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THE J-CURVE HYPOTHESIS: AN INVESTIGATION OF BILATERAL TRADE BETWEEN NIGERIA AND EUROPEAN UNION

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ABSTRACT

THE J-CURVE HYPOTHESIS: AN INVESTIGATION OF BILATERAL TRADE BETWEEN NIGERIA AND EUROPEAN UNION

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This thesis investigates the bilateral J-curve effects in the short-run and the Marshall–Lerner (ML) condition in the long-run between Nigeria and European Union in particular and between Nigeria and each of the countries that made up E.U.15. The study covers the period of fifty-six quarters (1999:Q1–2012:Q4) and employs Autoregressive Distributed Lag (ARDL - bounds-testing) approach to cointegration and error correction model to analyse the relationships. The study found no evidence of J-curve and also the Marshall–Lerner (ML) condition is not satisfied in the bilateral case between Nigeria and European Union, but found the evidence of J-curve in the bilateral cases between Nigeria and each of Austria, Denmark, Germany and Italy in the short-run, while in the long-run, the Marshall-Lerner (ML) condition exists only in the case of Luxemburg. The study concludes with strong support for the assertion that real exchange rate changes alone can only be used as a policy tool to design and control Nigeria's trade balance if the naira is to be appreciated against the currencies of this group of countries.

Keywords: J-curve, Marshall-Lerner (ML) condition , Trade balance, Exchange rate

ÖZET

J-EĞRİSİ HİPOTEZİ: NİJERYA VE AVRUPA BİRLİĞİ ARASINDAKİ İKİLİ TİCARET ÜZERİNE BİR İNCELEME

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Bu tez, Nijerya ve AB ile Nijerya ve AB(15)'i oluşturan ülkelerin herbiri arasındaki ticarette, kısa vadede j-eğrisi etkisini ve uzun vadede Marshall-Lerner (ML) koşulunu incelemektedir. Çalışma ellialtı çeyreklik(1999:Q1 - 2012:Q4) dönemi kapsamakta ve eşbütünleşme ve hata düzeltme modellemeye yönelik otoregresif dağıtılmış gecikme (ARDL - sınır - testi) yaklaşımını kullanmaktadır. Çalışmada, Nijerya ve AB arasındaki ticarette j-eğrisi etkisine rastlanmamış ve Marshall - Lerner (ML) koşulunun da sağlanmadığı tespit edilmiştir. Nijerya ile AB(15)'i oluşturan ülkeler arasındaki ikili ticarete bakıldığında ise, j-eğrisi etkisine Nijerya'nın Avustırya, Danimarka, Almanya ve İtalya ile olan ikili ticaretinde rastlanmış ve Marsall-Lerner (ML) koşulu da sadece Nijerya'nın Luxemburg ile olan ticaretinde sağlanmıştır. Doviz kuru bu ülkelerle olan ticarette bir politika aracı olarak kullanılmak isteniyorsa, dış ticaret dengesini iyileştirmek için Naira bu ülkelerin paralarına karşı değer kazanmalıdır.

Anahtar Kelimeler: J-eğrisi, Marshall-Lerner (ML) koşulu, Dış ticaret dengesi, Döviz kuru

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CHAPTER 1

INTRODUCTION

1.1 Background to the Study

A key relationship in international economics is that between trade balance and terms of trade. Understanding their dynamics is a major step toward creating an ideal trade policy. Whether depreciation actually helps improve trade deficits remain a key question that has drawn much scholarly attention. There exists a voluminous body of literature that has looked at the effect of currency depreciation on net exports of nations. Most of these centred on the concept of a 'J-curve' (Ghosh, 2012). "It is not clear if trade barriers and protectionism based on infant-industry arguments have achieved the desired changes in the trade balance. Much of the work centres on the twin concepts of the Marshall–Lerner (ML) condition and the J-curve phenomenon" (Bahmani-Oskooee and Ratha, 2004). For a country to improve its balance of trade, it needs to increase its competitiveness in international markets by devaluing its currency (if it uses fixed exchange rate system) or let its currency depreciate (if it uses flexible exchange rate system) against other currencies. But to benefit from currency depreciation/devaluation, a country needs to fulfil the Marshall–Lerner (ML) condition. The Marshall–Lerner (ML) condition - named after the two economists who discovered it independently, Alfred Marshall (1842-1924) and Abba Lerner (1903-1982), postulates that for a country to benefit from currency devaluation, the absolute sum of elasticities of demand for both import and export must be greater than unitary. The earlier literature developed on the relationship between currency devaluation and trade balance are on the agreement that this condition is necessary and sufficient for a successful

devaluation and are also interested in describing post-devaluation behaviour of a country's trade balance in the long-run until the work of Maggi (1973) who first explained the short-run post-devaluation behaviour of the U.S. trade balance. He observed that the U.S. trade balance continued to deteriorate despite the authorities' effort to control it through further devaluation in the short-run. He then explained the phenomenon and highlighted the implications of adjustment lags stemming from *currency contracts*, *Pass-through*, and *quantity adjustments*. He showed that these dynamics of the response of balance of trade to currency depreciation will trace out a j-shaped time path, which he eventually coined as 'J-curve'. This is how the classical definition of the phenomenon is derived that the trade balance deteriorates and then improves following the real depreciation of currency in the short-run. Therefore, Bahmani-Oskooee and Bolhasani, (2008) asserts that "Thus, while earlier studies concentrated on testing the Marshall–Lerner condition, more recent studies have tried to distinguish the short-run effects of devaluation from its long-run effects and assess the validity of the J-Curve hypothesis".

The text book definition of J-curve is now regarded as the classical definition of the phenomenon which expects the trade balance to deteriorate and then improve following the real depreciation of currency in the short-run. But Bahmani-Oskooee and Kovyryalova (2008) argue that

> "This new definition of the J-Curve put forward by Rose and Yellen (1989) that the phenomenon can be defined to reflect short-run deterioration combine with the long-run improvement, seems to be closer to theory than the old one. Magee (1973) who originally introduced the concept conjectured that the trade balance can follow any pattern in the short run. Thus, short-run fluctuations in the trade balance combined with long-run improvements could constitute an even better definition of the J-Curve".

Bahmani-Oskooee is the earliest researcher that applies empirical methodology to investigate the phenomenon in the mid of 80s as argued by Bahmani-Oskooee and Ratha (2004) that

"Bahmani-Oskooee is the first scholar to introduce the empirical methodology of testing the J-Curve in 1985 when he applied the method on four countries, with different exchange rate regimes viz. Greece, India, Korea and Thailand. He defines the trade balance as the excess of exports over imports, imposes an *Almon lag* structure on the exchange rate variable, and adds world income, the level of domestic high powered money, and the level of the rest of the world high powered money to the multiplier-based analysis of the effects of exchange-rate change or devaluation provided by Kruger (1983), the methodology which he eventually corrects later in Bahmani-Oskooee (1989a) because of the inconsistency in the way the real exchange rate variable is defined above. Since P is the domestic price level, E should be defined as the number of units of domestic currency per unit of foreign currency rather than units of foreign currency per unit of domestic currency. Furthermore, he argues that any measure of real exchange rate must also include a measure of foreign price level. Thus defined, the exchange rate variable should have negative coefficients followed by positive ones to corroborate the J-curve phenomenon".

The J-curve phenomenon has attracted the attentions of researchers from different parts of the world, considerably in the last four decades. Since the famous argument of Magee (1973) – who theoretically claims that it is possible in the short-run trade balance to worsen and then improve following the real depreciation of currency in the short-run, various researchers developed interest and start investigating the phenomenon. The earlier group of empirical studies employed aggregate trade balance approach[1], and they mostly used home country and rest of the world approach, thus suffer from aggregation bias as noted by Nazlioglu and Erdem (2011) that

"The problem associated with these studies is the employment of aggregate trade data, which potentially causes the so-called aggregation bias problem. The aggregation bias problem basically means that the significant effect of an explanatory variable on the dependent variable in some countries could be offset by the insignificant effect of the same variable in some other countries, thus (mis)leading to the conclusion that the variable in question would be insignificant in relation to the dependent variable".

[1] Magee (1973), Junz and Rhomberg (1973), Miles (1979), Kruger (1983), Himarios (1985), Bahmani-Oskooee (1985), Rosenweig and Koch (1988), Brissimis and Leventankis (1989), Bahmani-Oskooee (1989a).

