivities of labour in both domestic and foreign market must equal the marginal cost (the wage rate).

$$\left[p(q_t, e_t)\left(1 + \eta_t^{-1}\right)\right]\frac{\partial f}{\partial L_t} = w_t \tag{4.9}$$

$$\left[p(q_t, e_t)\left(1 + \eta_t^{-1}\right)\right]\frac{\partial f}{\partial L_t^*} = e_t w_t^* \tag{4.10}$$

Equations (4.9) and (4.10) reveal that the values of marginal productivities of domestic and foreign variable inputs (labour) are equal to marginal cost. Differentiating equation (4.6) with respect to capital yields:

$$\frac{\partial \pi_t(K_t)}{\partial K_t} = \left(1 + \eta_t^{-1}\right) p(q_t, e_t)\frac{\partial f}{\partial K_t} \tag{4.11}$$

In addition, the marginal productivity of capital can be derived by substituting the value of w_t *and* $e_t w_t^*$ in equations (4.9) and (4.10) in the average profit of capital.

$$\frac{\pi_t}{K_t} = \frac{p(q_t, e_t)q_t + P^*(q_t^*, e_t)q_t^*}{K_t} - (1 - n_t^{-1})p(q_t, e_t)\left[\frac{L_t}{K_t}\frac{\partial f}{\partial L_t} + \frac{L_t^*}{K_t}\frac{\partial f}{\partial L_t^*}\right] \tag{4.12}$$

The constant returns to scale production function ($f(K_t, L_t, L_t^*) = q_t + q_t^*$) can be transformed by using Euler's equation, that is:

$$\frac{\partial f}{\partial K_t}K_t + \frac{\partial f}{\partial L_t}L_t + \frac{\partial f}{\partial L_t^*}L_t^* = q_t + q_t^* \tag{4.13}$$

By substituting equation (4.13) into equation (4.12) yields:

$$\frac{\pi_t}{K_t} = \frac{p(q_t, e_t)q_t + P^*(q_t^*, e_t)q_t^*}{K_t} - (1 + \eta_t^{-1})p(q_t, e_t)\left[\frac{q_t + q_t^*}{K_t} - \frac{\partial f}{\partial K_t}\right] \tag{4.14}$$

Expressing equation (4.14) in terms of $\frac{\partial f}{\partial K_t}$ and substituting it into equation (4.12), the marginal profitability of capital gives:

$$\frac{\partial \pi_t}{\partial K_t} = \frac{\pi_t}{K_t} - \frac{p_t q_t + p_t^* q_t^*}{K_t} + (1 + \eta_t^{-1})\frac{p_t(q_t + q_t^*)}{K_t} \tag{4.15}$$

Factorizing and rearranging equation (4.15) becomes:

$$\frac{\partial \pi_t}{\partial K_t} = \frac{1}{K_t}\left[V^{-1}p_t q_t + V^{*-1}e_t p_t^* q_t - (w_t L_t + e_t w_t^* L_t^*)\right] \tag{4.16}$$

Where $V = \frac{1}{(1 + \eta_t^{-1})} = \frac{p_t}{MC_t}$ *and* $V^* = \frac{1}{(1 + \eta^{*-1})} = \frac{e_t p_t^*}{MC_t}$ are equal to mark up[16] of domestic and foreign markets, respectively. η_t *and* η_t^* are price elasticity of demand in the domestic and foreign market markets and MC_t is the marginal cost.

[16] Mark up is the price-cost margin of the firm

Assuming exchange rate is unanticipated and volatile, the expected marginal profitability in the future periods depends on today's marginal profitability of capital, $E\left[\pi_{t+\tau}^{k} \mid \omega_t\right] = \pi_t^k$, Equation (4.4) becomes $I_t = \upsilon' + P\pi_t^k$

$$I_t = \upsilon' + \frac{P}{K_t}\left[V^{-1} p_t q_t + V^{*-1} e_t p_t^* q_t^* - \left(w_t L_t + e_t w_t^* L_t^*\right)\right] \tag{4.17}$$

Where $P = \dfrac{\beta}{\theta\left(1-\beta(1-\delta)\right)}$

Differentiating equation (4.17) with respect to exchange rate, collecting the like terms, and multiplying and dividing by e_t and total revenue yields:

$$\frac{\partial I_t}{\partial e_t} = \frac{P_t'}{PV_t}\left[\left(\eta_{p,e} - \eta V_{p,e}\right)\left(1-EX\right) + \left(1 + \eta V^{*}{}_{P^*,e} - \eta V^{*}{}_{p^*,e}\right)EX - \left(1+\eta_{w^*,e}\right)\beta_t\right]\frac{de_t}{e_t} \tag{4.18}$$

Where $P_t' = \dfrac{P.TR}{K_t}$, TR is the total revenue. $\eta_{p,e}$ *and* $\eta_{p^*,e}$ are exchange rate pass-through elasticities in domestic and foreign markets $\eta V_{p,e}$ *and* $\eta V_{p^*,e}$ are mark up elasticities for domestic and foreign sales in response to exchange rate volatility. PV_t is the average mark up across domestic and foreign sales. EX_t *and* $\left(1 - EX_t\right)$ represent the share of total revenues associated with foreign and domestic sales. β_t is the share of imported input in the production cost times the elasticity of input costs with respect to exchange rate.

Let the total sales from domestic and foreign markets equal Q and the cost associated with the production and sales equals C, therefore, Q can be expressed in a functional form as:

$$Q = f(EX)$$

Where EX is foreign sales and Q is the total sales. Incorporate Q into equation (4.18), hence, from equation (4.18), the functional expression of the effect of exchange rate volatility on investment can be presented following Campa and Goldberg (1999) as:

$$I_t = f(e_t\, \partial e_t, Q_t, rir_t) \tag{4.19}$$

Equation (4.18) provides a useful framework on the channels through which exchange rate volatility affect firm's investment through the marginal profitability of capital. Exchange rate volatility raises marginal profitability of capital when export sales increases. Accordingly, higher export sales spur investment. However, if the import of capital goods rises, exchange rate volatility reduces marginal profitability of capital and depresses investment.

4.2.2 The Effect of Exchange Rate Volatility on Firm's Output and Export

The impact of the outputs (q_t) and exports (q_t^*) on the profit function of the firm can be derived by taking the partial derivative of the firm profit in equation (4.6) with respect to outputs and exports as well as domestic and foreign inputs.

$$\frac{\partial \pi}{\partial q_t} = q_t p\left(q_t, e_t\right)' + p\left(q_t, e_t\right) - \lambda = 0 \tag{4.20}$$

$$\frac{\partial \pi}{\partial q_t^*} = q_t^* e_t p^*\left(q_t^*, e_t\right)' + e_t p^*\left(q_t^*, e_t\right) - \lambda = 0 \tag{4.21}$$

$$\frac{\partial \pi}{\partial L_t} = -w_t - \lambda\left(q_t + q_t^*\right)' = 0 \tag{4.22}$$

$$\frac{\partial \pi}{\partial L_t^*} = -ew_t^* - \lambda\left(q_t + q_t^*\right)' = 0 \tag{4.23}$$

Equations (4.22) and (4.23) can be re-expressed as

$$\lambda = -\frac{w_t}{\left(q_t + q_t^*\right)'} \tag{4.24}$$

$$\lambda = -\frac{e_t w_t^*}{\left(q_t + q_t^*\right)'} \tag{4.25}$$

By substituting equation (4.24) and (4.25) into equation (4.20) and (4.21) yield:

$$q_t p(q_t, e_t)' + p(q_t, e_t) - \frac{w_t}{(q_t + q_t^*)'} = 0 \tag{4.26}$$

and

$$q_t^* e_t p^*(q^*, e_t)' + e_t p^*(q_t^*, e_t) - \frac{e_t w_t^*}{q_t + q_t^*} = 0 \tag{4.27}$$

Expressing the relationship in equations (4.26) and (4.27) in terms of q_t and q_t^* respectively will result in:

$$q_t = \frac{w_t - p(q_t, e_t)(q_t + q_t^*)'}{p(q_t, e_t)'(q_t + q_t^*)'} \tag{4.28}$$

$$q_t^* = \frac{w_t^* - p^*(q_t, e_t)(q_t + q_t^*)'}{p^*(q_t, e_t)'(q_t + q_t^*)'} \tag{4.29}$$

Hence, the changes in domestic and export sales as a result of exchange rate volatility can be expressed as:

$$\frac{\partial q_t}{\partial e_t} = -\frac{p(q_t, e_t)'(q_t + q_t^*)'\left[p(q_t, e_t)'(q_t + q_t^*)'\right]}{\left[p(q_t, e_t)'(q_t + q_t^*)'\right]^2} - \frac{\left[w - p(q_t, e_t)(q_t + q_t^*)'\right]\left[p(q_t, e_t)''(q_t + q_t^*)'\right]}{\left[p(q_t, e_t)'(q_t + q_t^*)'\right]^2} \tag{4.30}$$

and,

$$\frac{\partial q_t^*}{\partial e_t} - \frac{p^*\left(q_t^*, e_t\right)'\left(q_t + q_t^*\right)'\left[p^*\left(q_t^*, e_t\right)'\left(q_t + q_t^*\right)'\right]}{\left[p^*\left(q_t^*, e_t\right)'\left(q_t + q_t^*\right)'\right]^2} - \frac{\left[w_t^* - p^*\left(q_t^*, e_t\right)\left(q_t + q_t^*\right)'\right]\left[p^*\left(q_t^*, e_t\right)''\left(q_t + q_t^*\right)'\right]}{\left[p^*\left(q_t^*, e_t\right)'\left(q_t + q_t^*\right)'\right]^2} \tag{4.31}$$

In a reduce form, equations 4.30 and 4.31 can be expressed as:

$$\frac{\partial q_t}{\partial e_t} = -\frac{\left[w - p(q_t, e_t)\left(q_t + q_t^*\right)'\right]\left[p(q_t, e_t)''\left(q_t + q_t^*\right)'\right]}{\left[p(q_t, e_t)'\left(q_t + q_t^*\right)'\right]^2} \quad < 0 \tag{4.32}$$

and,

$$\frac{\partial q_t^*}{\partial e_t} = -\frac{\left[w_t^* - p^*\left(q_t^*, e_t\right)\left(q_t + q_t^*\right)'\right]\left[p^*\left(q_t^*, e_t\right)''\left(q_t + q_t^*\right)'\right]}{\left[p^*\left(q_t^*, e_t\right)'\left(q_t + q_t^*\right)'\right]^2} \quad < 0 \tag{4.33}$$

Equation (4.32) and (4.33) can be expressed in the functional form as;

$$q_t = f(e_t, \partial e_t, p_t, I_t, w_t) \tag{4.34}$$

Similarly

$$q_t^* = f\left(e_t, \partial e_t, p_t^*, I_t, w_t^*\right) \tag{4.35}$$

Here, since there is no wage differential $w_t = w_t^*$

Where p_t and p_t^* represent domestic and foreign price respectively, w_t and w_t^* stand for domestic and foreign wage and I_t is investment. Here, I_t comes in as a factor in the production process. The expression in equations (4.32) and (4.33) indicate that the effect of exchange rate volatility on domestic and foreign sales is negative. This implies on *a priori*,

that a risk averse producer will reduce his domestic and foreign sales in the presence of exchange rate volatility.

4.3 Methodology

4.3.1 Econometrics Model

This enquiry centers on the effects of exchange rate volatility on firms' economic activities. The theoretical model presented in the previous section shows the link between output and input of a firm operating in a competitive market, involving in international transaction. Exchange rate affects firms' activities via two channels, namely the import and export channels. The model draws from the work of Campa and Goldberg (1999) with some extensions to suit the peculiarities of the firms listed on the stock exchange in Nigeria and the environment in which they operate. More specifically, the model was modified to adapt for oil resources by capturing the variation in oil price[17]. The investment decision depends on previous capital stock, output, real interest rate real exchange rate and exchange rate volatility. In addition, output of the firms depends on its various inputs which include the level of investment, labour force as well as real exchange rate, exchange rate volatility and the price of other inputs which is proxied by the real price of oil. Firms' exports are affected by real exchange rate, exchange rate volatility, the level of investment and labour employed and oil price.

4.3.2 The Generalized Method of Moment Model

In order to determine the effect of exchange rate volatility on firm-level economic activities, the study would employ a panel data approach. The one step system GMM technique will be used in this study following Blundell and Bond (1997). All variables in level form would be instrumental by their lagged values. In addition to the correction of problems emanating from unobserved heterogeneity of firms, the systems GMM will also enable to solve endogeneity problem associated with systems of equation. The GMM estimator is consistent and asymptotically normally distributed. Besides, the GMM

[17] As a result of the level of development in Nigeria and unstable electricity supply many of the manufacturing firms depend on private own electrical plant which are being run by fuel. This is adapted into the model by including oil prices variation.

technique uses the lag of dependent variable which enables the incorporation of variables that are stationary at first difference. Hence, a system GMM suggested by Blundel and Bond (1998) is more appropriate for this study. The standard GMM has a weakness of generating large finite sample bias and very low precision. Blundell *et al* (2000) argued that a system GMM not only improves the precision but also reduces the finite sample size.

Essentially, in this study the number of observations differs among panel, since listed firms in Nigeria have different age[18]; many of the listed firms recently forwarded their annual reports to NSE[19] which makes their information not to be available in some years hence an unbalanced panel would be appropriate. A typical panel data model can be expressed as follows:

$$y_{it} = \alpha + X_{it}^{'}\beta + u_{it} \qquad i = 1,...,N; \qquad t = 1,...,T \tag{4.36}$$

The subscript i denotes firms in this case and t denoting time. Hence the i subscript denotes the cross-section dimension while t refers to the time-series dimension. A is the scalar component, β possesses K X 1 dimension and X_{it} is the $_i$th observation on K explanatory variable. The error component model for the disturbance u_{it} is given as:

$$u_{it} = \mu_i + v_{it} \tag{4.37}$$

Where μ_i denotes the unobservable individual-specific effect and v_{it} denotes the remainder disturbance. The disturbance v_{it} varies with individual and time and can be thought of as the usual disturbance in the regression. This study which involves a production function utilizing data on firms across time, y_{it} will measure the dependent variable and X_{it} will measure the explanatory variables. The unobservable firm-specific effects will be captured by μ_i. The model assumes X variables are non-stochastic and that the error term is normally distributed with mean zero, $E(u_{it}) \sim N(0, \delta^2)$. In this case, u_{it} is assumed to be

[18] This suggests different time series; also some are being established very recently.
[19] Following that the Nigeria Stock Exchange (NSE) made it mandatory for all public coated firms to summit their annual report to the organization.

fixed parameters to be estimated and the remaining disturbance stochastic component v_{it} are assumed to be independent and identically distributed $IID\left(0,\delta_v^2\right)$.

The model for estimation can be expressed in a more specific form. First is the equation that shows the relationship between exchange rate and listed firms' investment in Nigeria. The dependent variable is the firms' investment $I_{t,}$, while the while explanatory variable include, one period lag investment, real interest rate r_t, real exchange rate, real exchange rate volatility and output. Second is the output model, explanatory variables are investment measure by capital expenditure in each firm I_t, numbers of workers NW_t, real exchange rate rer_{it}, real exchange rate volatility, Vol, and price of other inputs (proxied by oil price, $Oilp_{it)}$. In the third equation, the value of export is the dependent variable and the explanatory variables include number of workers employed, real exchange rate, real exchange rate volatility and oil prices.