To do away with this aggregation bias, researchers from the late 1980s shifted their attention to investigating disaggregated trade data[2], as noted by Ardalani and Bahmani-Oskooee, (2007) that "because of the mixed conclusions, more recent studies have relied upon disaggregated data to test the phenomenon. Rose and Yellen (1989) was the first study to bring out the shortcomings associated with models using aggregate data and introduced a simple model that employed bilateral trade data between the United States and her six major trading partners". To shed additional light on the short-run as well as the long-run relation between the exchange rate and the trade balance, Ardalani and Bahmani-Oskooee (2007) contemplated to employ a disaggregated trade data by using U.S monthly trade data of imports and exports at the commodity level of sixty-six industries for the period 1991-2002.They investigate the short-run and the long-run effects of real depreciation of the dollar using *error-correcting modelling technique*. Though they were unable to find strong support for the J-Curve, their procedure has now become popular among researchers[3], because of its power to deal with the so-called disaggregation bias as argued by Yazici and Islam (2011), that "the most recent trend now is to disaggregate the trade data further, with the aim of avoiding possible aggregation bias problem, by considering trade balance at commodity or industry level in bilateral trade with a trading partner".

[2] Rose and Yellen (1989), Wilson (2001), Baharumshah (2001), Bahmani-Oskooee and Kanitpong (2001), Hacker and Hatemi-J. (2003), Bahmani-Oskooee and Goswami (2003), Bahmani-Oskooee and Ratha (2004b), Halicioglu, (2007),

[3] Bahmani-Oskooee and Kovyryalova (2008), Bahmani-Oskooee and Bolhasani (2008), Bahmani-Oskooee and Hegerty (2010), Yazici and Islam (2011), Soleymani and Saboori (2012), Verheyen (2012), and Bahmani–Oskooee and Hosny (2012) are some of the studies that followed their procedures.

1.2 The Nigerian Experience

Right from the independence, Nigeria had a persistent trade deficit, which turned to a surplus in 1966 with petroleum's rapid growth as the major export commodity. In the late 1977 & 1978, demand for Nigeria's crude oil decreased as oil became available from the U.S. and Mexico, and as global oil companies reacted to the less favourable participation terms offered by the Nigerian government. Since then the Nigeria's trade balance improved up to early 1980s (1981-1983) when the trade deficit persisted. The trade balance continue to improve at a very volatile rate to date with the year 1998 only proved to be exception with deficit trade balance of ₦85,562m recorded[4]. During this period Nigerian economy suffered quiet enough from the use of inappropriate exchange rate policies and exchange control regulations leading to an exchange rate transition due to structural changes in the economy, as explained by Sanusi (2004), that

> "The fixed exchange rate regime induced an overvaluation of the naira and was supported by exchange control regulations that engendered significant distortions in the economy. That gave vent to massive importation of finished goods with the adverse consequences for domestic production, balance of payments position and the nation's external reserves level. Moreover, the period was bedevilled by sharp practices perpetrated by dealers and end-users of foreign exchange. These and many other problems informed the adoption of a more flexible exchange rate regime in the context of the SAP, adopted in 1986".

From 1986 to date Nigeria ditched the fixed exchange rate system and adopted floating exchange rate system with different exchange–rate arrangements in the quest of choosing the best policy that will improve its external sector. This is noted by Adeoye and Atanda (2012) when they explain that "The adoption of the International Monetary Fund (IMF) Structural Adjustment Programme (SAP) in 1986 resulted in the transition from fixed exchange rate regime to floating exchange rate regime in Nigeria". Bala and

[4] See CBN Statistical Bulletin 2009 – Table D.1.1- Foreign Trade

Asemota (2013), add that

> "Nigeria has adopted different exchange–rate arrangements since its exit from fixed to flexible exchange–rate system. The frameworks employed in the FX market from 1986–2012 include: the dual exchange–rate system (1986–1987), the Dutch auction system (DAS) (1987), the unified exchange–rate system (1987–1992), and the fixed exchange–rate system (1992–1998). Others are the re–introduced DAS (1999–2002), the retail Dutch auction system (2002–2006), and the wholesale Dutch auction system (2006–to date)".

Yet, devaluing naira is not just enough for the Nigeria's external sector to improve. This is observed by Oladipupo and Onotaniyohuwo (2011), that

> "Exchange rate is a key determinant of the balance of payments (BOP) position of any country. If it is judiciously utilized, it can serve as nominal anchor for price stability. Changes in exchange rate have direct effect on demand and supply of goods, investment, employment as well as distribution of income and wealth. When Nigeria started recording huge balance of payments deficits and very low level of foreign reserve in the 1980s, it was felt that a depreciation of the naira would relieve pressures on the balance of payments. Consequently, the naira was devalued. The irony of this policy instrument is that our foreign trade structure did not satisfy the condition for a successful balance of payment policy. The country's foreign structure is characterized by export of crude petroleum and agricultural produce whose prices are predetermined in the world market and low import and export price elasticities of demand".

1.3 Studies about Nigeria

In Nigeria, the literature on the relationship between exchange rate and trade balance have not receive much research attention, is rather scanty and ended with mixed conclusions, as highlighted by Godwin O. (2009), that

> "In Nigeria, previous studies carried out on the external sector generally (e.g. Olisadebe, 1995; Egwaikhide, 1995; Egwaikhide, Chete and Falokun, 1994; Komolafe, 1996; Odusola and Akinlo, 1995; Orubu, 1988; Omotor and Jike, 2005; Omotor, 2008) and particularly on agricultural exports (e.g. Kwanashie, Ajilima and Garba, 1997; Omotor and Orubu, 2007) did neither address the theoretical issues nor the empirical evidence of the J-curve hypothesis".

Some of the studies in Nigeria found the evidence of the classical J-curve[5] and delayed J-Curve phenomenons[6], some found no evidence at all[7], while others found different shapes rather than the J-curve[8]. On the other hand, some studies couldn't confirm the short-run relation evidence but rather the long-run relation[9], while others claim that neither the short-run nor the long-run relation exist[10].

It should be noted that all the studies above used aggregate data in their analysis. This reason has led us to argue that these inconclusive results could be due to aggregation. To the best of our knowledge no study in Nigeria has used disaggregated data to conduct bilateral study between Nigeria and its trading partner leaving the wide gap in Nigerian literature on the J-curve phenomenon.

1.4 Objective of the Study

At this juncture, this study will try to bridge the gap to investigate the existence of the bilateral J-curve by analysing both the short-run and the long-run impacts of exchange rate changes on bilateral trade between Nigeria and E.U and then disaggregating the study further by investigating the existence of the phenomenon between Nigeria and each of the countries that made up E.U.15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, U.K). To accomplish this purpose, we estimate the trade balance model [The trade balance proposed by Rose and Yellen (1989), which models the real trade

[5] Akonji et al (2013)

[6] Kulkarni and Clarke (2009)

[7] Umoru and Oseme (2013), Umoru and Eboreime (2013)

[8] Godwin O. (2009), Joseph and Akhanolu (2011)

[9] Oyinlola et al (2010), Bahmani-Oskooee and Gelan (2012)

[10] Rincon and Nelson (2001), Joseph and Akhanolu (2011)

balance to be a direct function of the real domestic income, real foreign income and real effective exchange rate, is closely followed in this study as it has become popular among researchers][11] on the total trade data between Nigeria and European Union (EU15) for the period of 1999:Q1–2012:Q4 by applying Autoregressive Distributed Lag (ARDL) approach to cointegration (i.e., the bounds testing cointegration approach) developed by Pesaran, Shin, and Smith (2001).

1.5 Justification for Data and Methodology Used in the Study

The study chooses the finite size of 15 trading partners in the European Union (E.U.15) and the period of fifty-six quarters (1999:Q1–2012:Q4). This is because E.U.27 (as a single economic union) has become the Nigeria's major trading partner in recent years, and that this was the exact number of the union members as at 1st January, 1999 and the date also corresponds with Economic and Monetary Union (Euro-area) establishment date. Choosing E.U.15 as a proxy of E.U. is equally justified as they (E.U.15) cover a larger share of the Nigeria's bilateral trade with E.U.27 with the total exports of Nigeria to E.U.15 reaches 99.87% of the total exports to E.U.27 from 1999-2012 while the total import from the same stands for 96.25% of the total imports from E.U.27 during the study period.

The Autoregressive Distributed Lag (ARDL) approach to cointegration and error correction model is used in this study because of the length and the nature of the data in question and also because of the objective to be achieved in the study. This approach (ARDL) has certain econometric advantages in

[11]Example of these researchers include among others: Bahmani-Oskooee and Brooks (1999), Arora, et al (2003), Bahmani-Oskooee, and Goswami, (2003), Bahmani-Oskooee, and Ratha (2004b), Narayan (2004), Bahmani-Oskooee, et al (2006), Halicioglu, (2007), Ardalani and Bahmani-Oskooee (2007), Bahmani-Oskooee and Kovyryalova (2008), Bahmani-Oskooee and Bolhasani (2008), Baek et al (2009), Bahmani-Oskooee, and Kutan,(2009), Nazlioglu and Erdem (2011), Šimáková, J. (2012), Soleymani, and Saboori, (2012), and Umoru and Eboreime (2013).

comparison to other single cointegration procedures. Firstly, it avoids the endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger (1987) method (Halicioglu, 2007). Secondly, the estimates from small sample sizes are super consistent (Narayan 2004). This approach also distinguishes the short-run effects from the long-run effects simultaneously (Bahmani-Oskooee, and Kovyryalova 2008), i.e captures both the short-run and the long-run effects of real depreciation on the trade balance. Lastly, it avoids need for unit root pre-testing for the classification of variables into I(1) or I(0), unlike standard cointegration tests (Bahmani-Oskooee and Brooks 1999).

1.6 Significance of the Study

The results of this study will have important policy implications. We hope this study improves our understanding of dynamic effects of exchange rate changes on Nigeria's trade balance. It will also assist the policymakers to know that to what extent the real exchange rate changes shall be applied to design, control, forecast and manipulate trade flows in Nigeria and whether exchange rate can be a good indicator for monetary and exchange rate policies.

1.7 Organisation of the Study

This study is structured as follows. In the next chapter we review both theoretical and empirical literatures on the J-curve phenomenon. Following the literature study, the research methodology is identified for the research objective, trade balance model, data description and data sources are discussed in chapter three. The empirical estimation procedures and results are presented and discussed in chapter four, and finally, conclusions are drawn in the closing chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The last four decades witness the era in which the literature on the J-curve phenomenon gathers momentum. The genesis of this phenomenon emanated when developed countries decided to allow demand and supply to determine the value of their currencies in the foreign exchange markets, such that the trade balance disturbances can be handled by the invisible hands. This is noted by Bahmani-Oskooee and Goswami (2003) that "In March 1973 when most industrial countries decided to float their currencies, it was believed that exchange rate flexibility would take care of trade deficits and isolate countries from disturbances originated abroad so that they could use fiscal and monetary policies to better manage their economies. The belief was mostly based on the fact that import and export demand elasticities are high enough to warrant improvement in the trade balance due to currency depreciation". Magee (1973) is the first person to contemplate the phenomenon when he argued theoretically that it is possible in the short-run trade balance to worsen following the currency depreciation and eventually improve. He explains the phenomenon using three-stage lags: the *currency-contract period*, the *pass through* period, and the *quantity adjustment* period which he then coined as J-curve. From then on, researchers begin to investigate the short run as well as the long-run responses of trade balance to currency depreciation. This is stress by Bahmani-Oskooee and Goswami (2003) that

> "Since such a short-run pattern resembles the letter J, it is known as the J-curve phenomenon in the literature. Owing to this concept, most studies in the 1980s and 1990s concentrated on establishing a direct link between the trade balance and the exchange rate. Such practice was considered to be relatively more attractive due to the fact that it

> allowed the researchers to investigate the short-run response of the trade balance to exchange rate changes in addition to its long-run response. Bahmani-Oskooee (1985), Rosensweig and Koch (1988), Himarios (1989), and Bahmani-Oskooee and Malixi (1992) are some examples in this group with mixed conclusions".

This section will review both the theoretical and empirical literatures in the development of J-curve phenomenon and then review relevant empirical studies to Nigeria and European Union countries.

2.2 The Theoretical Frame Work on J-Curve Phenomenon

2.2.1 The J-Curve Hypothesis

The J-curve is a concept that explains the post-devaluation behaviour of a country's trade balance in the short run. Due to adjustment lags, after devaluation or depreciation a country's trade balance keeps deteriorating and then begins to improve, but only after a while. How long it takes for the trade balance to deteriorate, is an empirical question (Bahmani-Oskooee and Gelan, 2012). Magee (1973) was the first person to describe the phenomenon when he analysed the US monthly trade data from 1969 to1973. He explains the phenomenon using three-stage lags: currency contracts, pass-through, and quantity adjustments. Bahmani-Oskooee and Ratha (2004) noted that

> "US trade balance deteriorated from a surplus of $2.2 billion in 1970 to a deficit of $2.7 billion in 1971. The authorities sought to correct this by devaluing the dollar in 1971. This, however, did not help, as the trade balance deteriorated even further (to a deficit of $6.8 billion) in 1972. Magee (1973) explains this pattern in terms of adjustment lags. He analyses the implications of (a) *currency-contracts* signed prior to devaluation, (b) newer currency-contracts signed after devaluation, namely, the periods of *pass-through*, and finally, and (c) the sluggish *quantity adjustments*".

Godwin O. (2009) explains that the *currency-contract* period is the short period of time which follows ostensibly after the devaluation exercise. This short period is the immediate era that characterizes the exchange-rate variation

associated with the devaluation given that there are previously made contracts before the variation occurs. The "perverse valuation" worsens the initial trade balance as domestic currency prices of imports rise. The *pass-through* period are contracts signed after devaluation as explained by Bahmani-Oskooee and Ratha (2004) that

> "Increases in the domestic price index of imports, and decreases in the same for the trading partners', since quantity adjustments take longer, in the very short-run, a successful pass through implies a worsening of the trade balance. The constancy (or sluggishness) of quantities can result because of supply bottlenecks on either side: supply might be perfectly inelastic for a while because exporters cannot instantly alter their output or sales abroad. Likewise, demand might be perfectly inelastic because importers require time to substitute among commodities and to change their flow of orders. If both export and import supplies are inelastic in the short-run, the trade balance improves during the (fixed quantity) pass-through period".

The *quantity adjustment* period is the era long enough by which both prices and quantities can change. This is also predicated on the condition that should suitable conditions of the elasticities be fulfilled, then the balance of trade ought to improve following the Marshal-Lerner condition. These dynamic analyses in the transition process from the old to the new equilibrium with different speed of adjustments are complex and are characterized by coefficients of the exchange rate lags. Technically, speaking the pass-through period which lies between the other periods can be likened to lie between two points of inflexion. The pass-through period starts at the point of negative turn and ends at the point of a positive turn, (Godwin O., 2009).

The mixed results of the existence of J-curve in international trade started to develop when Miles (1979) observed the trade balances of 14 countries for the period of 1956–1972 and he found no existence of J-curve and concluded that devaluation does not improve trade balance account but rather improves balance of payment, by definition the capital account must be improving. He also asserts that the previous researches suffer from at least one of the three setbacks. Bahmani-Oskooee and Ratha (2004) explain that "studies such as Cooper (1971), Connolly and Taylor (1972), Laffer (1976), and Salant (1976)

investigated the J-curve" but they maintained that these studies suffer from at least one of the following: "(1) they do not investigate if the impact on trade balance is temporary or permanent; (2) they do not compare post devaluation levels of the accounts with pre-devaluation levels; (3) they do not account for the effects of other variables such as the government's monetary or fiscal policy". In his (Miles') words "the implication of these studies is considerably more evidence for the balance of payment to improve following the devaluation than for the trade balance to do so. But while some studies overcome one or two of the previous stated objections none take into account of all the three even more important none fully accounts for the 3rd objective". He therefore suggests that devaluation cause only a simple portfolio adjustment, that is causing only improvement in capital account.

In a direct critics to the above findings, Himarios (1985), stated that "Miles (1979) claims to have shown empirically the validity of the global monetarist proposition that devaluations do not affect the balance of trade", he then used Miles' own framework of analysis and reveals serious deficiencies in Mile's methodology and tests that cast doubt on the validity of its results. He used the same trade balance equation to prove that devaluations do affect the trade balance in the traditionally predicted direction when he found that devaluation improves trade balance in nine out of ten countries for the period of 1956–1972. He holds that "the pivotal differences between the two specifications arises from our inclusion of relative-price effects and longer lag structure for the exchange-rate variable".

The current method of testing the J-curve was first introduced by Bahmani-Oskooee (1985) when he conducted a study on four countries that employ different exchange rate systems (Greece, Thailand, Korea and India) between 1973–1980. Bahmani-Oskooee and Ratha (2004), state that he

> "defines the trade balance as the excess of exports over imports (TBt), imposes an Almon lag structure on the exchange rate variable (E/P), and adds world income (YWt), the level of domestic high powered money (Mt), and the level of the rest of the world high powered money (MWt) to the multiplier-based analysis of the effects of exchange-rate change or devaluation provided by Kruger (1983). Bahmani-Oskooee (1989a) corrects for an inconsistency in the way

> the real exchange rate variable is defined above. Since P is the domestic price level, E should be defined as the number of units of domestic currency per unit of foreign currency rather than units of foreign currency per unit of domestic currency. Furthermore, he argues that any measure of real exchange rate must also include a measure of foreign price level. Thus defined, the exchange rate variable should have negative coefficients followed by positive ones to corroborate the J-curve phenomenon. When he incorporates these changes and re-estimates for the same sample, he finds evidence of an inverse J-curve. However, his long-run results remain unchanged: devaluation improves the trade balance of only Thailand".