Therefore the empirical model for this study can be expressed as:

$$Inv_t = f\left(rer_t, Vol_t, Inv_{t-1}, rir_t, Q_t\right) \tag{4.38}$$

$$Q_t = f\left(rer_t, Vol_t, \ Inv_t, NW_t, Oilp_t\right) \tag{4.39}$$

$$\exp_t = f\left(rer_t, \ Vol_t, Inv_t \ NW_t, Oilp_t\right) \tag{4.40}$$

The GMM models for estimation in this study can be expressed as follows:

$$\ln Inv_{it} = \delta_0 + \delta_1 \ln inv_{it-1} + \delta_2 rer_{it} + \delta_3 Vol_{it} + \delta + \delta_4 rir_{it} + \delta_5 \ln Q_{it} + e_{it}$$
$$\delta_1 > 0, \ \delta_2 < 0 \ \ \delta_3 < 0, \ \delta_4 < 0, \ \delta_5 > 0 \tag{4.41}$$

$$\ln Q_{it} = \beta_0 + \beta_1 \ln Q_{it-1} + \beta_2 rer_{it} + \beta_3 vol_{it} + \beta_4 \ln inv_{it} + \beta_5 \ln nw_{it} + \beta_6 \ln Oilp_t + u_{it}$$
$$\beta_1 > 0, \ \beta_2 < 0, \ \beta_3 < 0, \ \beta_4 > 0, \beta_5 > 0, \beta_6 < 0 \tag{4.42}$$

$$\ln \exp_{it} = \alpha_0 + \alpha_1 \ln \exp_{it-1} + \alpha_2 rer_{it} + \alpha_3 vol_{it} + \alpha_4 \ln inv_{it} + \alpha_5 \ln nw_{it} + \alpha_6 \ln oilp_t + \varepsilon_{it}$$
$$\alpha_1 > 0, \ \alpha_2 < 0, \ \alpha_3 < 0, \ \alpha_4 > 0, \ \alpha_5 > 0, \alpha_6 > 0 \tag{4.43}$$

Equation 4.41 is the investment model; it is expected that the coefficients of one period lag investment and firms' output to be positive while the coefficients of exchange rate volatility, real exchange rate and real interest rate are expected to be negative. In the output

model (4.42), the *a priori* expectation require the coefficients of investment and number of workers to have positive effects on output while that of exchange rate volatility, real exchange rate and oil price are expected to be negative. Lastly, in equation 4.43, the expectation is that investment and number of workers to be positive whereas exchange rate volatility, real exchange rate and oil price are expected to exert negative effects on export.

Table 4.1 Definition of Variables

Denotation	Variables	Definition
Q	Output of listed firms	Proxy by their domestic turnover. It is the amount of sales by firms in the domestic country
Exp	Exports of various firms	This is the amount of foreign sales in Naira
Inv	Investment of the firms	Proxy by capital expenditure
rer	Real exchange rate	Changes in the level of bilateral real exchange rate adjusted for domestic and foreign prices.
Vol	Exchange rate volatility	sudden changes in bilateral real exchange rate
NW	Numbers of workers employed	labour force of the firms
Oilp	Oil price	crude oil price measures in USD
rir	real interest rate	Real real interest rate measuring return on investment

Notes: Q, exp and Inv are the dependent variables; Source: Compiled

4.4 Panel Unit Root Test

The first step before commencing on the estimation is to perform unit root test on all the series to avoid spuriousness in conducting regression on non stationary data. The IM-Pesaran-Shin panel unit root test is employed for this study. This has as its null hypothesis that all panel contain unit root while the alternative is that some panel contain unit root. If variables are stationary at levels, static regression can be relied on but if not then there is need to conduct dynamic regression (Adeniyi and Egwaikhide, 2013). The procedure enables to combine information from series that have both time and cross section dimensions. Additionally, this method is often adopted in analysis involving a few time observations and it allows for heterogeneity in the coefficient of the depended variable. The model specification for the IM-Pesaran-Shin test to be conducted in this study with individual effects and no time trend can be expressed as follows:

$$\Delta y_{it} = \alpha_i + \rho_i y_{it-1} + \sum_{z=1}^{p_i} \beta_{iz} \Delta y_{it-z} + e_{it} \qquad (4.44)$$

The null hypothesis state that all panel contain unit root. This occur when $H_0 : \rho_i = 0$ for all $i = 1, \ldots, N$. The alternative hypothesis is $H_1 : \rho_i < 0$ for all $i = 1, \ldots, N$ and $\rho_i = 0$ for $i = N_1 + 1, \ldots, N$ with $0 < N_1 \leq N$.

This test is based on the augmented Dickey Fuller statistics frequently used in time series analysis. The t-statistic for testing unit root in the i^{th} firm is

$$t - bar_{NT} = \frac{1}{N} \sum_{i=1}^{N} t_{iT} (\rho_i, \beta_i)$$

The statistic is assume to sequentially converge to a normal distribution when T tends to infinity followed by N (Hurlin, 2004).

4.5 GARCH Model

Different techniques have been used in the literature in estimation volatility. Some of these techniques include simple percentage change, standard deviation, variance, Autoregressive

Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH).

A generalized ARCH denoted as GARCH (1,1) model is adopted for this study to test the existence of volatility in the real exchange rate. It can be viewed as a special case of more general GARCH (p,q) model where p is the number of lagged, q is the number of lagged e^2 and h is the real exchange rate term. It follows the expression:

$$h_t = \rho + \alpha_1 e_{t-1}^2 + \beta_1 h_{t-1} \qquad (4.45)$$

GARCH (1,1) is a very popular specification because it tells us that the volatility changes with lagged shocks e_{t-1}^2 but there is a surprise shock in the system also working via h_{t-1}. GARCH model is used in this study to test the existence of volatility during the period under study.

4.6 Data Measurement and Sources

This study employs data from various sources from 1990 to 2012. Specifically, data on oil price, nominal exchange rate, real exchange rate, and real interest rate are collected from IMF International Financial Statistics publication. The data on exchange rate are measured in domestic currency to US dollars with some adjustment for consumer price index in the case of real exchange rate and real interest rate. The real exchange rate is use because of its close correlation with nominal exchange rate; nominal exchange rate is an important source of systematic volatility. Also data such as output, export, import, number of workers and investment are collected from various listed companies financial report and statement of account various issues.

CHAPTER FIVE
EMPIRICAL ANALYSIS AND INTERPRETATION

5.1 Introduction

This chapter presents the estimated results of the models specified in the preceding chapter. It begins with the descriptive statistics and unit root tests. The IM-Pesaran and Shin panel unit root tests for stationarity are reported for both the aggregate and the sub-sectors' variables. This is followed by the results of GARCH technique use to determine the existence of volatility in the real exchange rate. The estimated panel results for both aggregate and sector-specific using the system GMM are then discussed. The ARCH LM serial correlation test is used to determine the presence of autocorrelation in the regression. Accordingly, the choice of the instrumental variable employed in the dynamic regressions is validated by both the Sargan and Hansen tests.

5.2 Preliminary Analysis

5.2.1 Summary Statistics of the Sectoral Aggregate

Table 5.1 shows the summary statistics of the sectoral aggregate variables. The aggregate output has the highest mean value, implying that the average sales in the domestic market are higher than export during the period under consideration. However, the average real interest rate is low, suggesting an inducement of investment during the period. Export data have the highest standard deviation, possibly explained by factors namely, exchange rates, tariff and non-tariff barriers, labour and capital inputs affecting the volume of exports by firms listed on the NSE thereby producing highly unstable figures of their exports sales. The high figure of the standard deviation can be as a result of both economic and non-economic factors that affect the export of firms listed on the NSE. Some of the factors include logistic, infrastructure and exchange rate. Similarly, export data have skewness that

deviate significantly from normality[20]. However, the skewness of real exchange rate and real interest rate do not depart significantly from normal distribution. Additionally, real exchange rate and oil price have Platykurtic distribution which implies that their degrees of peakedness are flatter than normal distribution. Conversely, variables namely, export sales, investment, output, exchange rate volatility and numbers of workers employed have Leptokurtic distribution, sharper than a normal distribution, with values concentrated around the mean and thicker tails. The real interest rate and export's data have high coefficient of variation around their mean.

[20] If skewness is not close to zero and if kurtosis is not close to 3, then we reject the normality of the population

Table 5.1: Summary Statistics of the Sectoral Aggregate

Statistics	Q (₦)	rer(₦/USD)	Vol(%)	inv(₦)	exp (₦)	oilp (USD)	nw	rir (%)
Mean	2.0E+11	75.0	6.4	3.8E+09	5.8E+09	4.3E+01	5.7E+03	1.2
Max	2.2E+12	177.5	38.8	9.8E+10	2.4E+10	1.1E+02	8.3E+04	25.1
Min	5.6E+07	0.5	0.0	5.1E+06	1.1E+06	1.3E+01	0.0E+00	-32.0
Median	2.1E+10	70.3	3.4	5.1E+08	8.7E+07	2.5E+01	1.4E+03	0.8
Range	2.2E+12	177.1	38.7	9.8E+10	2.4E+11	9.9E+01	8.3E+04	57.2
Sd	4.3E+11	64.1	9.4	1.1E+10	2.6E+10	3.2E+01	1.2E+04	13.6
Skewness	3.0E+00	0.1	2.2	5.2E+00	7.3E+00	1.1E+01	3.7E+00	-0.4
Kurtosis	1.2E+01	1.4	7.3	3.6E+01	6.0E+01	2.7E+01	2.0E+01	3.0
Variance	1.8E+23	4116.1	88.2	1.1E+20	6.9E+19	1.0E+03	1.3E+08	189.2
CV	2.1E+00	0.9	1.5	2.8E+00	4.5E+00	7.5E-01	2.0E+01	11.2

Source: Author's computation using STATA 12

5.2.2 Summary Statistics of the Food Products and Beverage Sub-sectors

The summary statistics of the food products sub-sector on table 5.2 indicate that output recorded the highest mean value, followed by the export sales. This implies that, on average firms in this sub-sector sells more in the domestic market than foreign market. The average number of workers employed over the years under study was 3070. Comparing the workers employed with the investment in capital, clearly indicate that the sector is capital intensive. Output of the sub-sector has the highest standard deviation and variance; this could be explained by the fluctuation in business cycle, since the sub-sector heavily depends on agricultural products that are usually seasonal. Real exchange rate and oil price have platykurtic distributions while the value of real interest rate is 3, indicating a mesokurtic distribution.

The descriptive statistics of the beverage sub-sector show that the output recorded the highest mean value followed by investment. Also, output has the maximum value and the minimum value was obtained from exchange rate. Export has leptokurtic distribution (it implies that the degree of peakedness is higher than normal distribution). Output, investment and export have relatively high standard deviation and variance. All the variables except real interest rate have left skewed distribution. Output, investment and export show relatively high variances compare to other variables. The number of workers recorded the highest coefficient of variation.

Table 5.2: Summary Statistics of the Food Products and Beverage Sub-sectors

Food Product Sub-sector								
Statistics	**Q (₦)**	**rer(₦/ USD)**	**vol (%)**	**inv(₦)**	**exp (₦)**	**oilp (USD)**	**nw**	**rir (%)**
Mean	2.5E+10	75.0	6.4	4.4E+09	2.7E+09	42.5	3.1E+04	1.2
Max	2.6E+10	177.5	38.8	1.0E+11	2.3E+10	11.5	5.6E+05	25.1
Min	2.3E+07	0.5	0.0	0.0E+00	2.7E+06	12.7	8.5E+02	-32.1
Median	9.6E+09	70.3	3.4	5.7E+08	1.0E+09	25.0	2.0E+04	0.8
Range	2.6E+11	177.1	38.7	1.0E+11	2.3E+10	98.8	5.6E+05	57.2
Sd	3.8E+10	64.1	9.4	1.2E+10	4.2E+09	32.0	5.0E+04	13.7
Skewness	2.9E+00	0.1	2.2	5.4E+00	2.7E+00	1.1	8.3E+01	-0.4
Kurtosis	1.4E+00	1.4	7.3	3.8E+01	1.1E+01	2.7	8.6E+02	3.0
Variance	1.5E+21	4116.1	88.2	1.3E+20	1.8E+19	1022.6	2.5E+08	188.9
CV	1.6E+00	0.9	1.5	2.6E+00	1.6E+00	0.8	1.6E+01	11.2
Beverage Sub-sector								
Statistics	**Q**	**rer**	**vol**	**inv**	**exp**	**oilp**	**nw**	**rir**
Mean	2.6E+10	75.0	6.4	3.6E+09	2.7E+09	42.5	3.1E+03	1.2
Max	1.6E+11	177.5	38.8	3.7E+10	2.3E+10	11.5	5.6E+04	25.1
Min	4.0E+07	0.5	0.0	0.0E+00	2.7E+06	12.7	8.5E+01	-32.1
Median	1.2E+10	70.3	3.4	1.2E+09	1.0E+09	25.0	2.0E+03	0.8
Range	1.6E+11	177.1	38.7	3.7E+10	2.3E+10	98.8	5.6E+04	57.2
Sd	3.5E+10	64.1	9.4	5.6E+09	4.2E+09	32.0	5.0E+03	13.7
Skewness	1.8E+00	0.1	2.2	3.0E+00	2.7E+00	1.1	8.3E+00	-0.4
Kurtosis	6.2E+00	1.4	7.3	1.5E+01	1.1E+01	2.7	8.6E+01	3.0
Variance	1.2E+21	4116.1	88.6	3.1E+19	1.8E+19	1022.6	2.5E+07	188.9
CV	1.3E+00	0.9	1.5	1.6E+00	1.6E+00	0.8	1.6E+01	11.2

Source: Author's computation using STATA 12

5.2.3 Summary Statistics of the Conglomerate and Healthcare Sub-sectors

The average value of output recorded in the conglomerate sub-sector is ₦9.9billion, this exceeded the revenue derived from export sales which was ₦1.9billion (see table 5.3). It suggests that the conglomerate sub-sector sells more in the domestic market than foreign market. Output and investment recorded high standard deviation and variances in the period under consideration. Export of the sub-sector has a left skewed distribution. The number of workers employed in the sub-sector has leptokurtic distribution (higher than normal distribution).

The statistics of the healthcare sub-sector shows that on average, 306 workers were employed in the industry and a substantial investment in capital was incurred. The standard deviation of output sold in the domestic market was higher than foreign sales. Most of the variables have left skewed distribution, indicating that most values are concentrated on the right of the mean. Again, the kurtosis statistics shows that the values of export and real interest rate are near normal distribution. The variances of output, investment and export are relatively high compare to other variables employed in the analysis.

Table 5.3: Summary Statistics of the Conglomerate and Healthcare Sub-sector

Conglomerate Sub-sector								
Statistics	**Q (₦)**	**rer(₦/ USD)**	**vol (%)**	**inv(₦)**	**exp (₦)**	**oilp (USD)**	**nw**	**rir (%)**
Mean	9.9E+09	75.0	6.4	8.2E+08	1.9E+08	42.5	1885.4	1.2
Max	6.3E+10	177.5	38.8	1.4E+10	3.4E+08	11.5	6960.0	25.1
Min	5.4E+07	0.5	0.0	4.2E+04	5.2E+06	12.7	179.0	-32.1
Median	5.6E+09	70.3	3.4	1.6E+08	2.0E+08	25.0	1495.5	0.8
Range	6.3E+10	177.1	38.7	1.4E+10	3.4E+08	98.8	6781.0	57.2
Sd	1.2E+10	64.1	9.4	1.7E+09	7.3E+07	32.0	1571.1	13.7
Skewness	2.5E+00	0.1	2.2	4.4E+00	-6.5E-01	1.1	1.6	-0.4
Kurtosis	1.1E+01	1.4	7.3	3.0E+01	3.6E+00	2.7	4.9	3.0
Variance	1.4E+20	4116.1	88.5	3.0E+18	5.3E+15	1022.6	2.4E+06	188.9
CV	1.2E+00	0.9	1.5	2.1E+00	3.8E-01	0.8	0.83	11.2
Healthcare Sub-sector								
Statistics	**Q**	**rer**	**vol**	**inv**	**exp**	**oilp**	**nw**	**rir**
Mean	1.9E+09	75.0	6.4	1.6E+08	1.9E+07	42.5	305.7	1.2
Max	1.3E+10	177.5	38.8	2.6E+09	1.3E+08	11.5	931.0	25.1
Min	1.1E+07	0.5	0.0	2.8E+05	4.4E+05	12.7	57.0	-32.1
Median	8.8E+08	70.3	3.4	3.3E+07	5.9E+06	25.0	266.0	0.8
Range	1.3E+10	177.1	38.7	2.6E+09	1.3E+08	98.8	874.0	57.2
Sd	2.8E+09	64.1	9.4	3.5E+08	3.3E+07	32.0	233.0	13.7
Skewness	2.6E+00	0.1	2.2	3.8E+00	2.2E+00	1.1	1.2	-0.4
Kurtosis	9.8E+00	1.4	7.3	2.1E+01	6.8E+00	2.7	3.6	3.0
Variance	7.7E+18	4116.1	88.5	1.2E+17	1.1E+15	1022.6	49730.5	188.9
CV	1.5E+00	0.9	1.5	2.2E+00	1.8E+00	0.8	0.7	11.2

Source: Author's computation using STATA 12

5.2.4 Summary Statistics of the Agricultural and Household Durable Sub-sectors

On agricultural sub-sector, the summary statistics shows that the value of export sales is higher than domestic sales. This implies that, on average, the sub-sector sells more of its product in foreign market than domestic market. Investment has the maximum value and highest median value. Also, the standard deviation and variance of investment and output are high in the period under study. The skewness of the variables is similar to the ones obtained in the sub-sectors discussed previously. The number of workers has platykurtic (flatter than normal distribution) distribution while output, investment and export have leptokurtic distribution (higher than normal distribution).