Brissimis and Leventankis (1989), found the evidence of a J-Curve for Greece using quarterly data for the period of 1975–1984 and employing Almon lag technique. Their long-run results are consistent with Bahmani-Oskooee (1989a).

Rosenweig and Koch (1988) introduce the concept of a 'Delayed J-curve' when they employed Granger Tests of Causality on US monthly data from April 1973 to December 1986. The evidence of 'Delayed J-curve' which is caused by incomplete pass-through was later revealed by the work of Flemingham (1988), Wassink and Carbaugh (1989) and Mahdavi and Sohrabian (1993). But Meade (1988) found no evidence of delayed J-curve when she used quarterly US trade data for the period of 1968–1984.

All the above studies testing the J-curve phenomenon employed aggregate data, but later studies employ disaggregated data when researchers realised that the aggregate data may be misleading and may not necessarily give the true picture of countries' trade positions. This is clearly pointed out by Bahmani-Oskooee and Brooks (1999) that

> "Studies that have tested the J-curve phenomenon have employed aggregate trade data. The list includes Bahmani-Oskooee (1985), Felmingham and Divisekera (1986), Felmingham (1988), Rosensweig and Koch (1988), Himarios (1989), Bahmani-Oskooee and Malixi (1992) and Bahmani-Oskooee and Alse (1994). Many of these studies also employed the effective exchange rate. A problem with this approach is that a country's currency could appreciate against one currency and simultaneously depreciate against another currency. The weighted averaging will therefore smooth out the effective exchange

> rate fluctuations, yielding an insignificant link between the effective exchange rate and the total trade balance. Furthermore, as Rose and Yellen (1989) argue, when estimating a trade balance model using aggregate data one needs to construct a proxy for the rest-of-the-world income. This construct is ad hoc at best and at worst misleading. These problems can be avoided altogether by employing disaggregated data".

The first study to use disaggregated data is that of Rose and Yellen (1989), then others followed for example: Marwah and Klein (1996), Bahmani-Oskooee and Brooks (1999), Baharumshah (2001), Wilson (2001), Bahmani-Oskooee and Kanitpong (2001), Bahmani-Oskooee and Goswami (2003), to mention just few.

Lately in the last decade another group of literature emerged with a view to further disaggregate data and reduce aggregation bias. Ardalani and Bahmani-Oskooee, (2007) open the door for this group in the J-Curve literature (at industry level). They assert that "we propose to disaggregate the trade data by employing imports and exports at the commodity level".

2.2.2 Aggregated Data Studies

The earlier empirical studies on J-curve phenomenon are those that use aggregate trade balance approach and they are based in a two-country case - home country and rest of the world (Halicioglu, 2007). The J-curve hypothesis has gained relevance since the end of the Bretton Woods System in 1973 (Kulkarni and Clarke, 2009). Bahmani-Oskooee (1985) buttresses that "numerous authors, such as Cooper (1971), Connolly and Taylor (1972), Laffer (1974) and Salant (1974), have investigated the effects of devaluation on the trade balance and on the balance of payments, none of them has taken into account variables other than exchange rate that might affect those balances", he also adds that 1973 is the first year of a move to a floating rate system. Therefore, the work of Magee (1973) is believed in the international economics literature to be the first work on testing the J-curve hypothesis. This is

confirmed in the work of Bahmani-Oskooee and Goswami (2003) who quoted that

> "Magee (1973) was the first to notice that the U.S. trade balance deteriorated despite devaluation of the dollar in 1971. He then theoretically argued that it is possible for the trade balance to deteriorate subsequent to currency depreciation, mostly due to lags in the response of trade flows to a change in exchange rate. Once the lags are realized, eventually the trade balance improves. Since such a short-run pattern resembles the letter J, it is known as the J-curve phenomenon in the literature".

All the studies that follow that of Magee (1973) up to the work of Rose and Yellen in 1989 employ the aggregated data to explain the hypothesis. These studies play a greater role is shaping the concept of the J-curve hypothesis, for example see the work of: Magee (1973), Junz and Rhomberg (1973), Miles (1979), Kruger (1983), Himarios (1985), Bahmani-Oskooee (1985), Brissimis and Leventankis (1989), Bahmani-Oskooee (1989a).

2.2.3 Disaggregated Data Studies

The earlier studies on international economics literature employed aggregated data to explain the J-curve phenomenon until the work of Rose and Yellen in 1989 when they tested the existence of J-curve using bilateral trade data. Rose and Yellen (1989) bring out the shortcomings associated with models using aggregate data and introduced a simple model that employed bilateral trade data between the United States and her six major trading partners. They (Rose and Yellen, 1989) argue that the use of disaggregated data offer the opportunity to avoid the problem of constructing a proxy for the rest-of-the world income while estimating trade balance model using aggregated data and that this construct is ad hoc at best and at worst misleading . Another problem of using aggregated data is echoed by Bahmani-Oskooee and Brooks (1999) that "a problem with this approach is that a country's currency could appreciate against one currency and simultaneously depreciate against another

currency. The weighted averaging will therefore smooth out the effective exchange rate fluctuations, yielding an insignificant link between the effective exchange rate and the total trade balance". Bahmani-Oskooee and Ratha (2004) add that the "same could be said of the real exchange rate. Aggregate data on each of these variables could suppress the actual movements taking place at the bilateral levels. This is why more recent studies on the topic, employ bilateral trade data". This is clearly summarised by Halicioglu, (2007) that

> "The second group studies in testing the J-curve tends to employ disaggregate data. This tradition began with Rose and Yellen (1989) which tested the J-curve between the US and her six major trading partners. The latter approach is based on the fact that a country's trade balance could be improving with one trading partner and at the same time deteriorating with another. Using aggregate data to measure the J-curve effect might suppress the actual movements taking place at the bilateral levels. Advocates of disaggregate approach to the J-curve argue that a positive impact of devaluation against one country might be offset by its negative impact against another one".

These studies on disaggregated data continue to shape the concept of J-curve and come up with mixed results leaving the hypothesis wide open for more studies to be conducted. These studies include among others: Rose and Yellen (1989), Wilson (2001), Baharumshah (2001), Bahmani-Oskooee and Kanitpong (2001), Hacker and Hatemi-J. (2003), Bahmani-Oskooee and Goswami (2003), Bahmani-Oskooee and Ratha (2004b), Halicioglu, (2007),

2.2.4 Industry Level Data Studies

Following the inherent mixed conclusions from the first group of the literature that employs aggregate data and the second group that adopts the bilateral data, a new group emerged in the J-curve literature and start gaining momentum from the end of the last decade, as noted by Ardalani and Bahmani-Oskooee (2007) that

> "Previous research seeking to assess the short-run and long-run effects of currency depreciation on a countries' trade balance has employed either aggregate trade data between a country and the rest of the world or bilateral trade data between a country and one of its major trading partners. There exits two groups of studies that have investigated the short-run and the long-run effects of currency depreciation on the trade balance. The first group has employed trade data at the aggregate level between one country and the rest of the world. The second group has used trade data at the bilateral level between one country and her major trading partners. Both groups have provided mixed conclusion".

This new emerged group of literature came up with the aim of further disaggregation and avoidance of possible aggregation bias. This is asserted by Yazici and Islam (2011) that "the most recent trend now is to disaggregate the trade data further, with the aim of avoiding possible aggregation bias problem, by considering trade balance at commodity or industry level in bilateral trade with a trading partner". This new group is traced back to the work of Ardalani and Bahmani-Oskooee in 2007 when they contemplate to employ a disaggregated trade data by using imports and exports at the commodity level. They employ import and export data for sixty six industries in the U.S. monthly data for the period 1991-2002.[12] They investigate the short-run and the long-run effects of real depreciation of the dollar using error-correcting modelling technique. They were unable to find strong support for the J-Curve phenomenon because their results reveal evidence of the J-curve effect only in six industries which is less than 10% of the industries under study while the long-run favourable effect of real depreciation is supported in 22 industries, that is 1/3 of the industries considered. [13] After the new door is opened by

[12] SITC Commodity Groupings. Through the data bank of the Bureau of Census the authors were able to identify 66 commodity groupings for which monthly data from January 1991 till August 2002 were available.

[13] These were ADP equipment, alcoholic beverages, aluminum, basketware, chemicals, cigarettes, clothing, coal, copper, cork, corn, footwear, lighting, meat, plastic articles, rice, rubber tires, silver, textile yarn, toys (games), travel goods, and vegetables (fruits).

Ardalani and Bahmani-Oskooee in 2007, several other similar studies followed among which are Bahmani-Oskooee and Kovyryalova (2008), Bahmani-Oskooee and Bolhasani (2008), Bahmani-Oskooee and Hegerty (2010), Yazici and Islam (2011), and Soleymani and Saboori (2012).

2.2.5 Sectorial Data Studies

Other studies concentrated on particular sectors of the economy to explain the impact of devaluation on trade balance and J-curve phenomenon. This goes back to the work of Meade (1988), when she used U.S. quarterly trade data for the period of 1968–1984 to investigate sectorial J-curve. Bahmani-Oskooee and Ratha (2004), claim that she "recognizes the drawbacks of using aggregate data, and investigates sectorial J-curves. She focuses on three sectors: non-oil industrial supplies, capital goods excluding automobiles, and consumer goods", Some studies concentrate on agricultural sector but are very scanty as Yazici and Islam (2012) claim that the impact of exchange rate changes on agricultural trade balance is investigated in the literature but in a few papers, such as Carter and Pick (1989), Doroodian *et al*. (1999), Yazici (2008) and Baek *et al.* (2009). Moreover, Godwin O. (2009), Yazici and Islam (2012) are among others.

In the oil sector, only two works are reviewed in this work, thus, Yousefi and Wirjanto (2003) and Umoru and Eboreime (2013).

2.2.6 Marshall-Lerner (ML) Condition

The genesis of elasticity approach goes down to Marshall-Lerner (ML) condition. This is noted by Kulkarni and Clarke (2009) that "Alfred Marshall and Abba Lerner argued that an increase exchange rate can lead to a B.O.T surplus only if elasticity of demand for exports by the rest of the world, and similarly demand for imports by domestic residents, are strong enough".

Rincon and Nelson (2001) add that "the basic result of the elasticities approach is that devaluation improves the trade balance if the absolute values

of the sum of the demand elasticities for exports and imports exceed unity. If this (Marshall-Lerner) condition holds, there is excess supply of foreign exchange when the exchange rate is above the equilibrium level and excess demand when it is below".

The conventional answer to the question, what is the effect of depreciation/devaluation on the balance of trade of the devaluing country, goes in terms of the supply and demand conditions in the devaluing country and in the rest of the world. It is believed that the devaluation tends to reduce the foreign prices of the country's exports in proportion to the devaluation initially. At such reduced prices, foreign demand for the country's exports will be increased, therefore causing to bid up the foreign prices of these exports part-way back toward their pre-devaluation levels. How much the foreign currency proceeds of the country's exports will change, then depends upon the elasticity of foreign demand for the country's exports and the elasticity of domestic supply of export goods. On the other hand, i.e the import side, the effect of the devaluation is to raise the domestic price of imports at initial stage, presumably leading to some decrease in the country's demand for imports, which consequently reduce the world price of the imported goods. The elasticity of domestic demand for imports and the elasticity of foreign supply of imports determine the size of these reactions on imports (Alexander 1952).

"Traditional economic theory asserts that favourable outcome of devaluation will depend on the export and import elasticities. Providing that sums of these elasticities are greater than unity, which is known as the Marshall-Lerner (ML) condition, one expects an improvement in the trade balance after currency depreciation" (Halicioglu, 2007). Additionally on the explanation Marshall-Lerner (ML) condition, Bahmani-Oskooee, et al (2006), buttress that

> "In a partial equilibrium setting, the sum of the absolute values of the import and the export demand elasticities must be greater than one for devaluation to be successful in improving the trade balance. The major intuition behind this elasticity approach is of two fold. First, devaluation provides an incentive to the exporters in that they earn more money once the foreign exchange that is earned from exports is converted into the domestic currency. Second, more domestic

currencies per unit of foreign exchange are needed for imports once the domestic currency is devalued. As a net result of this encouragement in exports and discouragement in imports, devaluation is expected to improve the balance of trade with the assumption that both exports and imports are denominated in foreign currencies and the domestic country is in pre-devaluation balance. A large body of literature developed on the basis of this so-called elasticity approach of devaluation is interested in finding support to the elasticity approach in most of their empirical exercises both for developed and developing countries".

2.2.6.1 Mathematical Derivation of Marshall-Lerner (ML) Condition

The mathematical derivation of Marshall-Lerner condition is based upon some specified assumptions[14] and that Chee-Wooi and Tze-Haw (2008) maintain that according to the Marshall-Lerner (ML) condition, the trade balance can improve after devaluation only if the sum exports and imports demand elasticities is greater than one.

According Sasakura and Kulkarn , these assumptions include:

1. There is no capital account in the balance of payments. If there is no capital account, this assumes that there are no capital flows into or out of the economy, so the balance of payments is equivalent to the balance of trade.
2. The elasticity of supply for imports and the elasticity of supply for exports are infinite. In other words, there are no supply constraints. This means there is sufficient supply for any quantity of imports or exports demanded.
3. The balance of trade at the time of the increase in exchange rates is zero. In other words, it is assumed that the current account starts at zero (is balanced) before the currency devaluation. According to Krugman and Obstfeld, "if the current account is not zero initially the [Marshall-Lerner] condition becomes substantially more complex".

[14]See for example Sasakura J.A and Kulkarni K.G (undated), Stern, R. M. (1973), Salvatore, D. (2001), Hermawan M. (2011)

The following derivation follows from Salvatore (2001)[15]

Let:

P_X and P_M = foreign currency price of exports and imports, respectively,

Q_X and Q_M = the quantity of exports and imports, respectively, and

V_X and V_M = the foreign currency value of exports and imports, respectively.

Then the trade balance (B) is

$$B = V_X - V_M = Q_X \cdot P_X - Q_M \cdot P_M \quad (1)$$

Thus

$$\partial B = k[Q_X \cdot P_X (n_X - 1) + n_M \cdot Q_M \cdot P_M] \quad (2)$$

If to begin with

$$B = Q_X \cdot P_X - Q_M \cdot P_M = 0 \quad (3)$$

Then

$$\partial B = k[Q_X \cdot P_X (n_X + n_M - 1)] \quad (4)$$

And $\partial B > 0$ if

$$n_X + n_M - 1 > 0 \text{ or } n_X + n_M > 1 \quad (5)$$

Where both n_X and n_M are positive.

If the devaluation or depreciation takes place from the condition of $V_M > V_X$, n_M should be given proportionately greater weight than n_X, and the Marshall–Lerner condition for a stable foreign exchange market becomes more easily satisfied and is given by

$$n_X + (V_M/V_X)\, n_M > 1 \quad (6)$$

[15] Appendix A provides the full derivation of Marshall-Lerner (M-L) condition

If the price elasticities of the foreign supply of the country's imports (e_M) and it's supply of exports (e_X) are not infinite, then the smaller are e_M and e_X, the more likely it is that the foreign exchange market is stable even if

$$n_X + n_M < 1 \tag{7}$$

The Marshall–Lerner condition for stability of the foreign exchange market when e_M and e_X are not finite is given as

$$e_X \cdot e_M > n_X \cdot n_M \tag{8}$$

If the direction of inequality sign in Equation (8) is the reverse, the devaluing country's terms of trade improve, and if the two sides are equal, the terms of trade will remain unchanged.

The Marshall-Lerner theory is known for its simplicity and effectiveness in explaining required condition of trade balance improvement owing to exchange rate depreciation in elasticity approach. However, more complex version of the analysis based on the Marshall-Lerner theory occurs when it involves different basic standard assumptions, which are the balanced trade as the initial condition and infinitely elastic supply of import and export product (Hermawan, 2011) [16]

[16] In the case of deficit trade balance as the initial condition and upward sloping of supply elasticities, it can be explained through advance mathematical derivations (and graphical depiction) that Marshall-Lerner condition is a sufficient but not necessary condition for trade balance improvement in response of exchange rate depreciation. It has been proven that in this situation, the trade balance can still improve even the sum of demand elasticity of export and import is smaller than 1.