Data on export of firms in the household durable sub-sector were not available in the reference period. On average, output recorded the highest value, followed by investment. All the variables except the real interest rate have right skewed distribution, indicating that most values are concentrated on the left of the mean with extreme values on the right. Output and investment have leptokurtic distributions which implies that their values are concentrated around the mean with thicker tails (the variables are sharper than normal distribution).

Table 5.4: Summary Statistics of the Agricultural and Household Durable Sub-sectors

Agricultural Sub-sector								
Statistics	**Q (₦)**	**rer(₦/ USD)**	**vol (%)**	**inv(₦)**	**exp (₦)**	**oilp (USD)**	**nw**	**rir (%)**
Mean	1.3E+09	75.0	6.4	2.8E+09	1.4E+10	42.5	6.8E+02	1.2
Max	1.1E+10	177.5	38.8	2.3E+10	8.0E+08	11.5	2.0E+03	25.1
Min	0.0E+00	0.5	0.0	6.7E+05	1.3E+07	12.7	7.3E+01	-32.1
Median	3.6E+08	70.3	3.4	1.0E+08	7.5E+07	25.0	4.5E+02	0.8
Range	1.1E+10	177.1	38.7	2.3E+10	7.8E+08	98.8	2.0E+03	57.2
Sd	2.0E+09	64.1	9.4	4.8E+09	2.1E+08	32.0	6.0E+02	13.7
Skewness	2.5E+00	0.1	2.2	1.7E+00	2.4E+00	1.1	5.3E-01	-0.4
Kurtosis	1.0E+01	1.4	7.3	5.3E+00	7.3E+00	2.7	1.9E+00	3.0
Variance	4.0E+18	4116.1	88.5	2.3E+19	4.4E+16	1022.6	3.6E+05	188.9
CV	1.5E+00	0.9	1.5	1.7E+00	1.5E+00	0.8	8.8E-01	11.2
Household Durable Sub-sector								
Statistics	**q**	**rer**	**vol**	**inv**	**exp**	**oilp**	**nw**	**rir**
Mean	2.2E+09	75.0	6.4	4.2E+08	N/A	42.5	392.2	1.2
Max	1.4E+10	177.5	38.8	2.0E+09	N/A	11.5	752.0	25.1
Min	2.0E+07	0.5	0.0	2.8E+05	N/A	12.7	85.0	-32.1
Median	5.8E+08	70.3	3.4	1.6E+08	N/A	25.0	406.0	0.8
Range	1.4E+10	177.1	38.7	2.0E+09	N/A	98.8	667.0	57.2
Sd	3.5E+09	64.1	9.4	5.5E+08	N/A	32.0	243.8	13.7
Skewness	2.1E+00	0.1	2.2	1.6E+00	N/A	1.1	0.0	-0.4
Kurtosis	6.6E+00	1.4	7.3	4.4E+00	N/A	2.7	1.3	3.0
Variance	1.2E+19	4116.1	88.5	3.0E+17	N/A	1022.6	5.95E+1	188.9
CV	1.6E+00	0.9	1.5	1.3E+00	N/A	0.8	0.6	11.2

Source: Author's computation using STATA 12

5.2.5 Summary Statistics of the Industrial Goods and Oil and Gas Sub-sectors

The summary statistics of the industrial goods sub-sector on table 5.5 show that output of the sub-sector recorded the highest mean value while the lowest mean was obtained from the real interest rate variable. Also, output has the maximum value. High values of standard deviation were recorded in the output and investment series. Output and the number of workers employed have leptokurtic distribution. Real interest rate has almost normal distribution but recorded the highest coefficient of variation.

On average, output of the oil and gas sub-sector recorded the maximum value in the period under study. Also, a substantial value of the oil and gas products was exported in the reference period. Export recorded the highest median statistics and the lowest value was obtained from the real interest rate variable. Output, investment and export have high values of standard deviation and variances. The variables considered here have right skewed distribution. Accordingly, output, investment and export exhibit leptokurtic distribution. The skweness of output, investment, export and exchange rate volatility are asymmetrical (fall outside the symmetric distribution). Both the number of workers employed and real interest rate have approximately normal distribution.

Table 5.5: Summary Statistics of the Industrial Goods and Oil and Gas Sub-sectors

Industrial Goods Sub-sector								
Statistics	**Q (₦)**	**rer(₦/ USD)**	**vol (%)**	**inv(₦)**	**exp (₦)**	**oilp (USD)**	**nw**	**rir (%)**
Mean	5.3E+09	75.0	6.4	5.6E+07	N/A	42.5	288.9	1.2
Max	4.5E+10	177.5	38.8	1.8E+08	N/A	11.5	693.0	25.1
Min	9.3E+07	0.5	0.0	1.6E+06	N/A	12.7	137.0	-32.1
Median	1.1E+09	70.3	3.4	5.1E+07	N/A	25.0	271.0	0.8
Range	4.5E+10	177.1	38.7	1.8E+08	N/A	98.8	556.0	57.2
Sd	1.1E+10	64.1	9.4	4.7E+07	N/A	32.0	116.8	13.7
Skewness	2.7E+00	0.1	2.2	6.2E-01	N/A	1.1	1.8	-0.4
Kurtosis	8.9E+00	1.4	7.3	2.6E+00	N/A	2.7	6.2	3.0
Variance	1.3E+20	4116.1	88.5	2.2E+15	N/A	1022.6	1.4E+04	188.9
CV	2.1E+00	0.9	1.5	8.4E-01	N/A	0.8	0.4	11.2
Oil and Gas Sub-sector								
Statistics	**q**	**rer**	**vol**	**inv**	**exp**	**oilp**	**nw**	**rir**
Mean	4.2E+10	75.0	6.4	2.3E+09	1.1E+10	42.5	380.9	1.2
Max	5.1E+11	177.5	38.8	8.2E+10	2.4E+11	11.5	995.0	25.1
Min	0.0E+00	0.5	0.0	3.3E+04	7.7E+06	12.7	0.0	-32.1
Median	1.3E+10	70.3	3.4	4.2E+08	6.2E+11	25.0	396.0	0.8
Range	5.1E+11	177.1	38.7	8.8E+10	2.4E+11	98.8	995.0	57.2
Sd	7.3E+10	64.1	9.4	8.5E+09	3.8E+10	32.0	220.0	13.7
Skewness	3.0E+00	0.1	2.2	7.6E+00	4.7E+00	1.1	0.1	-0.4
Kurtosis	1.4E+01	1.4	7.3	6.9E+01	2.7E+01	2.7	2.6	3.0
Variance	5.4E+21	4116.1	88.5	7.2E+19	1.5E+21	1022.6	4.8E+04	188.9
CV	1.7E+00	0.9	1.5	3.7E+00	3.6E+00	0.8	0.6	11.2

Source: Author's computation using STATA 12

5.2.6 Summary Statistics of the Printing and Publishing Sub-sectors and Automobile and Tyres Sub-sectors

The summary statistics of the printing and publishing sub-sector show that the average value of output in the sub-sector is ₦927.0million. In addition, the sub-sector recorded a substantial amount of export. Also, the median statistics of the output is high compare to other variables. Right skewed distributions were obtained for the variables except for real interest rate. Output, real exchange rate, export and number of workers employed have leptokurtic distribution. This implies the values concentrated around the mean with thicker tails. Output has the highest variance in the series.

The mean value of output in the automobile and tyres sub-sector is ₦2.08 billion. On average, substantial expenditure was made on investment in the industry. The maximum value was obtained from output while exchange rate volatility recorded the minimum value. Relatively high standard deviations were obtained from output and investment. Additionally, the skewness shows that most values are concentrated around the mean. The kurtosis indicates that only exchange rate volatility has leptokurtic distribution. Other variables, namely, output, exchange rate volatility, investment, export, oil price and number of workers employed have platykurtic distribution. Real interest rate recorded the highest coefficient of variation statistics while the highest standard deviation was obtained from output.

Table 5.6: Summary Statistics of the Printing and Publishing and Automobile and Tyres Sub-sectors

Printing and Publishing Sub-sector								
Statistics	**Q (₦)**	**rer(₦/ USD)**	**vol (%)**	**inv(₦)**	**exp (₦)**	**oilp (USD)**	**nw**	**rir (%)**
Mean	9.3E+08	75.0	6.4	5.5E+07	7.3E+07	42.5	2.7E+02	1.2
Max	4.6E+09	177.5	38.8	6.5E+08	6.5E+08	11.5	5.0E+02	25.1
Min	3.5E+07	0.5	0.0	0.0E+00	6.9E+04	12.7	1.9E+03	-32.1
Median	5.0E+08	70.3	3.4	2.1E+07	2.5E+07	25.0	2.6E+02	0.8
Range	4.6E+09	177.1	38.7	6.5E+08	6.5E+08	98.8	5.0E+02	57.2
Sd	1.1E+09	64.1	9.4	9.3E+07	1.3E+08	32.0	7.7E+01	13.7
Skewness	1.5E+00	0.1	2.2	4.2E+00	3.3E+00	1.1	2.9E-01	-0.4
Kurtosis	4.8E+00	1.4	7.3	2.6E+01	1.5E+01	2.7	6.3E+00	3.0
Variance	1.1E+18	4116.1	88.5	8.6E+15	1.7E+16	1022.6	5.9E+03	188.9
CV	1.2E+00	0.9	1.5	1.7E+00	1.8E+00	0.8	2.8E-01	11.2
Automobile and Tyres Sub-sector								
Statistics	**q**	**rer**	**vol**	**inv**	**exp**	**oilp**	**nw**	**rir**
Mean	2.1E+09	75.0	6.4	2.1E+08	3.9E+07	42.5	5.2E+02	1.2
Max	6.4E+09	177.5	38.8	8.6E+08	1.1E+08	11.5	1.2E+03	25.1
Min	4.7E+07	0.5	0.0	480124.3	1.3E+06	12.7	203.00	-32.1
Median	2.7E+08	70.3	3.4	7.5E+07	2.2E+07	25.0	2.2E+02	0.8
Range	6.3E+09	177.1	38.7	8.6E+08	1.1E+08	98.8	1.2E+03	57.2
Sd	2.4E+09	64.1	9.4	2.5E+08	3.7E+07	32.0	5.0E+02	13.7
Skewness	5.3E-01	0.1	2.2	8.2E-01	7.5E-01	1.1	3.1E-01	-0.4
Kurtosis	1.5E+00	1.4	7.3	2.4E+00	1.9E+00	2.7	1.2E+00	3.0
Variance	5.6E+18	4116.1	88.5	6.2E+16	1.4E+15	1022.6	2.5E+05	188.9
CV	1.1E+00	0.9	1.5	1.2E+00	9.5E-01	0.8	9.6E-01	11.2

Source: Author's computation using STATA 12

5.3 Correlation Results

Table 5.7 shows the correlation matrix of all variables employed in the study. The p-values are presented below the correlation coefficients. The relationship between exchange rate volatility and the variables of interest, namely, investment, output and export is statistically significant. A strong relationship was obtained between exchange rate volatility and real exchange rate. This is not surprising since the exchange rate volatility was obtained from the real exchange rate variable. The relationship between exchange rate volatility and export is negative. It implies that as exchange rate volatility increases, export of the sample firms decreases, on the average. A mild and positive relationship was obtained between exchange rate volatility and firm-level investment. Exchange rate volatility has a strong and positive relationship with crude oil price. The result shows that 78% of the variation in crude oil price can be predicted by exchange rate volatility. A plausible explanation for the result obtained is due to the fact that Nigerian economy depends largely on crude oil.

A positive and statistical significant relationship was obtained between real exchange rate and firm-level investment and output; however, the coefficients of the correlation indicated mild relationships among the variables. Also, the coefficient of the relationship between investment and output indicated that 52% of the variation in output is accounted for by investment. This emphasizes the importance of substantial capital expenditure in producing the required output. In addition, a positive and statistically significant relationship exists between investment and export as well as output and export. The positive relationship between real interest rate and investment is striking, though this is only significant at the 10% level. The counter intuitive relationship that exist between real interest rate and investment could be explained by some other factors driving investment of firms, such as, turnover rate and market size.

The relationship between number of workers employed, real exchange rate, exchange rate volatility and crude oil price is negative. However, this relationship is not significant at the conventional levels. Overall, the correlation results show evidence of relationship between the variables employed in the study.

Table 5.7 Correlation Matrix of the Variables

Variables	inv	q	exp	rer	vol	rir	oilp	nw
inv	1.0000							
q	0.5204	1.0000						
	0.0000***							
exp	0.6020	0.5115	1.0000					
	0.0000***	0.0000***						
rer	0.3349	0.4168	0.2514	1.0000				
	0.0000***	0.0000***	0.0023***					
vol	0.2618	0.3828	-0.2952	0.7131	1.0000			
	0.0001***	0.0000***	0.0003***	0.0000***				
rir	0.1164	-0.1338	0.0485	0.3020	0.1682	1.0000		
	0.0780*	0.0426**	0.5621	0.0000***	0.0106***			
oilp	0.3421	0.4191	0.3076	0.8730	0.7846	0.2455	1.0000	
	0.0000***	0.0000***	0.0002***	0.0000***	0.0000***	0.0002***		
nw	0.1318	-0.0843	0.0139	-0.0921	-0.0800	0.0172	-0.1024	1.0000
	0.0464**	0.2039	0.8681	0.1647	0.2278	0.7961	0.1223	

Source: Computed by the author based on data collected from IMF's International Financial Statistics and various firms' financial statement.

5.4 Panel Unit Root Results

The results of the panel unit root tests for the sectoral aggregate are presented in table 5.8, while that of the sub-sectors are presented in appendix C1-C5. IM Peseran and Shin unit root test was conducted for all the variables in the sectoral aggregate. The estimates shows that the null hypotheses that all panels contain unit root can be rejected for most of the variables in the aggregate level. Specifically, the variables namely output and real interest rate are stationary at level. However, other variables such as investment, export, number of workers, oil price, real exchange rate and exchange rate volatility are stationary after first difference.

Similarly, the unit root test was conducted on variables in the various sub-sectors. Since the variables employed in this study are different across sub-sectors, it is important to test the unit root of all the variables across different sub-sectors. Different results were obtained from the stationarity tests in individual sub-sector. For instance, in food products, beverages, healthcare, agriculture, industrial goods and oil and gas sub-sectors, all the variables except real interest rate, are integrated of order one. Two variables are stationary in the printing and publishing, and the automobile and tyres sub-sectors. In the printing and publishing sub-sector investment and real interest rate are stationary at level while other variables employed are stationary after first difference. In addition, output and real interest rate are stationary in the automobile and tyres sub-sector. The stationarity tests of the variables in the conglomerates and the household durable sub-sectors show that output, investment and real interest rate are stationary at level. An evaluation of the stationarity tests conducted implies that static regression may be bias; hence there is a need to conduct dynamic regression.