2.3 The Empirical Evidences on J-Curve Phenomenon

2.3.1 Empirical Studies Using Aggregated Data

When the idea of possible short-run analysis of the effects of currency depreciation/devaluation came into being, researchers contemplate to carry empirical studies to test the phenomenon's relevance in the real world. Their study use aggregate data mostly between a country and the rest of the world scenarios. These studies include but not limited to the below mentioned. Miles (1979) claim that all the previous empirical observations about the effect of devaluation are all based on the raw account figures making no attempt to standardize for other variables that affect the accounts. He therefore incorporates exogenous variables other than devaluation into his analysis such as government monetary policy, consumption policy and growth rate, to examine the statistical relationship between devaluation and both trade balance and balance of payment for 16 devaluations of 14 countries using several tests involving cross-section time series regression techniques on the annual data for the period of 1956–1972. His results show that the residuals indicate small improvement in the trade balance in the year following the devaluation. But this improvement is small compared with the deterioration of trade balance in the year of devaluation or succeeding years. On the other hand, there is clear evidence of the balance of payment improving following devaluations, i.e. devaluation improves the balance of payments but not the trade balance, saying that the capital account improves following devaluation. Thus, there is no support for the J-curve. His work supports the positions of Laffer (1976) and Salent (1976).

In a direct contrast to the above study, Himarios, (1985) examines the phenomenon in ten countries for the period of 1956–1972. He uses Miles' own framework of analysis to reveal serious deficiencies in the methodology and tests that cast doubt on the validity of the Mile's results. In a re-specified trade balance equation, his results show that devaluations almost always determine the trade balance positions as it provides evidence in nine out of ten cases in

which devaluation improves trade balance. But he is clearer to state that the pivotal difference between the two specifications arises from his inclusion of relative-price effects and longer lag structure for the exchange-rate variable.

In his search for the phenomenon, Bahmani-Oskooee (1985) conducted a study on four developing nations that employ different exchange rate system between 1973-1980 He maintained that during the study period India and Thailand pegged their currency to U.S.D while Korea used fixed exchange rate system against the U.S.D and subsequently from 1979 moved to manage float rate system and Greece was chosen because it used floating rate system throughout the period under study. He proves that the elasticities condition is no longer the necessary and sufficient conditions for the successful devaluation. He then suggests a short-run procedure for detecting the impacts of currency devaluation on trade balance, but he was careful to say that even though, his results have sound theoretical implication, but it is more of empirical observation than theory.

Rosenweig and Koch (1988) use the U.S. aggregate monthly trade data for the period 1973-1986. They employ Granger Tests of Causality to examine the relative depreciation of the US dollar and the lag in improving the trade balance. They noted that the delayed improvement in the US trade balance has been significantly longer than most economists forecast, which they termed *Delayed J-curve*.

Narayan (2004), examines the evidence of the phenomenon by investigating the casual relationship of real effective exchange rate, real domestic and foreign income on trade balance variables of New Zealand within the Granger causality framework, and also investigates, using the impulse response analysis, whether a J-curve pattern exists for New Zealand over the 1970–2000 period. He adopts ARDL approach to cointegration. His results show that New Zealand's trade balance, REER and domestic income and foreign income are not cointegrated, that there is a casual connection in both directions between trade balance and foreign income, the existence of a one way link from trade balance to real effective exchange rate, but still there is

clear evidence for the existence of the J-curve path for New Zealand's trade balance.

2.3.2 Empirical Studies Using Disaggregated Data

The inherent problems of aggregation bias associated with earlier studies forced researchers to shift their attention to investigating the evidence of the phenomenon at bilateral level, that is, the cases between a country and its partner(s). Bahmani-Oskooee, Economidou & Goswamin (2006) add that

> "Since the publication of Magee's paper (1973), many studies test the J-curve hypothesis on aggregate basis first and on disaggregated basis later. The disaggregated approach that uses bilateral data to solve the aggregation bias has gained momentum in recent years. Limited numbers of studies that use disaggregated data provide as mixed results as numerous studies that use aggregate data".

Rose and Yellen (1989) may be recognized as the pioneers of using disaggregated data to analyse the hypothesis. Their main arguments are that when one uses disaggregated data, (1) he does not require to construct the proxy of the rest-of-the-world income variable which is very cumbersome and may not be reliable, and (2) aggregation bias is also limited. Their study uses US and its seven major trading partners' quarterly data for the period of 1963–1988. Although, when they test cointegration they used and employed OLS technique, no statistically reliable evidence of a stable J-curve is detected because of several deficiencies they encountered as noted by Bahmani-Oskooee and Brooks (1999) that

> "Rose and Yellen did not find a long-run effect nor any evidence supporting the J-curve phenomenon between the U.S. and her major trading partners. Such negative findings could be due to several deficiencies. First, they define the real trade balance to be the "difference between merchandise exports and imports, measured in current U.S. dollars, deflated by the American GNP deflator." (p. 58). The evidence in Miles (1979) versus Himarios (1985) suggests that the results are sensitive to the units of measurement. Second, their

> method was based on Engle-Granger cointegration analysis which uses the DF or ADF tests. Since no evidence was found in favor of cointegration, the short-run analysis was based on simple autoregressive analysis, rather than an error-correction modelling".

The above claim was based on the argument provided by Kreamers et al (1992) that while employing Engel-Granger (1987), error-correction based test is more powerful than Dicky-Fuller (DF) test due to its low power, DF may reject cointegration. Thereafter, Bahmani-Oskooee and Brooks (1999), employ ARDL approach to cointegration and error correction modelling on U.S. and her six major trading partners' trade data in their study, using quarterly trade data for the period 1973Q1–1996Q2. They reached a conclusion that, although they couldn't provide any evidence of J-curve in the short-run, but their results suggest that the U.S trade balance has long-run favourable advantage after dollar depreciation against the currencies of her six major trading partners.

Bahmani-Oskooee and Goswami (2003) test the J-curve hypothesis between Japan and her nine major trading partners by employing ARDL approach to cointegration and error-correction modelling on quarterly bilateral data over the period of 1973-98. They demonstrate that when aggregate data are used, the J-curve could not be detected in the short run and also there is no evidence of cointegration. But when the data was disaggregated, they found that the j-curve exists between Japan and each of the Germany and Italy, equally, in the long-run, depreciation of Japanese yen has favourable effects on her trade balance in three cases viz. Canada, U.K, and the U.S.

Bahmani-Oskooee, Economidou & Goswamin (2006) observe the existence of J-curve between the United Kingdom and her twenty major trading partners between the period of 1973:1- 2001:3. They employ ARDL approach for cointegration on U.K imports and exports trade data. They were able to detect the phenomenon in only two cases in the short-run, and the long-run, the result is not equally helping as the trade balance appeared favourable in five cases out of twenty.

2.3.3 Empirical Studies Using Industry Level Data

Previous studies have investigated the impact of exchange rate on trade balance either at the aggregate or bilateral levels. Results obtained from both types of studies are mixed and such a result is attributed to the problem of aggregation bias. Realizing these problems, a new body of research has emerged with the hope of reducing the bias, namely the bilateral analysis at the commodity level (Yazici and Islam, 2011).

The first paper in this category is the work of Ardalani and Bahmani-Oskooee in 2007 when they propose to disaggregate the trade data by employing imports and exports at the commodity level. Through the data bank of the Bureau of Census (of U.S.) they were able to identify 66 commodity groupings for which monthly data from January 1991 till August 2002 were available. They employ error-correcting modelling technique. Their results were unable to find strong support for the J-curve phenomenon (as the phenomenon prevailed only in 6 out of 66 industries), whereas, in the long-run, effects of real depreciation of the dollar were favourable at least in 22 industries.

The bilateral trade data of Canada and her major trading partner - U.S was disaggregated and 152 industries were analysed by Bahmani-Oskooee, and Bolhasani (2008) using the ARDL approach to cointegration and error-correction modelling, for the period of 1962-2004. Their findings suggest that real depreciation of Canadian dollar against U.S dollar have significant impacts on the two-third of the industries in the short-run while in half of the industries the short-run effects transform in to the long-run effects.

Bahmani-Oskooee and Kovyryalova (2008), conduct a disaggregated bilateral study on the exports and import data between U.S and U.K for the period of 1962-2003 and adopted the Bounds-testing approach to cointegration and error-correction modelling. They found that in the short run, more than half of the industries (107 of 177) respond to real depreciation of dollar against starling pound but with no predicted behaviour while in the long-run only 66 cases respond to real depreciation. This result enable them to reveal the

evidence of the phenomenon described by the new definition of J-curve in some industries, moreover, among these industries that responds to real currency depreciation in the long-run are durable as well as non-durable commodities contradicting the work of Burda and Gerlach (1992).