Table 5.8: Panel Unit Root Test for the Aggregate

Aggregate					
Variable	**Level**		**1st Difference**		**Decision**
	Statistics	**P- Value**	**Statistics**	**P-Value**	
q	-4.6127	0.0000	-5.0591	0.0000	I(0)
inv	-1.2750	0.1011	-8.0176	0.0000	I(1)
exp	1.4128	0.9211	-4.7209	0.0000	I(1)
oilp	4.8647	1.0000	-8.5272	0.0000	I(1)
nw	0.2158	0.5854	-7.4330	0.0000	I(1)
rer	6.6377	1.0000	-7.3484	0.0000	I(1)
vol	7.0974	1.0000	-10.4354	0.0000	I(1)
rir	-5.5438	0.0000	-8.5665	0.0000	I(0)

Source: Author's Computation using STATA

5.5 The GARCH Model Results

As indicated in the literature review, several methods are employed in the literature for measuring exchange rate volatility. The choice of the method depends on time horizon considered. The volatility measures usually include some variants of the standard deviation of per period exchange rate. The GARCH (1,1) developed by Bollerslev (1986) is used in this study to measure exchange rate volatility. The first step here is to investigate whether the real exchange rate is actually volatile. This is estimated using GARCH technique; the existence of ARCH effect is also examined. The results of the GARCH are shown in equation (5.1)

$$\begin{array}{lccccc} h_t & = & 3249.11 & + & 1.84822e_{t-1}^2 & - & 0.92598h_{t-1} \\ (t) & & (0.88671) & & (0.871987) & & (-2.205301) \end{array} \qquad (5.1)$$

The significance of the coefficient of h_{t-1} suggests the existence of volatility. The null hypothesis is that there is no GARCH effect in the model. Here, the null hypothesis is rejected at the 1% significant level. Additionally, Figure 5.1 depicts the monthly exchange rate volatility for the period. A close look indicates that real exchange rate exhibits low volatility between 1994 and 1998, while the period 1998-2002 witnessed high volatility. The period of low volatility happens to coincide with the time the local currency was pegged to U.S. dollars.

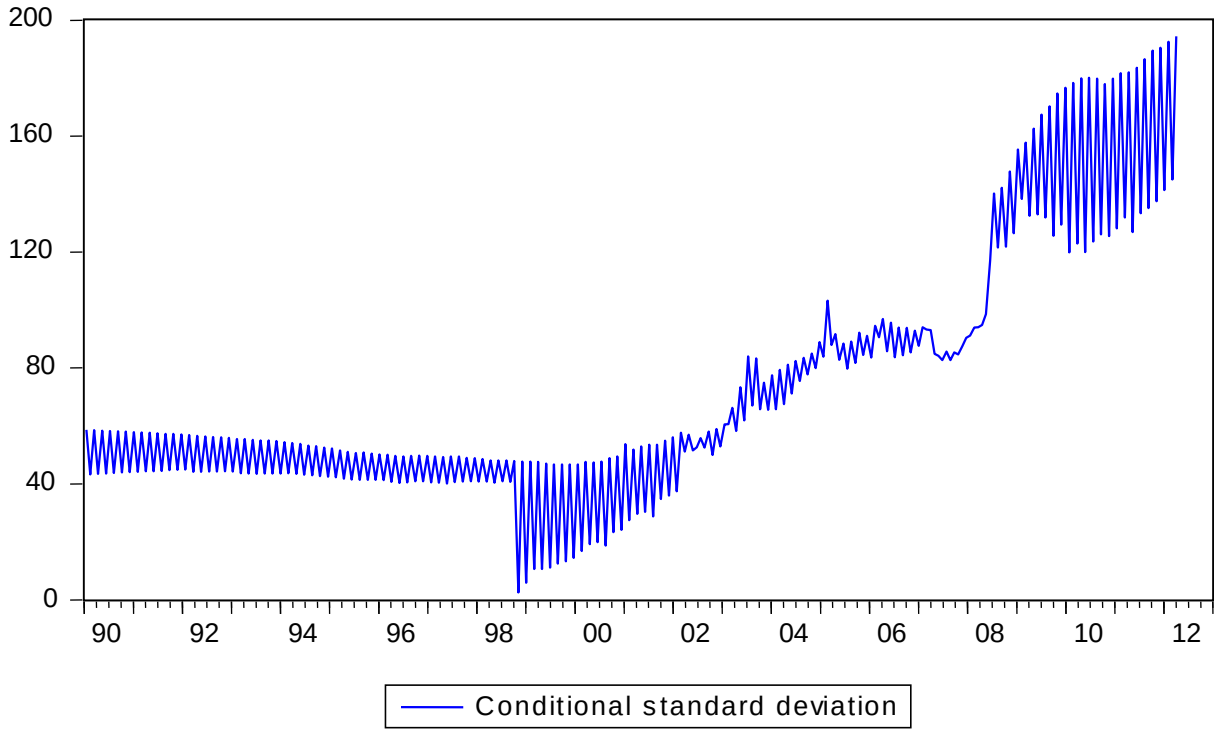

Fig. 5.1: Real Exchange Rate Volatility from 1990M1 to 2012M12

5.6 Discussion of the Generalized Method of Moments Results

5.6.1 Sectoral Aggregate Results

Three models were estimated, each addressing an objective of the study. These models are broken down into the investment, output and export equations. In other to compare results and ensure detail information regarding the interaction between the independent and dependent variables, estimates of aggregate and sub-sector models were analyzed. The analysis of the sub-sector model becomes necessary because heterogeneity can arise due to the differences in the degree of competition, industry structure and import pressures in the manufacturing sector.

The diagnostic tests (Sargan and Hansen) indicate that the instruments are valid and orthogonal to the random disturbance term. Additionally, the autocorrelation test shows that there is no first order and second order serial correlation problems. Overall, the coefficient of exchange rate volatility is only significant in the export equation. This shows the degree of sensitivity of the export to exchange rate volatility. It suggests that risk averse producers will export less in the presence of excessive exchange rate volatility.

The parameter estimates of the investment model on table 5.9 show that real exchange rate and one period lag investment exert significant influence on the current investment. Both are significant at 1% level. Although, the positive sign of the coefficient of the real exchange rate at level is not in line with theory that of its volatility corroborate with *a priori* expectation. A negligible and statistically insignificant coefficient of exchange rate volatility was obtained. This suggests that firms imports capital stocks irrespective of the degree of the exchange rate volatility. The possible explanation for this is that most of the firms' operate with physical capitals that could only be imported from advanced country, hence, they still engage in importation of such capital to meet production target in the presence of exchange rate volatility. The sign of the coefficient of exchange rate volatility is negative which corroborate with the theoretical expectation. Additionally, previous year investment is important in increasing the value of the current investment. This shows a substantial increase in capital accumulation in the manufacturing sector of the firms listed on the NSE, the validity of the instruments chosen for the GMM model were tested and

supported by both Sargan and Hansen tests. Similarly, the test for serial correlation shows that there is no evidence of either first or second order autocorrelation problem. This relationship has being empirically supported by Nucci and Pozzolo (2001) and Fuentes (2006). These studies found out that an increase in exchange rate volatility suppressed the level of investment in the country especially when the physical capitals needed for investment are being procured from abroad.

The empirical evidences from the output model of the sectoral aggregate analysis shows that lagged of output and real exchange rate at level influence current output of listed firms at 1% and 10% significant levels respectively. In addition, the signs of real exchange rate, exchange rate volatility and the labour employed are consistence with the *a priori* expectations; although, the coefficient of the exchange rate volatility is statistically not significant. The result suggests that the performance in the previous year tended to influence the current output. Also, the negative coefficient of the real exchange rate implies that exchange rate depreciation increases output. It suggests that real exchange rate depreciation increases the cost associated with imported inputs and enhance the competitiveness of domestic industries leading to increase in output of domestic firms. This implies that on average, exchange rate depreciation increases output. The non significant coefficient of exchange rate volatility is due to the fact that some firms hedge against the risk of exchange rate volatility on the procurement of raw materials and other intermediate inputs. The result is in line with the one obtained by Mustafa and Demir (2012) that found that exchange rate volatility affect firms' productivity negatively in Turkey.

In the export regression, a period lag export and exchange rate volatility are significant at 1% and 5% respectively. The negative coefficient of the exchange rate volatility is in line with theory, however, that of the real exchange rate at level does not conform to theoretical expectation. This could be as a result of the diverse operations of firms in the industry; while some firms' export decisions are sensitive to exchange rate others are not. Evidence from the regression results shows that a percentage reduction in exchange rate volatility could boost export by 2.1%. This result shows that exchange rate volatility substantially affects firms that involve in both domestic and foreign sales more than those that produce only for domestic sales. These results are not surprising because firms that engage in

exports, exchange rate volatility affects them via two channels; which are the import and export channels. However, in the case of firms that produces for domestic market, exchange rate volatility affect them only through the import channel, since the main purpose of utilizing foreign exchange is for the procurement of raw materials and intermediate inputs. These findings are in line with the one obtained by Chit *et al* (2010) and Hericourt and Poncet (2013) that exchange rate volatility has a significant negative effect on exports.

Table 5.9: System GMM for the Sectoral Aggregate

Dependent Variable	Ininv	lnq	lnexp
cons	3.0117*** (2.86)	-2.8172 (-0.85)	-0.7243 (-0.37)
lnq L1		0.9594*** (5.87)	
lnexp L1			1.0927*** (5.09)
lninv L1	0.7309*** (7.23)		
rer	0.1500*** (2.52)	-1.3200* (-1.67)	0.0900 (0.38)
vol	-0.0100 (-0.02)	-0.4600 (-1.29)	-2.1300** (-2.35)
lninv		0.0410 (0.42)	-0.0021 (-0.01)
lnoilp		1.2157* (1.87)	0.0699 (0.45)
lnnw		-0.0070 (-0.17)	-0.1296 (-0.75)
lnq	0.1031 (1.32)		
rir	-0.0025 (-0.94)		
Sargan test Chi-Sq	3.89 [0.566]	0.58 [0.445]	8.30 [0.141]
Hansen Test Chi-Sq	3.14 [0.678]	0.41 [0.520]	0.00 [1.000]
AR(1)	-2.84 [0.005]	-1.33 [0.183]	-2.54 [0.011]
AR(2)	-0.07 [0.945]	0.39 [0.694]	-0.71 [0.479]

Notes: The dependent variables are natural log of output, export and investment. The t-ratios are in parentheses, while the figures in bracket are p-value for Sargan test and serial correlation test. *,**,*** represent statistical significance at 1, 5 and 10 percent levels respectively.

5.6.2 Sub-sectors Results

The sub-sector results of the effect of exchange rate volatility on firm-level economic activities are presented in this section. Since firms' heterogeneity have important consequences for the impact of exchange rate volatility, it is necessary to investigate the likely variation across various manufacturing sub-sectors. The first task is to determine the appropriate instrumental variables in each model of the sub-sector. The process of identifying and including the instrumental variables is crucial, since the choice of variables selected has implication for the results. This was done by estimating the model and using both the Sargan and Hansen tests to determine the validity of the instrumental variables in each sub-sector. An insignificant status of the diagnostic tests suggests that the choice of instrument in the regression model is appropriate and valid. Hence, the instrumental variables identified for the purpose of correcting the endogeniety problems differ across the sub-sectors, though, similar in some cases.

Table 5.10 (Panel A) shows the GMM results of the food product sub-sector. In the investment regression, findings show that real exchange rate, output and first period lag investment are significant at the 1% level. The coefficient of real exchange rate at level is contrary to theory, suggesting that exchange rate depreciation reduces firms' expenditure on investment in the food product sector. The expectation is that when domestic currency depreciates, imported capital goods become more expensive. A possible reason is the fact that the sub-sector does not depend heavily on imported capital goods. Additionally, the coefficient of exchange rate volatility is not significant in the model, which indicates that exchange rate volatility do not necessary affect investment decisions in the sub-sector. This can also be associated with the low level of imported capital needed for operations. The nature of operations in the food products industry is such that firms source their raw materials locally and few capital goods are imported from abroad. The robustness of the result obtained are validated by serial correlation tests which show that the model do not suffer from autocorrelation. A similar result was obtained by Harchaoui *et al* (2005) for Canada. Their findings reveal an insignificant effect of exchange rate on manufacturing industries' investment.

The estimates of the output model show that exchange rate volatility, investment, number of workers employed and first period lag output significantly influence the current output. However, the coefficient of real exchange rate at level is insignificant. It suggests that firms in the food product sub-sector are sensitive to contemporaneous exchange rate changes. In addition, the sign of the coefficient of real exchange rate at level and exchange rate volatility are consistent with theoretical expectation, showing that some of the producers in this sub-sector are risk averse that tend to import less of intermediate inputs during the period of excessive volatility. The high reliance of the firms in this sub-sector on imported inputs for production could be the main reason for their sensitivity to exchange rate risk. The coefficient of the regression results reveals that a percentage increase in exchange rate volatility will reduce output by 0.39%. Additionally, a percentage increase in investment and lagged-output will raise current output by 0.34% and 0.79%, respectively. However, the negative sign of the coefficient of labour employed shows the possibility of diminishing marginal productivity of labour. A plausible explanation for this could be associated to the reward to labour which is less than capital.

Empirical evidence from the export equation of the food products sub-sector indicates that exchange rate volatility, real exchange rate and lagged-export influence current export at 1% significant level. The effect of exchange rate volatility on export sales is stronger than that of the domestic output sales, since its level of significance in the output model is 5% compared with the 1% obtained in the export model. A plausible reason for higher significance level in the export model could be as a result of the channels of impact. In the case of export model, the effect of exchange rate volatility arises through two main channels, namely, imported inputs and export sales channels while for output, exchange rate volatility only affect it through the imported inputs. The coefficient of exchange rate volatility is consistent with *a priori* expectation. However, the sign of the coefficient of real exchange rate is not in line with theory. This shows that even at the time of domestic currency depreciation, the exports of the firms do not increase. Explanation beyond exchange rate changes might be responsible for the result obtained. Some factors, namely, lack of competitiveness of the sub-sector's products in the international market, insufficient incentives and problems associated with logistics could lead to a decrease in exports of firms.

The variables were tested for serial correlation. The statistically insignificant status of the coefficients of the first order and second order serial correlation in the output equation suggests that there is no evidence of autocorrelation in the regression. Although, the export and investment equations show evidence of first order autocorrelation but the models do not exhibit second order autocorrelation problem. In addition, the Sargan and Hansen tests validate the choice of instrumental variables used in the regression.

The results of the investment model of the beverages sub-sector shows that real exchange rate, output and first period lag investment exert significant influence on current investment. However, the coefficient of the real exchange rate at level is not in line with theory. It implies that exchange rate depreciation does not hinder the procurement of capital goods from abroad. In addition, the coefficient of exchange rate volatility is not significant and its contrary to theoretical expectation. This can also be associated to the possibility of investors' using hedging instruments to guard against excessive exchange rate volatility. The result also confirms that a substantial increase in output will lead to increase in investment in the sub-sector. The Sargan and Hansen tests support the validity of the instruments used. Also, there is no evidence of either first or second order autocorrelation problems.

The estimates of the output model of the beverage sub-sector show that real exchange rate, exchange rate volatility, investment and oil price significantly influence output level at 1%. However, the number of workers employed affects output at 10% significant level. A substantial increase in investment contributes positively to output. The coefficients of the exogenous variables employed in the regression model are in line with theory. Exchange rate depreciation increases output. Additionally, a percentage reduction in exchange volatility leads to 1.12% increase in output. The result is due to the fact that firms in this sub-sector employed more of imported inputs in their production, and therefore, are sensitive to exchange rate volatility. The choice of the instrumental variables in the analysis was supported by Sargan and Hansen tests. The study shows that the effect of exchange rate volatility is higher for those firms with high import contents of inputs. These results are consistent with the findings of Varela (2007) who reported that for Chile.