Yazici and Islam (2011) investigate the short-run and long-run impact of exchange rate and customs union on the trade balance at commodity-group level of Turkey with EU (15) for the period of 1982:I to 2001:IV. They employ Bounds testing approach and adopt a new strategy in the model selection phase to ensure that optimal model is selected from those models satisfying both diagnostics and cointegration. Their results indicate that in the short-run exchange rate matters in determination of trade balance of 13 commodity groups out of 21 and customs union in 8 cases. In the short-run no J-curve effect is observed in any of industries, while for the long-run effect, real depreciation of Turkish Lira and customs union have not significantly affected trade balance of any of industries. Thus their finding suggests that exchange rate policy can't be used as a policy tool to improve the trade balance, they then conclude that the factors that are significant determinants of trade balances of Turkish industries in the long-run are Turkish and EU (15) real incomes.

Soleymani and Saboori (2012) consider 67 industries (2-digit and 3-digit SITC classifications) bilateral trade data between Malaysia and Japan for the period of 1974 – 2009, and investigate the J-curve phenomenon and the long-run effect of the real depreciation of Malay ringgit against Japanese yen on the trade balance of those industries. They employ the Bounds testing approach to cointegration and error-correction modelling. Their findings suggest that, although the majority of the industries are affected by the real ringgit depreciation in the short-run, but the phenomenon exits in only twenty-two industries while the short-run effects turn into the favourable long-run effects in twenty-four cases.

Verheyen (2012) observes the $/€ exchange volatility effect on exports of eleven euro zone countries to the US using monthly data for the period 1996M02 - 2009M10, and apply the ARDL bounds testing approach for

cointegration on disaggregated SITC[17] export categories. Using a simple export demand model, he found evidence of cointegration in more than 75% of the cases. His results suggest that if exchange rate volatility does exert a significant influence, it is typically negative. Furthermore, the exports most often negatively affected seem to be those of SITC categories 6 and 7.

Bahmani–Oskooee and Hosny (2012), found the evidence of J-curve phenomenon in 24 out of the 59 industries that trade between Egypt and European Union (EU) using quarterly data for commodity trade for the period 1994I–2007IV, and employ the bounds testing approach to test the impact of currency depreciation on trade balance.

2.3.4 Empirical Studies Using Sectorial Data

One of the first writers on this hypothesis to use sectorial data is Meade (1988), she identified the disadvantages of using aggregate data. Her focus was on three sectors: consumer goods, capital goods excluding automobiles, and non-oil industrial supplies. Sectorial trade balances responses to exchange rate exchange rate movement, the deterioration in the trade balance for industrial supplies and materials was short and soon improved, while trade balance of capital goods never deteriorates at all. Therefore, she concluded that there is considerable uncertainty surrounding the J-curve (Bahmani-Oskooee and Ratha, 2004).

Doroodian, et al (1999) examine the J-curve hypothesis for US agricultural and manufactured goods, using the Shiller lag model on quarterly data for the period 1977:1–1991:4. The results support the J-curve effect for agricultural goods, but not for manufactured goods. They assert that is why many studies in

[17] The SITC main categories are: 0: food and live animals; 1: beverages and tobacco; 2: crude materials, inedible, except fuels; 3: mineral fuels, lubricants and related materials; 4: animal and vegetable oils, fats and waxes; 5: chemicals and related products; 6: manufactured goods; 7: machinery and transport equipment; 8: miscellaneous manufactured articles; 9: commodities and transactions not classified elsewhere.

the literature fail to support the J-curve phenomenon because of the aggregation bias of the combined data of both agricultural and manufactured goods and most of these countries under study are often industrialised nation like the US or Japan with a high proportion of manufactured goods in both exports and imports.

Baek et al (2009), investigate the impact of exchange rates on bilateral trade of agricultural products between the United States and its 15 major trading partners. They paid special attention to investigate whether or not the J-curve hypothesis holds for U.S.A agricultural trade using quarterly data from 1989 to 2007. They employed autoregressive distributed lag (ARDL) approach to cointegration on the U.S.A agricultural imports and exports for their analysis. The study results show that the exchange rate appeared to be an important factor in determining the short-run and long-run behaviour of U.S.A agricultural trade and that there is little evidence of the J-curve for U.S.A agricultural products with the United States' major trading partners.

Yazici (2006) investigates the existence of J-curve hypothesis in Turkish agricultural sector using quarterly data for the period of 1986: I - 1998: III, and imposing Almon lag structure on the exchange rate. He found that, when the Turkish currency is devalued, agricultural trade balance initially improves, then worsens, and then improves again. He then concludes that J-curve effect does not exist in Turkish agricultural sector and that devaluation worsens the trade balance of the sector in the long run.

2.3.5 Relevant Empirical Studies to Nigeria

The studies on this phenomenon about Nigeria are very scanty and all the studies reviewed in this work use aggregated data to test the existence of hypothesis in the Nigerian economy. The results of these studies are with mixed conclusions as some of them show evidence of the hypothesis, some show the evidence of delayed J-curve and others come up with different shapes whereas the remainders detect no evidence of the hypothesis at all.

One recent study of Akonji et al (2013), found the evidence of J-curve in Nigeria. They employ Co-integration, Vector Auto regression Estimate, Granger Causality and Variance Decomposition to analyse the hypothesis to test the impact of depreciation of naira on the trade balance in the Nigeria economy for the period 1980-2010. They found that J-curve hypothesis do exist in the Nigeria economy, as their study shows that there is absence of long-run relationships among variables under consideration, but found that there is short run relationship between exchange rate devaluation and trade balance through Granger causality test and therefore confirming the existence of J-curve hypothesis, that is, domestic currency devaluation have bi-directional effect on trade balance in the short-run but with little effect in the long-run. They therefore, recommend the need to diversify the sources of foreign exchange apart from petroleum sector, so as to benefit from the initial devaluation of the domestic currency, in term of increasing Nigeria's exports earnings.

Another study that found the evidence of delayed J-curve is that of Kulkarni and Clarke (2009) who observe the hypothesis for Nigeria for 10 years, 1998-2007.Their result show that a sharp devaluation of the currency was followed in the short run by a sharp increase in the balance of trade, which then dipped before rising again. They describe this as a delayed J-curve, and attributed it to factors exogenous from currency, particularly the changeover of government from a protectionist military leadership to a more open civilian government that coincided with the change in currency valuation. They recommend that more testing would have to be done to determine whether there is such a phenomenon as a delayed J-curve effect that can occur in such a case, or if the appearance of a J-curve in this case was simply due to other unobserved factors unique to that case.

Oyinlola et al (2010), apply the bounds testing (ARDL) approach to cointegration to analyse Nigeria's trade data between 1980:I to 2007:IV. Their empirical results indicate that real domestic and real foreign incomes affect Nigeria's trade balance both in the short-run and in the long-run, but that the

naira depreciation/devaluation affects her trade balance only in the long-run, suggesting that the M-L condition is satisfied.

The above study is reinforced by Bahmani-Oskooee and Gelan (2012) who test the J-curve hypothesis for nine African countries for the period 1971Q1–2008Q1 (in the case of Nigeria) using the bounds testing approach to co-integration and error-correction modelling. They were unable to find any support for the short-run J-curve effect in all countries studied. But they found that a real depreciation is expected to improve the trade balance in the long run in the case of Egypt, Nigeria, and South Africa while for Burundi, Kenya, Mauritius, Morocco, Sierra Leone and Tanzania real depreciation seems to have no long-run favourable impact on the trade balance.

The two studies above are also supported by the work of Umoru and Oseme (2013) who used Nigerian data (period not specified) to investigate the phenomenon by adopting the vector error correction methodology. Their results show that the short-run predictions of the J-curve are not observable in Nigeria but the co-integration analysis shows a long-run relationship between the trade balance and the real exchange rate in Nigeria, they also add that, what is empirically supported is the cyclical trade effect of exchange rate shocks. That is, a real exchange rate shock will initially improve, then worsen and then improve the country's aggregate trade balance.

Other studies found different shapes rather than the J-shaped phenomenon. Godwin O. (2009), use the model of multiplier-based framework which imposes an Almon lag structure on the exchange rate regimes, for the data set covering the period 1970–2006 for Nigerian agricultural trade data. His empirical results indicate that the J-curve does not exist in Nigerian agricultural sector precisely in the long-run since the pattern of lag between the exchange rate depreciation and the trade balance resembles more of an asymmetric S-shape of a horizontal S.

Joseph and Akhanolu (2011) investigate the impact of exchange rate volatility on trade flow in Nigeria. They employed annual data for the period of 1970-2009. Their study estimates the exchange rate volatility with the use of Generalized Autoregressive Conditional Heteroskedasticity (GARCH). They

found that an inverse and statistically insignificant relationship exist between aggregate trade and exchange rate volatility in Nigeria.