Evidence from the export model of the beverages sub-sector reveals that exchange rate volatility, oil price and lagged-export are statistically significant at 1% level. Similarly, the coefficient of numbers of workers employed is significant at 5%. Although, the coefficient of real exchange rate at level is not significant in the model; its sign is in line with *a priori* expectation. This implies that a sudden depreciation of domestic currency may not lead to an immediate increase in export in the sub-sector. It could take time for exchange rate depreciation to boost export due to time lags associated with adjustment of the scale of production by the producer. In addition, the firms do import large quantity of inputs ahead using forward exchange rate. Besides, the result indicates that a percentage increase in exchange rate volatility will lead to 3.14% decrease in export. This shows that exporters in the sub-sector are risk averse. Further evidence reveals that there is diminishing marginal productivity of an additional worker in the sub-sector.

Table 5.10: System GMM for the Food Products and Beverage and Sub-sectors

	Panel A: Food Products			Panel B: Beverages		
Dependent Variable	**lninv**	**lnq**	**lnexp**	**lninv**	**lnq**	**lnexp**
cons	-3.3815* (-1.69)	4.2108*** (3.48)	8.5986* (1.95)	4.8112*** (4.66)	0.6621 (0.17)	-3.1131 (-0.46)
lnq L1		0.7873*** (20.14)			0.4017** (2.00)	
lnnexp L1			0.5090*** (2.59)			1.3535*** (5.90)
lninv L1	0.5379*** (21.86)			0.1670** (2.21)		
rer	0.4400*** (3.09)	-0.4600 (-0.91)	1.2100*** (7.10)	0.7900*** (7.35)	-1.7600*** (-2.54)	-1.1200 (-1.14)
vol	-0.4900 (-0.97)	-0.3900** (-2.02)	-1.120*** (-3.09)	0.7200 (1.14)	-0.1128*** (-2.48)	-3.140*** (-3.31)
lninv		0.3382*** (5.66)	0.0517 (0.48)		0.8044*** (3.71)	0.0986 (0.35)
lnoilp		-0.2237 (-0.61)	0.2495 (0.87)		0.8326*** (3.90)	0.4062*** (7.48)
lnnw		-0.6678*** (-5.33)	-0.2274 (-0.63)		-0.6767* (-1.79)	-0.7905** (-2.03)
lnq	0.5471*** (5.91)			0.5235*** (6.75)		
rir	-0.0078 (-0.94)			0.0032 (0.44)		
Sargan test Chi-Sq	4.21 [0.648]	1.03 [0.960]	7.00 [0.321]	4.71 [0.194]	1.26 [0.869]	8.63 [0.125]
Hansen Test Chi-Sq	2.77 [0.837]	3.63 [0.163]	0.52 [0.470]	3.27 [0.712]	3.42 [0.143]	2.32 [0.647]
AR(1)	-1.50 [0.133]	-1.29 [0.196]	-1.68 [0.093]	-1.95 [0.051]	-1.19 [0.233]	8.63 [0.125]
AR(2)	-1.22 [0.224]	-1.49 [0.136]	0.37 [0.711]	-0.03 [0.976]	0.00 [1.000]	0.00 [1.000]

Notes: The dependent variables are natural log of output, export and investment. The t-ratios are in parentheses, while the figures in bracket are p-value for Sargan test and serial correlation test. *,**,*** represent statistical significance at 1, 5 and 10 percent levels respectively

In the investment model of the conglomerate sub-sector (Table 5.11, Panel A), real exchange rate and output are statistically significant. However, a negative coefficient of output suggests that there is a tradeoff between acquisition of capital and production level in the current period. The coefficient of the exchange rate volatility is not significant but it follows *a priori* expectation. These results imply that exchange rate volatility may not be a major concern for those firms operating in the conglomerate sub-sector. The findings is consistent with the one obtained by Harchaoui *et al* (2005) for Canada, which showed that the overall effect of exchange rate volatility on firms' investment is statistically insignificant.

Estimates of the output model of the conglomerate sub-sector show that lagged-output, investment and number of workers employed significantly influence current output. The coefficient of exchange rate volatility is not significant, contrary to theoretical expectation. This could be due to the meager external commitment of firms operating in the sub-sector. Indeed, most firms in the sub-sector procure their inputs locally. Similarly, the coefficients of exchange rate volatility and real exchange rate in the export equation are not significant owing to low export share of the total output in the sub-sector. The possible explanation of this finding might be that the exports of the firms in the conglomerates sub-sector consist to a large extent of necessary raw material and intermediate inputs that have relatively low sensitivity to exchange rate volatility. A similar result was obtained by Chit *et al* (2010) for Chile which revealed that exchange rate volatility did not significantly reduce export of firms in the East Asian economies.

Table 5.11, panel B shows the results of investment, output and export models in the healthcare sub-sector. The coefficients of exchange rate volatility are statistically significant in the output and the export models. However, exchange rate volatility is not significant in the investment equation. This could be attributed to the nature of the sub-sector and government policies to facilitate investment in healthcare irrespective of the degree of the exchange rate volatility. Further, in the investment results, output real interest rate and lagged-output are significant. An increase in output will lead to a substantial increase in investment in the healthcare sub-sector. The coefficient of exchange rate volatility is in line with theory but not significant in the model. This result is consistent with

the findings of Demir (2013) that established an insignificant relationship between exchange rate volatility and investment in Turkey.

In addition, the number of workers employed and lagged output significantly influence output of the sub-sector. The results revealed that a reduction in exchange rate volatility by 1% will lead to 0.76% increase in output. Both the coefficients of the exchange rate volatility and real exchange rate at level are in line with *a priori* expectation. The Sargan and Hansen tests diagnostics tests supported the validity of the instruments used in the dynamic model. The result of the estimates is consistent with the findings of Varela (2007) which revealed that exchange rate volatility negatively affects output.

Evidence from the export model reveals that exchange rate volatility, oil price and numbers of workers exert significant influence on export. This implies that a percentage decrease in exchange rate volatility will increase export by 3.98%. The result indicates that an increase in exchange rate volatility hamper export of the firms. The negative coefficient of number of workers employed support the theory of diminishing marginal productivity of labour.

Table 5.11: System GMM for the Conglomerates the Healthcare Sub-sectors

Panel A:	**Conglomerates**			**Panel B:**	**Healthcare**	
Dependent Variable	**lninv**	**Lnq**	**lnexp**	**lninv**	**lnq**	**lnexp**
cons	22.3921*** (2.72)	2.9509*** (3.33)	8.5121 (1.29)	-5.1266 (-5.66)	-4.5204 (-1.24)	16.8288*** (5.52)
lnq L1		0.7928*** (14.49)			1.4228*** (4.08)	
lnnexp L1			0.6027** (2.05)			0.1533 (0.95)
lninv L1	2.1086 (3.55)			0.3604* (1.84)		
rer	0.0283*** (2.00)	0.0003 (0.06)	-0.0002 (-0.2)	0.0122 (0.98)	-0.0049 (-0.60)	0.0067 (0.84)
vol	-0.3900 (-0.67)	0.1800 (1.34)	0.2600 (0.58)	-0.3100 (-1.30)	-0.7600** (-2.15)	-3.9800*** (-3.99)
lninv		0.0366* (1.79)	-0.0296 (-0.68)		-0.0643 (-0.64)	0.3503 (1.33)
lnoilp		-0.0687 (-1.25)	-0.1893 (-1.67)		0.1362 (1.64)	2.2793*** (4.27)
lnnw		0.1720* (1.68)	0.0060 (0.20)		-0.4836* (-1.69)	-2.4636*** (-6.92)
lnq	-1.8910** (-2.31)			0.8046*** (4.01)		
rir	0.0192 (0.88)			-0.0041* (-1.90)		
Sargan test Chi-Sq	1.32 [0.517]	26.24 [0.000]	1.31 [0.252]	7.43 [0.283]	2.24 [0.692]	8.28 [0.141]
Hansen Test Chi-Sq	0.00 [1.000]	3.54 [0.512]	1.98 [0.892]	3.84 [0.537]	2.64 [0.351]	4.28 [0.752]
AR(1)	-1.51 [0.138]	-1.89 [0.059]	-1.51 [0.130]	7.43 [0.039]	-1.82 [0.069]	-1.34 [0.179]
AR(2)	1.52 [0.308]	-0.01 [0.995]	1.52 [0.130]	0.00 [0.378]	0.22 [0.827]	-1.18 [0.237]

Notes: The dependent variables are natural log of output, export and investment. The t-ratios are in parentheses, while the figures in bracket are p-value for Sargan test and serial correlation test. *,**,*** represent statistical significance at 1, 5 and 10 percent levels respectively

On the agricultural sub-sector (table 5.12, panel A), the results obtained from the investment model show that exchange rate volatility is significant only at the 5% level and the coefficient is in line with the theoretical expectation. This suggests that effect of exchange rate volatility in reducing imported capital goods in the sub-sector is negligible. The findings here are consistent with the result of Fuentes (2006) who found a negative and significant effect of exchange rate volatility on sectoral investment in Chile.

Estimates of the output model show that investment, oil price and numbers of workers employed exert significant effect on output. However, the coefficient of the exchange rate volatility and real exchange rate are not significant. A possible explanation for the deviation from theoretical prediction is that most of the production activities in the agricultural sub-sector used locally sourced raw materials; hence, the effect of exchange rate is negligible on the output. In addition, empirical evidence from export equation of the agricultural sub-sector shows that exchange rate volatility has no significant influence on exports. The used of hedging instruments by firms in the sub-sector reduces the impact of exchange rate volatility on their exports. Also, the products of this sub-sector are perishable in nature which demands urgent sales even at the time of exchange rate volatility.

The firms listed on the household durable and industrial goods sub-sectors do not provide data on their exports, therefore, export results are excluded in the regressions of the two sub-sectors. In the investment model of the household durable sub-sector, the coefficient of the exchange rate volatility is significant at the 5% level. This implies that exchange rate volatility adversely affects investment through the acquisition of machinery and equipment. The output model regression shows that the coefficients of real exchange rate, investment and oil price are statistically significant. The coefficient of the real exchange rate suggests that exchange rate depreciation will increase output of firms operating in the sub-sector. This could occur by increasing the products price competitiveness of domestic industry relative to foreign firms, thereby stimulating production activities by domestic firms. Similarly, capital acquisition for investment increases output. However, exchange rate volatility is not significant in the model and this could be associated with hedging of exchange rate risk by the firms. The diagnostic tests validate the appropriateness of the

instrument. The negative and significant effect is in line with the one obtained by Kandilov and Leblebicioglu (2011) for Colombian manufacturing firms.

Table 5.12: System GMM for the Agriculture and the Household Durables Sub-sectors

Panel A:	**Agriculture**			**Panel B: Household Durables**	
Dependent Variable	**lninv**	**lnq**	**lnexp**	**lninv**	**lnq**
cons	-3.3429 (-5.08)	-0.7835 (-0.69)	0.7893 (0.37)	-1.5926 (-0.77)	2.1098 (0.80)
lnq L1		1.1132*** (28.87)			
lnnexp L1			1.0277*** (102.09)		
lninv L1	1.1007 (23.66)			-0.0002 (-0.00)	
rer	0.0155 (1.51)	0.0015 (0.42)	-0.0130 (-2.72)	0.0080* (1.72)	-0.0132*** (-2.90)
vol	-0.4000** (-2.03)	0.1001 (0.69)	0.5100 (1.53)	-0.7000** (-2.11)	0.5600 (0.80)
lninv		-0.0321*** (-3.25)	-0.0237* (-1.68)		0.3745*** (27.41)
lnoilp		-0.3105*** (-3.47)	-0.2815 (-1.40)		0.1496** (2.29)
lnnw		0.0590* (1.76)	0.0001 (0.00)		0.4145 (1.27)
lnq	0.0861 (1.56)			1.0180 (51.31)	
rir	-0.0011 (-0.25)			0.0004*** (7.94)	
Sargan test Chi-Sq	4.17 [0.244]	4.04 [0.543]	2.24 [0.134]	0.18 [0.669]	1.02 [0.313]
Hansen Test Chi-Sq	5.27 [0.481]	3.41 [0.548]	2.86 [0.154]	4.16 [0.625]	2.62 [0.124]
AR(1)	-1.48 [0.139]	-1.39 [0.163]	-1.26 [0.208]	-0.74 [0.456]	-1.36 [0.175]
AR(2)	1.81 [0.071]	-0.14 [0.886]	0.30 [0.761]	-0.70 [0.483]	0.03 [0.973]

Notes: The dependent variables are natural log of output, export and investment. The t-ratios are in parentheses, while the figures in bracket are p-value for Sargan test and serial correlation test. *,**,*** represent statistical significance at 1, 5 and 10 percent levels respectively

The parameter estimates of the investment model in the industrial goods sub-sector (table 5.13 panel A) show that real exchange rate and real interest rate significantly influence investment of the sub-sector. This confirms that bank lending rate could reduce the firms' investment. Although the coefficient of the exchange rate at level is not in line with theory that of exchange rate volatility conforms to *a prior* expectations. In the output model, investment and oil price are statistically significant at the 1% level. However, the coefficient of the exchange rate volatility is not significant but its sign is consistent with *a priori* expectation. The statistically insignificant effect of exchange rate volatility on firms' output in this sub-sector can be attributed to domestic procurement of major inputs use in the sub-sector. The production structure in the sub-sector is such that firms used a large extent of domestically sourced raw materials which reduces their sensitivity to exchange rate risk. This result is consistent with the empirical findings of Diallo (2007), which reveal a negative effect of exchange rate volatility on Indian firms. The first period lag investment contributes significantly to current investment which suggests substantial capital accumulation in the sector.

In the investment model of the oil and gas sub-sector, the diagnostic tests (Sargan and Hansen) validate the choice of instruments used in the dynamic model. Also, the test of serial correlation indicates that the model does not suffer from autocorrelation. The results of the regression indicate that exchange rate volatility, output and a lagged investment significantly affect current investment. A striking observation of the findings is that the coefficient of exchange rate volatility is contrary to *a priori* expectation. This could be attributed to the structure of production in the oil and gas industry that requires a substantial investment even in the periods of excessive volatility. In addition, most firms in the oil and gas sub-sector earn foreign exchange from their exports to moderate the adverse effect of exchange rate volatility. These results are in line with the findings of Mustafa and Rebecca (2008) that exchange rate volatility has stimulating effect on investment through import channel in Mexico. The current output level positively influences investment in the industry. A percentage increase in output of the sub-sector will give rise to 0.22% increase in investment.

The empirical findings from the output equation of the oil and gas sub-sector reveal that real exchange rate, exchange rate volatility and investment significantly influence output. The signs of the coefficients of exchange rate volatility and investment conform to *a priori* expectation. However, the coefficient of the real exchange rate at level is not in line with theory. The result suggests that a percentage increase in exchange rate volatility will lead to 0.3% decline in output of the sub-sector. Additionally, a percentage increase in investment and lagged output will generate increase in output of 0.44% and 0.79% respectively. These results are in line with the findings of Kandilov and Leblebicioglu (2011), revealing a negative effect of exchange rate volatility on firms with a high import content of capital goods.

In the export model, real exchange rate at level and numbers of workers employed in the firms are significant. The sign of the coefficient of the real exchange rate is consistent with *a priori* expectation, indicating that a depreciation of domestic currency increases export. Although the coefficient of exchange rate volatility is consistent with theoretical prediction, it is not significant in the model. This could be attributed to the dominance of the sub-sector in the nation's economy; operating firms have incentives to export even in the presence of exchange rate volatility. Evidence from the coefficient of labour employed shows that there is a substantial increase in the marginal productivity of labour.

Table 5.13: System GMM for the Industrial Goods and the Oil and Gas Sub-sectors

Panel A:	**Industrial Goods**		**Panel B:**	**Oil and Gas**	
Dependent Variable	**lninv**	**Lnq**	**lninv**	**lnq**	**lnexp**
cons	2.8315 (16.43)	0.1734 (0.07)	4.1089 (1.96)	0.8482 (0.36)	-8.5516 (-2.47)
lnq L1				0.7916*** (6.41)	
lnnexp L1					
lninv L1	0.6590*** (4.63)		0.5230* (3.70)		
rer	0.0130*** (2.65)	0.0005 (0.10)	0.1400 (0.10)	0.0866* (1.81)	-0.0371*** (-2.97)
vol	-0.0500 (-0.60)	-0.0600 (-1.18)	0.4800* (1.80)	-0.3420* (-1.74)	-0.2600 (-0.50)
lninv		-0.1068*** (-3.49)		0.4438*** (2.42)	0.1589 (0.37)
lnoilp		-0.3896*** (-2.89)		0.3831 (0.75)	1.8083 (1.40)
lnnw		-0.3192 (-0.95)		-0.7417 (-1.23)	1.1716* (1.96)
lnq	0.1497 (1.32)		0.2263* (1.96)		
rir	-0.0036* (-1.76)		-0.0085 (-0.91)		
Sargan test Chi-Sq	-1.62 [0.453]	9.64 [0.086]	7.73 [0.258]	0.51 [0.972]	0.13 [0.716]
Hansen Test Chi-Sq	0.631 [0.971	0.480 [0.816]	5.15 [0.525]	0.58 [0.965]	0.364 [0.722]
AR(1)	-1.62 [0.105]	-1.40 [0.163]	-2.06 [0.040]	-1.03 [0.302]	-1.50 [0.133]
AR(2)	1.72 [0.086]	-0.98 [0.328]	1.41 [0.159]	0.42 [0.677]	1.60 [0.110]

Notes: The dependent variables are natural log of output, export and investment. The t-ratios are in parentheses, while the figures in bracket are p-value for Sargan test and serial correlation test. *,**,*** represent statistical significance at 1, 5 and 10 percent levels respectively

The results of the investment model of the printing and publishing sub-sector on table 5.14, panel A, show that real exchange rate, exchange rate volatility and output significantly influence investment. Again, a counter intuitive result was obtained from the coefficient of exchange rate volatility showing that exchange rate volatility could increase investment. The output equation indicates that exchange rate volatility and the numbers of workers employed significantly affect output. However, the coefficient of exchange rate volatility does not conform to the theoretical prediction owing to the nature of the sub-sector in which production occur on a seasonal basis. Therefore, the sub-sector might not be sensitive to exchange rate volatility. In addition, the producer could procure inputs ahead of production time and hedge against exchange rate risk when excessive volatility is being anticipated.

Similar results were obtained from the export model where the coefficient of the exchange rate volatility is not in line with theory but it is significant. This could also be associated with timing as it concerns educational materials that time factor is important. Additionally, there is increasing marginal productivity of workers in the sub-sector as shown by the coefficient of the labour employed variable. A similar finding was revealed by the study of Tang (2011) which emphasizes a positive and significant impact of exchange rate volatility on region's investment and exports in South Asia. In addition, the coefficient of real interest rate shows that a higher rate could reduce investment.

On the automobile and tyre sub-sector, basically, firms that operate here are mainly tyres manufacturing companies. Some of the firm largely involve in importation of raw materials and equipment needed to facilitate production from abroad. The estimates of the investment model indicate that real exchange rate and output significantly influence investment at 1% level. The negative coefficient of exchange rate at level shows that a depreciation of domestic currency adversely affects the import of capital goods. This is in line with the Mundel-Flemming's proposition that exchange rate depreciation makes imports more expensive and export attractive. The result also reveals that an increase in output of the industry increases capital accumulation.

The findings from the output model of the automobile and tyre sub-sector show that exchange rate volatility and lagged output are statistically significant. However, the

coefficient of exchange rate at level is not significant. This suggests that the producers in this sub-sector are not sensitive to exchange rate depreciation; however, long term volatility could make them alter their production activities. A similar result was found by Kandilov and Leblebicioglu (2011) for firms that heavily depended on imported raw materials. Sargan and Hansen tests of the validity of instruments show that the choice of the instruments used are appropriate. In addition, the serial correlation test indicates that there is no evidence of either first or second order autocorrelation in the model.

Table 5.14: System GMM for the Printing and Publishing and the Automobile and Tyres Sub-sectors

Panel A:	**Printing and Publishing Sector**			**Panel B: Automobile and Tyres**	
Dependent Variable	**lninv**	**Lnq**	**lnexp**	**lninv**	**lnq**
cons	10.4850 (2.81)	14.0663 (1.71)	-15.1357*** (-6.82)	-3.4810*** (-4.92)	-1.1292 (-0.35)
lnq L1		0.0956 (0.21)			1.1409*** (2.98)
lnnexp L1			-0.3501 (-0.51)		
lninv L1	-0.1060* (-1.84)			0.2637 (1.25)	
rer	0.0135 (0.42)	-0.0100 (-0.02)	-0.0123 (-0.26)	-0.0413*** (-9.20)	0.0038 (0.15)
vol	1.080* (1.95)	1.600* (1.95)	0.9130*** (145.06)	0.8400 (1.55)	-0.0130** (-2.03)
lninv		0.0501 (0.61)	-0.3624 (-0.60)		-0.1042 (-0.53)
lnoilp		-0.2386 (-1.18)	-5.5698*** (-18.22)		0.0167 (0.67)
lnnw		0.5054*** (41.86)	9.6821*** (13.39)		0.0454 (0.32)
lnq	0.3726* (1.78)			0.7934*** (4.04)	
rir	-0.0053 (-1.34)			-0.0050 (-1.61)	
Sargan test Chi-Sq	1.57 [0.905]	0.73 [0.392]	0.01 [0.915]	0.13 [0.988]	0.15 [0.696]
Hansen Test Chi-Sq	6.03 [0.841]	3.20 [0.682]	2.12 [0.246]	3.11 [0.521]	2.52 [0.216]
AR(1)	-1.26 [0.290]	-0.68 [0.498]	-1.26 [0.208]	-1.22 [0.222]	-1.40 [0.161]
AR(2)	-1.00 [0.218]	0.59 [0.556]	-1.00 [0.318]	1.20 [0.231]	-0.40 [0.688]

Notes: The dependent variables are natural log of output, export and investment. The t-ratios are in parentheses, while the figures in bracket are p-value for Sargan test and serial correlation test. *,**,*** represent statistical significance at 1, 5 and 10 percent levels respectively

CHAPTER SIX

SUMMARY AND CONCLUSION

6.1 Introduction

This chapter presents the key findings of the study. Some lessons for policy are also drawn, followed by agenda for future research and conclusion.

6.2 Summary of Findings

This study examined the effects of exchange rate volatility on firm-level economic activities in Nigeria. A special consideration was given to the impact of exchange rate volatility on firm-level output, export and investment. Data were collected from 50 manufacturing firms listed on the Nigerian Stock Exchange. These firms were classified into sub-sectors, namely, food product, conglomerates, beverages, healthcare, agriculture, household durables, industrial goods, oil and gas, printing and publishing and automobile and tyres. The criteria for data classification were based on representativeness of the various sub-sectors. Exchange rate volatility was computed using GARCH technique. The GARCH technique captures the long lags in shocks of the real exchange rate. Additionally, it accounted for high and low variances in data clustering. The series generated by computing the GARCH of real exchange rate was used in the regression model as the volatility variable. The one-step system GMM (dynamic model) was used to determine the effect of exchange rate volatility on firm-level economic activities. This technique was used to correct the potential endogeniety problem that could emanate from the static model.

Evidence revealed that the liberalization of the foreign exchange market in Nigeria in 1986 had increased exchange rate volatility with adverse effect on firm-level economic activities. Trend analysis showed that real exchange rate recorded large swings during the study period. The average exchange rate volatility between 1990 and 1994 was 79.0%. A relatively mild movement occurred between 1994 and 1998 which marked the period when

naira was pegged to the U.S. dollars. The pegged arrangement was not sustainable as a result of the dwindling external reserve. After the pegged arrangement, exchange rate volatility intensified with further liberalization of the foreign exchange market. In addition, the performance of the firms in the manufacturing sector showed that there were periods of high decline in their economic activities attributed to heavy dependence on imported inputs with less export commodities, thereby, putting pressure on foreign exchange. For instance, firms in the food product sub-sector recorded an average decline in output of 34.0% between 1991 and 1995. In the same period, the agricultural sub-sector recorded a decline of 46.6% in export. This period corresponded to the time of high exchange rate volatility.

The first that was conducted in the empirical analysis was to generate the descriptive statistics. It was shown that output (domestic sales) has the highest mean value, implying that the sales in the domestic market were higher than foreign market. Export data have the highest standard deviation, possibly explained by the swings in export due to exchange rate. The stationarity of the variables in the regression were tested using IM Pesaran and Shin panel unit root test. This procedure enables to combine information from series that have both time and cross section dimensions. The results of the unit root test indicated that some of the variables were stationary at level while others were stationary at first difference. This suggested that using static[21] regression technique could generate bias estimates; hence, there was a need to conduct a dynamic panel analysis.

The aggregate manufacturing sector results revealed that exchange rate volatility was detrimental to the exports of firms in Nigeria. It showed that a percentage increase in exchange rate volatility reduces aggregate export by 2.1%. The high percentage recorded in export was attributed to the fact that the exporting firms use more foreign exchange than firms that produce for the domestic market. In the output regression, the coefficient of the real exchange rate at level was significant, showing that exchange rate depreciation increased the demand for domestic products relatively to the imported goods. Hence, during naira depreciation, consumers reduce their purchase of imported products. Accordingly, the result supported the theoretical prediction that exchange rate depreciation increases output. However, the coefficient of exchange rate volatility is not significant in the output and

[21] Static model are the fixed and random effects models

investment equations, a plausible explanation for this is that the firms hedge against exchange rate risk in the procurement of raw materials and capital goods.

On the sub-sectors results, exchange rate volatility significantly influenced outputs of food products, beverages, healthcare and automobile and tyres sub-sectors. This showed that excessive exchange rate volatility has adverse effect on production activities. Specifically, the effects of exchange rate volatility on the sub-sectors' output occurred through the procurement of imported inputs. In addition, a statistically significant effect of exchange rate volatility was obtained in the export equations of the food products, beverages, health care and printing and publishing sub-sectors. A close examination of the coefficients of the parameter estimates indicated that the magnitude of impact of exchange rate volatility was higher in the export than output. This is due to the fact that in the case of output, exchange rate volatility affected it only through the imported inputs channel. However, exchange rate volatility affected export through both imported inputs and export sales channels. Further, the effect of exchange rate volatility on investment was evident in the agricultural and household durables sub-sectors. However, the results of oil and gas and printing and publishing sub-sectors were counter intuitive, showing that, excessive volatility increased investment. A plausible reason for the result obtained in the oil and gas industry is due to the dominance of the industry in the nation's economy which necessitates high investment to keep production at pace with both domestic and foreign demands. Moreover, firms operating in the oil and gas sub-sectors earn foreign exchange which they use to moderate the adverse effects of exchange rate volatility. In the printing and publishing industry, investors used hedging instruments to reduce the risk of exchange rate volatility.

A positive effect of exchange rate depreciation on output was obtained in the beverages and household durables sub-sectors. However, the results of the oil and gas sub-sector showed that exchange rate depreciation reduces output. This could be attributed to factors outside the explanation of exchange rate such as government policy, crises due to the activities of militant in the oil producing regions and oil price fluctuation in the international market. Consistent with theory, real exchange rate depreciation promoted exports in the agriculture and oil and gas sub-sectors. A plausible explanation for this is that the two sub-sectors are

the key export focus in the Nigerian economy; hence, the sensitivity of the industries to exchange rate depreciation is expected.

6.3 Policy Implications of Findings and Recommendation

The findings of this study have important policy lessons. It is apparent that exchange rate volatility adversely affects firm-level economic activities in Nigeria. The greater effects occurred in firms that rely heavily on imported inputs. Since the monetary authority manages the exchange rate with the external reserve mainly generated from crude oil export, it has been identified that turbulence in crude oil export and nominal shocks trigger exchange rate volatility which adversely affects firm-level economic activities. Therefore, an effective exchange rate management and export diversification are essential to reduce the effect of exchange rate volatility on investment, output and exports by firms.

In addition, it was found that food products, beverages and healthcare sub-sectors of the manufacturing were adversely affected by exchange rate volatility. Hence, necessary measures should be put in place by the government to reduce the reliance of the manufacturing sub-sector on imported inputs. Some strategies that can be adopted are the expenditure switching and import dampening policies.

This study revealed that investors were very sensitive to the risk inherent in exchange rate volatility. A proper measure should be put in place by the monetary authority to manage exchange rate volatility risk and ensure an investment friendly environment to increase firms' output, export and investment in the country.

6.4 Limitation and Suggestions for Future Research

One of the major limitations of this research is the availability of data; many firms listed on the Nigerian Stock Exchange did not provide detail information of their international transactions in their financial statements. Also, there were some inconsistencies in record of the firms' financial statement which gave rise to rigorous reconciliation of information by the author.

Future studies can increase the number of firms employed for the study. This study used data of 50 firms; specifically it concentrated on the non-financial firms listed on the

Nigerian Stock Exchange. It could be important to increase the numbers of firms to achieve better observations and inferences. This would improve the confidence in generalizing the study across firms in Nigeria.

6.5 Conclusion

This study examined the effect of exchange rate volatility on firm-level economic activities in Nigeria. Specific attention was given to the effect of exchange rate volatility on firms' investment, output and export. The problem of exchange rate volatility in Nigeria emanated from both the demand and supply sides of the economy. The demand side is as a result of substantial increase in demand for imported finished products, dependence of the industrial sector on imported raw materials and other inputs, capital flow reversals by portfolio investors and high speculative demand causing uncertainty in the foreign exchange market. The supply side springs from the sources of foreign exchange reserve to the country. Nigeria generated a huge amount of its foreign exchange earnings from crude oil export. Recently crude oil output and export has been severely affected by price fluctuation in the international market. This had reduced foreign exchange earnings to manage exchange rate volatility.

It was discovered that exchange rate volatility is one of the factors responsible for stumpy firms' investment, output and export in Nigeria. The negative effects were higher in the food products, beverages, healthcare and household durable sub-sectors. This was as a result of the high reliance of the sub-sectors on imported inputs. Further, higher negative impacts of exchange rate volatility were obtained among exporting firms. This is due to the fact that most of them are risk averse. A mild adverse effect of exchange rate volatility was recorded in the oil and gas sub-sector. This is because the oil and gas sub-sector earns substantial amount of foreign exchange from export, hence, it could hedge against the risk of exchange rate volatility. The monetary authority should device measures that can reduce the negative effect of exchange rate volatility on investment, output and export in Nigeria.

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Appendix A1

Table 1: Exchange Rate Types and Real Exchange Rate Volatility

Year	NER (₦/$)	RER (₦/$)	NEER	REER	RER Volatility
1990	8.038	0.472	7.700	82.260	0.017
1991	9.910	0.631	6.300	70.110	0.073
1992	17.298	1.548	3.700	58.150	0.434
1993	22.051	3.013	3.000	63.420	0.375
1994	21.886	4.597	3.000	118.330	0.807
1995	21.886	7.693	0.700	100.310	0.916
1996	21.886	9.651	30.200	123.310	0.556
1997	21.886	10.241	28.800	143.320	0.298
1998	21.886	11.091	28.300	159.420	0.433
1999	92.693	48.811	73.900	80.290	1.952
2000	102.105	55.613	77.200	81.360	3.774
2001	111.943	70.318	81.300	90.450	3.582
2002	120.970	84.698	89.000	90.270	5.785
2003	129.857	101.209	100.600	85.310	10.339
2004	133.500	116.567	107.100	87.600	3.333
2005	132.147	131.270	106.600	100.000	5.670
2006	128.652	134.894	105.000	106.950	3.406
2007	125.833	135.171	106.400	104.800	3.704
2008	118.567	136.851	79.000	116.380	10.245
2009	147.272	156.381	95.700	108.960	8.364
2010	148.309	156.895	96.600	117.930	26.893
2011	157.790	177.533	96.200	120.350	18.099
2012	152.790	169.474	96.200	120.350	38.758

Source: Central Bank of Nigeria Bulletin, 2012 for Nominal Official Exchange Rate (NER), Nominal Effective Exchange Rate (NEER). Author's computation for REER, RER and RER volatility.

Appendix A2

Table 2: Listed Companies Assessed on the Nigerian Stock Exchange

S/N	Sub-sectors	Numbers	Firms
1	Food Products	6	Cadbury Nigeria plc, Nestle Nigeria plc, Flour Mills of Nigeria plc, Unilever Nigeria plc, PS Mandrides and Company plc, PZ Cussons Nigeria plc
2	Beverages	6	7-UP Bottling company plc, Nigerian Bottling Company, Nigerian Breweries plc, Guinness Nigeria plc, Jos International Breweries plc, International Breweries plc
3	Conglomerates	5	A.G. Leventis Nigeria plc, Chellarams plc, John Holt plc, Transnational corporation of Nigeria plc, UAC of Nigeria plc.
4	Health care	5	Evans Medical plc, Fidson Health care plc, Morison Industries plc, GlaxoSmithKline Consumer Nigeria plc, May & Baker Nigeria Plc
5	Agriculture	4	Livestock Feeds, Ftn cocoa processor plc, Okomu oil palm plc, Presco plc.
6	Household durables	4	Vita foam Nigeria plc, Vono foam Nigeria plc, Nigerian Enamelware Plc, Rokana Industry plc
7	Industrial Goods	4	Berger Paints Plc, Beta Glass Company plc, CAP plc, DN Meyer plc
8	Oil and gas	8	B.O.C. Gases plc, Eterna Plc, Mobil Oil Nigeria plc, Mrs Oil Nigeria plc, Total Nigeria plc, Afroil plc, Conoil Oil plc, Texaco plc
9	Printing and Publishing	4	Academy Press plc, University Press plc, Longman plc, Learn Africa plc
10	Automobile and Tyres	4	Dunlop Nigeria plc, INCAR plc, SCOA plc, R T Briscoe plc

Source: Compiled by the author

APPENDIX B1: Summary of Literature Review

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
1	Sato K. et al (2013)	Industry-specific exchange rate volatility and intermediate goods trade in Asia	The paper investigates whether and how the volatility of exchange rate affects intra-regional production and distribution networks characterized by trade of intermediate goods in Asia between 2003 and 2010.	Employed an extended gravity model proposed by Anderson and Wincoop (2003) which allows for time varying exporter and importer effects	A pooled OLS estimation. Taking into account time varying country effect and time fixed effects.	It was found that exchange rate impact on intraregional trade differs across industries. Exchange rate volatility has negative significant effect only on general machinery industry in Asia.
2	Chia-Lin Chang Hui-Kuang HSU and Micheal Mctheer (2013)	Is small beautiful? Size effects of volatility spillovers for firm performance and exchange rates in Tourism	Examine the size effects of volatility spillover for firm performance and exchange rate asymmetry in Taiwan tourism industry from 1 July 2008 to 29 June 2012.	Traditional demand model that incorporate international tourism demand.		Empirical findings revealed that there was a negative correlation between exchange rate returns and stock index returns implying greater diversification benefits of portfolio.

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
3	Alberto C. and Mark G. (2009)	Volatility and firm growth in 80 countries between early 1999 and late 2000..	Investigate the effect of volatility on firm growth	It follows theoretical model by Caballero (1991)	Standard curve enterprise questionnaire methodology. Extensive questionnaire via face to face interview with firm manager	The paper established the existence of an adverse effect perceived volatility on growth.
4	Antonio A. et al (2007)	The impact of exchange rate volatility on Brazilian manufactured exports	Examine the impact of exchange rate volatility on the volume of Brazilian manufactured exports using data from 1985:1 to 2002:2	The theory follows from Mckenzie (1999) which suggested that quantum of export may be affected by the volatility of the real exchange rate	The volatility variable was proxy by the standard deviation of the changes in the real effective exchange rate. ARDL was used to determine the long run and short run dynamics was estimated using ECM	The result shows that exchange rate volatility significantly affected Brazilian manufactured exports between 1986 and 2002.
5	Anubha D. (2013)	Real effective exchange rate and manufacturing sector performance: Evidence from Indian firms.	Investigate the impact of real effective exchange rate on firm level performance between 2000 and 2012	extended Cobb-Douglas production function	Random effect was used to estimate the model. To check the robustness of the model the output growth was replaced with income and sales growth.	The empirical analysis shows that real exchange rate movements have significant impact on Indian firm's performance through the cost as well as revenue channel.

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
6	David G. Richard Kneller and Xufei Z. (2010)	Exchange rate uncertainty and export decision in the UK.	Examine empirically the effects of exchange rate uncertainty on firm export decision in UK using firm-level data from 1988 to 2004.	Theory of investment under uncertainty with some specific modification to test for hysteresis effects.	Standard deviation of the first difference logarithmic spot exchange rate is used to measure uncertainty. Firm level panel regression with two stage sample selection model.	The result show that exchange rate uncertainty has little effect on firm's export participation but a significant impact on export intensity.
7	Arturo G. Aleyandro I. and Jose M. (2006)	Real exchange rate dollarization and industrial employment in Latin America	analyze the impact of real exchange rate changes on industrial employment in Latin America from 1990 to 1999.	Follows from Campa and Golbeg (2001). Exchange rate shocks influence labour demand by affecting the marginal revenue product of labour	Following Arellano and Bover (1995) and Blundell and Bond (1998), the study employed GMM estimation technique.	The result suggests that in industries with high liability dollarizarion the overall impact of real exchange rate depreciation can be negative.
8	Mustafa C. and Friat D. (2012)	Firm productivity, exchange rate movements, sources of finance and export orientation	Investigate the effects of real exchange rates volatility on productivity growth of manufacturing firms in Turkey between 1993 and 2005 period.	Theoretical model follows from Burgess and Knetter (1998) which has been extended by Leblebicioglu (2011)	GARCH (1,1) model was used to measure volatility. The paper employed GMM estimation technique following Arellano and Bond (1991)	It was found that exchange rate volatility affects productivity growth negatively; having access to foreign or domestic equity, or debt market does not alleviate these effects.

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
9	Aghion P. Bacchetta R. and Rogoff K. (2009)	Exchange rate volatility and productivity: The role of financial development	Investigate whether a country level of financial development matter in choosing the flexibility of an exchange rate system Using data set for 83 countries of the years 1960 - 2000 .	A stylized model following Dornbusch (1987), this allow for a small open economy with sticky prices	GMM methodology	The paper offers empirical evidence that real exchange rate volatility can have significant impact on productivity growth. However the effect depend critically on a country's level of financial development
10	Prashanth M., Rainer S. and Aitya S. (2009)	Sectoral research and development intensity and exchange rate volatility: A panel study for OECD countries	Analyzes the impact of macroeconomic volatility on research and development in OECD countries between 1987 and 2003.	Simple one sector AK model was used to show how volatility affects growth through investment	Exchange rate volatility was measured using GARCH approach. Panel regression with fixed effect was adopted for the model	The findings show that the direct effect of volatility is pronounced in manufacturing sector but is dominated by the indirect effect via export channel
11	Ben T. (2008)	Exchange rate volatility, plant turnover and productivity	examine the effect of movements in the real exchange rate on productivity at firm level in 256 industries from 1973 to 1997	It follows a theoretical model of entry and exit of firms developed by Jovanovic (1982) and extended by Melitz (2003)	Two models were estimated. First is simple OLS and the second involve the estimation of fixed-effects model.	Findings show that depreciation (appreciation) of the real exchange rate increases (decrease) the probability that a given plant will stay in the market and that higher productivity plant are more likely to stay in the market

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
12	Tarek H., Faouzi T. and Terence Y. (2005)	The effects of exchange rate on investment. Evidence from Canadian manufacturing industries	Examine the relationship between exchange rates and investment in Canadian manufacturing industries during 1981 and 1997	An investment model in which both input and output prices are affected by the exchange rate following Chirinko (1993)	GMM estimation technique following Arellano and Bond (1991). Volatility in exchange rate was computed using GARCH (1,1) model.	The result shows that the overall effect of exchange rate on total investment is statistically insignificant.
13	Jerome H. and Sandra P. (2012)	Exchange rate volatility, financial constraints and trade: empirical evidence from Chinese firms	Investigate how firm-level export performance is affected by RER volatility using export data for more than 113,368 Chinese firms from 2000 to 2006	It follows the theoretical model proposed by Aghion *et al* (2009)	Exchange rate volatility was computed using standard deviation. The model was estimated using firm-county fixed effect estimation technique	The result indicated a trade-deterring effect of RER volatility but suggest that its magnitude depends mainly on the extent of financial constraints
14	Steven J. and James A. (2008)	Interpreting the great moderation: changes in the volatility of economic activity at macro and micro levels	Investigate the behaviour at micro level for clues about the sources and consequences of aggregate volatility changes. It covers post-Korean war data	The study applied the theory of improved investment control from the work of Kahn (1987), Bils and Kahn (2000)	Volatility was computed using standard deviation approach. Basic graphical and descriptive approach was used to describe the estimate	Volatility increase in microeconomic data on wages, incomes, consumption expenditures. Declines volatility was experienced in aggregate output.

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
15	Toseef A., Muhammad J. Aneela K. and Ali K. (2005)	Impact of exchange rate volatility on growth and economic performance: A case study of Pakistan	Investigate the impact of real exchange rate volatility on growth and economic performance in Pakistan data from 1973 to 2003	IS and LM framework that provides a link between exchange rate volatility and economic growth	GARCH was used to measure volatility and VAR model was employed to estimate the model	The result obtained are positive but are insignificant, and do not support the position that excessive volatility or shifting of exchange rate regimes has pronounced effects for manufacturing production.
16	Luis J. Carranza J. and Goldon S. (2011)	Exchange rate volatility and economic performance in Peru: A firm level analysis	Analyzes the impact of exchange rate volatility on the performance of Peruvian economy using163 non-financial listed firms' data between 1994 and 2001.	Liquidity constraint hypothesis	Dynamic GMM estimation technique	The findings show that for firms holding dollar denominated debt, investment decisions are negatively affected by real exchange rate depreciation.
17	Robert D. Hyeok J. and Iteajin R. (2008)	Firm level heterogeneity and aggregate disconnect puzzle between exchange rates and exports	reconcile the conflicting evidence between microeconomic data on the exchange rate elasticity of export in Japan from 1982 to 1997	An open economy type of monopolistic completion model pioneered by Obstified and Rogoff (1996)	Estimation technique adopted include OLS, fixed effect and random effect estimators	Micro and aggregates estimate of this elasticity agree with each other and are significantly negative

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
18	Fung L. and Jui-Tan L. (2009)	The impact of large real exchange rate movement on firm performance: A case study of Taiwanese manufacturing firms	Examine the impact or real exchange rate movement on Taiwanese manufacturing firms covering the period from 1992 to 2000	It follows the theory developed by Fung (2004) that predicted exchange rate movements would affect a firm's productivity by changing its scale of production	Unbalanced panel data and fixed effect regression technique	Findings indicate that the real depreciation of New Taiwan dollar led to an increase in export, domestic sales, total sales and value-added.
19	Miguel F. and Pablo I. (2009)	Firm dynamics and real exchange rate fluctuation: Does trade openness	Investigate the effect of NAFTA on the responsiveness of Mexican economy to real exchange rate shocks in mid 1980s and Tequila crisis of 1984 to 1992	Developed from Calvo, Izquierdo and Talvi (2008)	Balanced panel regression.	The result indicate that after the commencement of NAFTA, exporting firms exhibited higher growth rates of employment, sales and vis a vis non-exporters in Mexico
20	Katheryn N. (2011)	Exchange rate volatility and firs entry by multinational firms	Investigate the impact of exchange rate variability on investment behaviour of multinational firms from 1986 to 2005	A simple model with heterogenous firms following Bachetta and Van Wincoop (2000)	Using GARCH framework for volatility and a panel regression model	Findings show that real exchange variability can increase FDI inflows from partners in the peg regions

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
21	Muhammad T., Taghavi M. and Bandidarian A. (2011)	The effect of exchange rate uncertainty on import (TARCH Approach)	Examine the effect of exchange rate uncertainty on Iran's import trade using annual data from 1959 to 2009 periods	The theoretical framework follows from Clark (1973)	TARCH model was used to generate volatility of exchange rates, OLS technique was employed to estimate the structural equation	Result show significant and negative impact of exchange rate uncertainty on Iran's imports and demand is positively affected by real national income.
22	Ivan T. and Asli L. (2010)	The impact of exchange rate volatility on plant-level investment: Evidence from Colombia	Investigate the impact of exchange rate volatility on firms' investment decision in Colombia from 1981 to 1987.		GMM estimation technique GARCH was used to measure volatility	A negative impact of exchange rate volatility on investment was found.
23	Mustafa C. and Rebecca I. (2008)	The effect of exchange rates on investment in Mexican manufacturing industry	Investigate the linkages between the level and the volatility of exchange rates and firms' capital investment behaviour in Mexico from 1994 to 1999	The theoretical model adopted was a variant of Campa and Goldberg (1995,1999)	ARCH mode was used to measure exchange rate volatility. Panel regression with fixed effect was used to analyze the model	It was found that exchange rate depreciation affect capital investment positively through the export channel and depresses expected profits if there is a high reliance on imported inputs

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
24	Sarah Guilleu (2008)	Exports and exchange rate: a firm level investigation	Investigate how export intensity and export penetration by French firms are sensitive to the level and volatility of exchange rates firms from 1994 to 2004	It follows Campa (2004) who estimates dynamic discrete choice firm model	Panel regression using random effect	The result show that exchange rate volatility has a positive impact on probability that a firm will enter the export market
25	Nan Geng and Pape N. (2012)	Determinants of corporate investment in China: Evidence from cross country firm level data	Explain the dynamics of investment in China using firm-level data from 1990 to 2009		GMM estimation technique using an unbalanced panel of 52 economies	The result suggest that financial sector reforms, including that which raises interest rates and appreciates the real effective exchange rate would lower investment and help rebalanced growth away from exports and investment towards private consumption
26	Christopher F. Mustafa C. and John T. (2012)	Exchange rate uncertainty and firm profitability	Investigate the effects of permanent and transitory components of the exchange rate on firm's profitability under imperfect information	A Cobb-Douglas framework extended to incorporate capital stock, investment, exchange rate and price of output	First and second moment prediction technique	The finding show that greater exchange rate volatility associated with the permanent component of the exchange rate leads to more vigorous action and greater variability in the growth rate of the firm's profit

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
27	Hsaio C. and Tang (2011)	Intra-Asia exchange rate volatility and Intra-Asia trade: Evidence by type of goods	Examine the impact of intra-Asia exchange rate volatility on intra-Asia trade in primary goods, intermediate goods, equipment goods and consumption goods from 1980 to 2009		Panel dynamic ordinary least squares that accounts for cross sectional and time series properties	The result shows a significant and positive impact of exchange rate volatility on regional production networks for South Asia.
28	Fuentes Olga M. (2006)	Exchange rate volatility and investment: Evidence at the plant level	To provide empirical evidence on the effect of exchange rate uncertainty on capital accumulation under the presence of irreversibility in the investment process.	A simple model that defines how exchange rate volatility affect investment decision following Dixit and Pyndick (1994) Lee and Shin (2000)	A panel regression of 52000 manufacturing firms in Chile using fixed effect to control for plant specific heterogeneity	Overall, the resul tsupport the view that uncertainty has a significant and negative effect on plant-level investment
29	Mpofu T. (2013)	Real exchange rate volatility and employment growth in South Africa	Examine the impact of real exchange rate volatility on employment growth using data from 1995 to 2010	The model follows from Belke and Setzer (2003) which illustrates the transmission channel between exchange rate volatility and employment growth	ARDL cointegration method	Findings indicate that real exchange rate volatility has significant and contractionary effect on manufacturing employment growth in South Africa

S/N	Author	Title of the paper	Objective	Theoretical Framework	Methodology and Variables	Findings
30	Fuat S. (2011)	Exchange rate volatility and stock returns in the U.S.	Examine the effect of exchange rate volatility on the profits of firms in the U.S employing data on stock returns from 1980 to 2008.	Theoretical model developed by Shapiro (1975) on profitability effect of exchange rate uncertainty on the value of multinational firms	Using squared residuals from ARMA process	This paper found that exchange rate volatility might negatively affect firm's profitability because of increasing cost of covering exchange rate risk under a flexible exchange rate system.

Appendix B2: Types of Exchange Rate Regimes

S/No.	Types	Descriptions
1	Currency Boards	This is a monetary Regime based on an explicit legislation commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate combine with restrictions on the issuing authority to ensure the fulfillment of its legal obligations
2	Fixed-Peg	The country pegs its currency at a fixed rate to another currency or a basket of the currencies of major trading partners weighted to reflect the geographical distribution of trade, services or capital flows. The parity is irrevocable.
	Pegged within horizontal bands	The value of the currency is maintained within certain margins of fluctuation around a fixed central rate. There is a limited degree of monetary policy discretion, depending on the band's width.
3	Crawling Peg	The currency is adjusted periodically in small amounts at a fixed rate or in response to changes in selective quantitative indicators such as pas inflation differentials of major trading partners, differentials between the inflation targets and expected inflation in major trading partners.
	Crawling Bands	The degree of exchange rate flexibility is a function of the width of the bands. The commitment to maintain the exchange rate within the band imposes constraint on monetary policy.
4	Managed Floating	The monetary authority attempts to influence the exchange rate without having a predetermined path or target for it. Indicators for managing the rate include the balance of payments position, the level of international reserves and parallel market developments and adjustment may not be automatic. Intervention may be direct or indirect.
5	Independent Floating	The exchange rate is determined by the markets. Official intervention in the foreign exchange market is infrequent and discretionary. It is usually aimed at moderating the rate of change of and preventing fluctuations in the exchange rate rather than establishing a level for it.

Source: Extracted from IMF Economic Issue, by Duttagupta *et al*, 2005

Appendix C1

Panel Unit Root Test For Food Products and Beverages Sub-sectors										
	Food Products					Beverages				
Variable	**Level**		**1st Difference**		**Decision**	**Level**		**1st Difference**		**Decision**
	Stat.	P-Value	Statistics	P-Value		Statistics	P-Value	Statistics	P-Value	
q	-1.3202	0.0934	-5.6193	0.0000	I(1)	0.4107	0.6594	-4.1203	0.0000	I(1)
inv	-0.5932	0.2765	-6.3175	1.0000	I(1)	-0.5937	0.2764	-5.4979	0.0000	I(1)
exp	0.3983	0.6548	-4.0573	0.0000	I(1)	-0.3682	1.0000	-1.3413	0.0000	I(1)
oilp	4.0701	1.0000	-7.1344	0.0000	I(1)	3.4399	0.9997	-6.0297	0.0000	I(1)
nw	1.2876	0.9011	-6.0922	0.0000	I(1)	-1.0150	0.1551	-5.3526	0.0000	I(1)
rer	5.5535	1.0000	-6.1481	0.0000	I(1)	4.6936	1.0000	-5.1961	0.0000	I(1)
vol	5.9381	1.0000	-8.7309	0.0000	I(1)	5.0186	1.0000	-7.3789	0.0000	I(1)
rir	-4.6383	0.0000	-7.1672	0.0000	I(0)	-3.9201	0.0000	-6.0574	0.0000	I(0)

Source: Author's Computation using STATA. Null Hypothesis: All Panels Contains unit root, Alternative Hypothesis: Some Panels are Stationary

Appendix C2

Panel Unit Root Test for Conglomerates and Healthcare Sub-sectors										
	Conglomerates					Healthcare				
Variable	**Level**		**1st Difference**		**Decision**	**Level**		**1st Difference**		**Decision**
	Stat.	P-Value	Stat.	P-Value		Stat.	P-Value	Stat.	P-Value	
q	-3.1689	0.0008	-3.9733	0.0000	I(0)	-0.0920	0.4633	-4.8649	0.0000	I(1)
inv	-2.0041	0.0225	-7.0380	0.0000	I(0)	-1.4515	0.0733	-6.6547	0.0000	I(1)
exp	-0.9050	0.1827	-5.9520	0.0000	I(1)	N/A	N/A	N/A	N/A	
oilp	3.7682	0.9999	-6.6052	0.0000	I(1)	3.7682	0.9999	-6.6052	0.0000	I(1)
nw	0.2593	0.6023	-5.2241	0.0000	I(1)	-0.4338	0.3322	-6.6694	0.0000	I(1)
rer	5.4976	1.0000	-8.0832	0.0000	I(1)	5.4976	1.0000	-8.0832	0.0000	I(1)
vol	5.1415	1.0000	-5.6920	0.0000	I(1)	5.1415	1.0000	-5.6920	0.0000	I(1)
rir	-4.2942	0.0000	-6.6356	0.0000	I(0)	-4.2942	0.0000	-6.6356	0.0000	I(0)

Source: Author's Computation using STATA. Null Hypothesis: All Panels Contains unit root, Alternative Hypothesis: Some Panels are Stationary

Appendix C3

Panel Unit Root Test for Agriculture and Household Durables Sub-sectors										
	Agriculture					Household Durables				
Variable	**Level**		**1st Difference**		**Decision**	**Level**		**1st Difference**		**Decision**
	Stat.	P-Value	Stat.	P-Value		Stat.	P-Value	Stat.	P-Value	
q	-0.4454	0.3280	-4.0374	0.0000	I(1)	-1.6118	0.0535	-2.8704	0.0020	I(0)
inv	-1.3165	0.0940	-5.6389	0.0000	I(1)	-1.6347	0.0511	-3.3893	0.0004	I(0)
exp	0.4837	0.6857	-3.1705	0.0008	I(1)	N/A	N/A	N/A	N/A	
oilp	3.0767	0.9990	-5.3931	0.0000	I(1)	2.1756	0.9852	-3.8135	0.0001	I(1)
nw	0.2554	0.6008	-4.3761	0.0000	I(1)	0.3345	0.6310	-3.1694	0.0008	I(1)
rer	4.4888	1.0000	-6.5999	0.0000	I(1)	3.1741	0.9992	-4.6668	0.0000	I(1)
vol	4.1980	1.0000	-4.6475	0.0000	I(1)	2.9685	0.9985	-3.2863	0.0005	I(1)
rir	-3.5062	0.0002	-5.4179	0.0000	I(0)	-2.4793	0.0066	-3.8310	0.0001	I(0)

Source: Author's Computation using STATA. Null Hypothesis: All Panels Contains unit root, Alternative Hypothesis: Some Panels are Stationary

Appendix C4

Panel Unit Root Test for Industrial Goods and Oil and Gas Sub-sectors										
	Industrial Goods					Oil and Gas				
Variable	**Level**		**1st Difference**		**Decision**	**Level**		**1st Difference**		**Decision**
	Stat.	P-Value	Stat.	P-Value		Stat.	P-Value	Stat.	P-Value	
q	-1.0225	0.1533	-2.9141	0.0018	I(1)	-0.6744	0.2500	-5.1216	0.0000	I(1)
inv	-0.5060	0.3064	-4.7447	0.0000	I(1)	-1.4606	0.0721	-6.8431	0.0000	I(1)
exp	N/A	N/A	N/A	N/A		-0.5199	1.0000	-3.0191	0.0000	I(1)
oilp	2.6645	0.9961	-4.6706	0.0000	I(1)	4.2491	1.0000	-7.6644	0.0000	I(1)
nw	0.0072	0.5029	-4.2227	0.0000	I(1)	0.8753	1.0000	-5.5638	0.0000	I(1)
rer	3.8874	0.9999	-5.7157	0.0000	I(1)	4.1396	1.0000	-8.9970	0.0000	I(1)
vol	3.6356	0.9999	-4.0249	0.0000	I(1)	5.2577	1.0000	-6.4542	0.0000	I(1)
rir	-3.0365	0.0012	-4.6921	0.0000	I(0)	-4.9634	0.0000	-7.5966	0.0000	I(0)

Source: Author's Computation using STATA. Null Hypothesis: All Panels Contains unit root, Alternative Hypothesis: Some Panels are Stationary

Appendix C5

Panel Unit Root Test for Printing and Publishing Sub-sectors										
	Printing and Publishing					Automobile and Tyres				
Variable	**Level**		**1st Difference**		**Decision**	**Level**		**1st Difference**		**Decision**
	Stat.	P-Value	Stat,	P-Value		Stat.	P-Value	Stat.	P-Value	
q	0.2743	0.6081	-3.3415	0.0004	I(1)	-2.3374	0.0097	-2.7720	0.0028	I(0)
inv	-1.6387	0.0506	-4.5301	0.0000	I(0)	-0.2138	0.4153	-3.9766	0.0000	I(1)
exp	-2.3071	1.0000	-2.5795	0.0000	I(1)	-0.8688	0.1925	-1.5657	0.0587	I(1)
oilp	2.6645	0.9961	-4.6706	0.0000	I(1)	2.1756	0.9852	-3.8135	0.0001	I(1)
nw	0.4130	0.6602	-2.2546	0.0121	I(1)	-0.3896	0.3484	-2.8072	0.0025	I(1)
rer	3.8874	0.9999	-5.7157	0.0000	I(1)	3.1741	0.9992	-4.6668	0.0000	I(1)
vol	3.6356	0.9999	-4.0249	0.0000	I(1)	2.9685	0.9985	-3.2863	0.0005	I(1)
rir	-3.0365	0.0012	-4.6921	0.0000	I(0)	-2.4793	0.0066	-3.8310	0.0001	I(0)

Source: Author's Computation using STATA. Null Hypothesis: All Panels Contains unit root, Alternative Hypothesis: Some Panels are Stationary

Appendix D 1: Correlation Matrix

	inv	q	exp	rer	vol	rir	oilp	nw
inv	1.0000							
q	0.5204	1.0000						
	0.0000							
exp	0.6020	0.5115	1.0000					
	0.0000	0.0000						
rer	0.3349	0.4168	0.2514	1.0000				
	0.0000	0.0000	0.0023					
vol	0.2618	0.3828	-0.2952	0.7131	1.0000			
	0.0001	0.0000	0.0003	0.0000				
rir	0.1164	-0.1338	0.0485	0.3020	0.1682	1.0000		
	0.0780	0.0426	0.5621	0.0000	0.0106			
oilp	0.3241	0.4191	0.3076	0.8730	0.7846	0.2455	1.0000	
	0.0000	0.0000	0.0002	0.0000	0.0000	0.0002		
nw	0.1318	-0.0843	0.0139	-0.0921	-0.0800	0.0172	-0.1024	1.0000
	0.0464	0.2039	0.8681	0.1647	0.2278	0.7961	0.1223	

APPENDIX D 2: Estimates of Real Exchange Rate Volatility

Dependent Variable: RER
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 11/16/14 Time: 23:39
Sample: 1990 2012
Included observations: 23
Failure to improve Likelihood after 18 iterations
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
@SQRT(GARCH)	0.081141	0.537887	0.150850	0.8801
C	54.23891	42.12403	1.287600	0.1979
Variance Equation				
C	3249.114	3664.224	0.886713	0.3752
RESID(-1)^2	1.848220	2.119550	0.871987	0.3832
GARCH(-1)	-0.925975	0.401671	-2.305307	0.0211

R-squared	-0.036706	Mean dependent var	81.18612
Adjusted R-squared	-0.086073	S.D. dependent var	74.90538
S.E. of regression	78.06251	Akaike info criterion	11.33836
Sum squared resid	127968.9	Schwarz criterion	11.58521
Log likelihood	-125.3912	Hannan-Quinn criter.	11.40044
Durbin-Watson stat	0.045897		

APPENDIX D 3: Estimates of One-Step System GMM for Sectoral Aggregate

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: firms                           Number of obs      =       220
Time variable : year                            Number of groups   =        10
Number of instruments = 11                      Obs per group: min =        22
Wald chi2(4)  =   1572.13                                      avg =     22.00
Prob > chi2   =     0.000                                      max =        22
------------------------------------------------------------------------------
             |               Robust
       lninv |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lninv |
         L1. |   .7309453   .1011518     7.23   0.000     .5326913    .9291992
             |
         rer |    .149300    .059300     2.52   0.012     .0003308    .0026553
         vol |  -.0090700   .0461160    -0.02   0.984    -.0091292    .0089478
         rir |  -.0024564   .0026267    -0.94   0.350    -.0076046    .0026918
         lnq |   .1031047   .0784061     1.32   0.189    -.0505683    .2567778
       _cons |   3.011656    1.05138     2.86   0.004     .9509896    5.072322
------------------------------------------------------------------------------


------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.84  Pr > z =  0.005
Arellano-Bond test for AR(2) in first differences: z =  -0.07  Pr > z =  0.945
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(5)    =   3.89  Prob > chi2 =  0.566
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(5)    =   3.14  Prob > chi2 =  0.678
  (Robust, but weakened by many instruments.)
```

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: firms                           Number of obs      =       219
Time variable : year                            Number of groups   =        10
Number of instruments = 8                       Obs per group: min =        21
Wald chi2(5)  = 266054.69                                      avg =     21.90
Prob > chi2   =     0.000                                      max =        22
------------------------------------------------------------------------------
             |               Robust
         lnq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lnq |
         L1. |   .9594073   .1635186     5.87   0.000     .6389167    1.279898
             |
         rer |  -1.319440   .7882900    -1.67   0.094    -.0286445    .0022557
         vol |  -.4591200   .3571100    -1.29   0.199    -.0115905     .002408
       lninv |   .0409565    .096568     0.42   0.671    -.1483133    .2302264
        lnnw |  -.0070059   .0406866    -0.17   0.863    -.0867502    .0727385
      lnoilp |   1.215682   .6512863     1.87   0.062    -.0608159    2.492179
       _cons |  -2.817185   3.302891    -0.85   0.394    -9.290733    3.656363
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.89  Pr > z =  0.004
Arellano-Bond test for AR(2) in first differences: z =  -1.21  Pr > z =  0.227
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1)    =   0.58  Prob > chi2 =  0.445
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(1)    =   0.41  Prob > chi2 =  0.520
  (Robust, but weakened by many instruments.)
```

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: firms                           Number of obs      =       138
Time variable : year                            Number of groups   =         7
Number of instruments = 12                      Obs per group: min =        14
Wald chi2(5)  =   4973.98                                      avg =     19.71
Prob > chi2   =     0.000                                      max =        22
------------------------------------------------------------------------------
             |               Robust
       lnexp |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnexp |
         L1. |   1.092663   .2147353     5.09   0.000     .6717895    1.513536
             |
         rer |   .0858700    .022340     0.38   0.701    -.0035198    .0052372
         vol |  -2.126960   .9070100    -2.35   0.019    -.0390468   -.0034924
       lninv |  -.0020592   .2059508    -0.01   0.992    -.4057152    .4015969
        lnnw |  -.1295723   .1725557    -0.75   0.453    -.4677753    .2086306
      lnoilp |   .0699421    .156901     0.45   0.656    -.2375782    .3774625
       _cons |  -.7242526   1.939495    -0.37   0.709    -4.525593    3.077088
------------------------------------------------------------------------------


------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.54  Pr > z =  0.011
Arellano-Bond test for AR(2) in first differences: z =  -0.71  Pr > z =  0.479
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(5)    =   8.30  Prob > chi2 =  0.141
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(5)    =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)
```