While others found no evidence of stable long-run relationship between exchange rate and trade balance as no co-integration is found at all. Rincon and Nelson (2001), use a vector error-correction model (VECM) for analysing multivariate co-integrated systems when investigating whether devaluation improve the Trade Balance of small semi-open economies (Nigeria included). They found that currency depreciation in all the cases cause deterioration in trade balance at least at the first lag and then followed by subsequent improvements in the short-run while the impacts extend into the long-run to influence thirteen of seventeen cases. Additionally, the Marshall-Learner condition holds in 10 of these thirteen cases, while cointegration couldn't be formed in long-run in four cases viz. Nigeria, Indonesia, Kenya and Venezuela.

In a special case in the oil sector, Umoru and Eboreime (2013), tested the J-curve effect of real exchange rate depreciation with special focus on the Nigerian oil sector using the bounds testing approach on time series data that spans over a 40-year period. Their empirical evidence could not establish the classic J-curve exchange rate effect on the trade balance of the Nigerian oil sector. However, the trade balance contemporaneously gains improvement in the short-run making it imperative for them to tag such an observation the 'inverted' J-curve and hence conclude that the standard J-curve hypothesis cannot be validated for the Nigerian oil sector. They also conclude that because Nigerian exports and imports are frequently denominated in foreign currency (the US dollar) it is a possible explanation for the contradicted J-curve effect.

2.3.6 Relevant Empirical Studies to European Union

Just like other empirical studies' results show in different part of the world, so also empirical studies in Europe among the member nations and the union or the union and its trading partner(s) are of mixed results. Some studies support the phenomenon while others do not. Cantavella-Jordá and Suárez-Burguet (1998) examine the long-run and short-run effects of devaluation for major

European Union countries (Germany, France, U.K, and Italy) for the period of 1975-1997 using quarterly data and employing cointegration techniques. Their empirical results indicate the existence of a positive relationship between the exchange rate and the trade balance for each country although long-run effects are rather moderate, but in the short-run analysis, they only find evidence of J-curve for Italy and rate may be rather small for major EU countries.

Hacker and Hatemi-J (2003) tests the J-curve for five North European countries, viz. Belgium, Denmark, Netherlands, Norway, and Sweden. They employed generalized impulse response functions. Their results provide empirical support for the J-curve in the short-run and in the long-run export-import ratio appears to be higher than the low point of its early dip in almost all cases. The study also shows that, in the majority of the cases, the export-import ratio appears in many periods after the depreciation to be converging from below to a higher long-run equilibrium.

Nikiforos (2005) employs Exponentially Generalized Auto-Regressive Conditionally Heteroskedastic (EGARCH) model to test whether exchange rate volatility has any significant adverse effects on the trade volume between several European Union countries and Germany over the 1979-1998 period. His results indicated that short-run volatility did not have any deleterious effects on the volume of bilateral trade despite its noticeable increase or at least, persistence for most of the exchange rates.

Hsing (2009), tests the J-curve for the bilateral trade between six selected new EU countries and US. He employs the Johansen co-integration test and the generalised impulse response function based on the vector error-correction model. He finds that the J-curve is not empirically confirmed for any of these new EU countries. But rather, after a shock to real depreciation, the trade balance improves in the case of Czech Republic, but deteriorates for Hungary, Poland, Slovakia, and Slovenia, while it improves first and then deteriorates for Croatia. Estimated co-integrating equations show that except for the Czech Republic, currency real depreciation deteriorates the trade balance for the other five countries in the long run.

Ketenci and Uz (2011) propose an alternative way of assessing the impact of currency depreciation by using the real exchange rate and the impact of income on bilateral trade. Their models are applied between the EU and its major trading partners (the analysis includes the six major trading regions alongside the eight major trading countries) using quarterly data for the period 1980–2007. Their model uses the autoregressive distributive lag (ARDL) approach. Their results indicate a higher importance of income compared to the real exchange rate in defined bilateral export and import demand functions. Also in their estimates, they found evidence of the J-curve in the cases of Canada, China, Japan and the NAFTA in bilateral export demand function and in the case of Canada in the bilateral import function.

Nazlioglu and Erdem (2011), examine the role of exchange rate on Turkey's fresh fruits and vegetables bilateral trade balance with 14 trading partners in the European Union, for the period of 1995:Q1–2007:Q2. They employ ARDL approach to cointegration (i.e., bounds testing cointegration) approach and found the results that support evidence of the J-curve effect in only two cases in the short-run, but in the long-run, the exchange rate has a positive impact on the trade balance in 7 out of 14 cases.

Yazici and Islam (2011) empirically investigate the short-run and long-run impact of real exchange rate changes and Customs Union (CU) agreement on the trade balance of Turkey with European Union (15) countries [EU (15)], by employing bounds testing approach to the co-integration and the error correction modelling and also adopting a new strategy in the model selection phase that ensures the selection of a statistically reliable and co-integrated model as the optimal model for estimation. Using quarterly data for the period 1982-I to 2001-IV.they found no evidence of J-curve effect and no significant effect of customs union in the short-run, and in the long-run, only domestic income variable has significant and expected negative effect and neither exchange rate nor customs union has any significant effect on the trade balance of Turkey with EU (15).

Bahmani–Oskooee and Hosny (2012) use Egypt's quarterly data for commodity trade with her major trading partner, the European Union (EU) for

the period 1994I–2007IV, and employ the bounds testing approach to test the impact of currency depreciation on trade balance. The results reveal the evidence of J-curve phenomenon in 24 out of the 59 industries that trade between the two regions.

Yazici and Islam (2012), assess the impact of exchange rate on Turkish agricultural trade balance of with EU (15) countries, using 21years quarterly data (1988-I to 2008-IV). They employ bounds testing approach to the cointegration and the error correction modelling is employed and a new strategy in the model selection phase to choose those models that satisfy both diagnostic tests and co-integration. Their results reveal that, in the short-run real exchange rate variable affects agriculture trade balance in trade with EU (15) and depreciation of Turkish lira improves the trade balance, but for the long-run impact of the exchange rate, depreciation of Turkish lira has a statistically significant negative effect on trade balance of agriculture.

Verheyen (2012) found evidence of cointegration in more than 75% of cases he observe on the $/€ exchange volatility effect on exports from eleven euro zone countries to the US using monthly data for the period 1996 M02 - 2009 M10. He employed the ARDL bounds testing approach for cointegration on disaggregated SITC export categories. His results suggest that if exchange rate volatility does exert a significant influence, it is typically negative. Furthermore, the exports most often negatively affected seem to be those of SITC categories 6 and 7.

Bahmani-Oskooee, and Kutan,(2009), employ bounds testing approach to cointegration and error correction modelling in eleven Eastern Europe emerging economies (Bulgaria, Croatia, Cyprus, the Czech Republic, the Hungary, Poland, Romania, Russia, Slovakia, Turkey and Ukraine) trade data between 1990:1 and 2005:6. Their study reveals the evidence of the phenomenon in only three cases (Russia, Croatia and Bulgaria) and they conclude with advise to policymakers of these countries that for them to achieve a smooth convergence towards European Union standards in the long-run, they should not consider exchange rate policy alone to control the adverse effect of their trade balances, thus, they propose that in these countries, fiscal

and monetary policies will better be used to promote economic growth rather than exchange rate policy.

2.4 Brief Discussion on the Literature Reviewed

Few studies on J-curve phenomenon were carried out about Nigeria. All of them used aggregate data to explain the phenomenon. Some of them found the evidence of J-curve[18], some couldn't find any evidence of the phenomenon[19], although some couldn't find any relationship in the short-run they confirm long-run relationship between exchange rate and trade balance[20], while others couldn't detect any long relationship between exchange rate depreciation and trade balance[21]. This study revealed the wide gap needed to be filled in this area of study because while in Nigeria no single study use disaggregated data (bilateral data) to date, some current studies go deeper to reduce aggregation bias as they use some countries disaggregated bilateral data at commodity level to explain the phenomenon[22].

On the other hand, there is substantial number of studies in Europe. Some found the evidence of the phenomenon[23], some couldn't find any[24]. Some

[18] Akonji et al (2013)

[19] Umoru and Oseme (2013)

[20] Oyinlola et al (2010), Bahmani-Oskooee and Gelan (2012)

[21] Rincon and Nelson (2001), Joseph and Akhanolu (2011)

[22] Ardalani and Bahmani-Oskooee (2007), Bahmani-Oskooee, and Bolhasani, (2008), Bahmani-Oskooee and Kovyryalova (2008), Yazici and Islam (2011), Soleymani and Saboori (2012), Verheyen (2012) and Bahmani–Oskooee and Hosny (2012) among others.

[23] Hacker and Hatemi-J (2003)

[24] Hsing (2009), Yazici and Islam (2011)

studies use aggregate data[25], some use bilateral data[26], others are between one European country and the rest of Europe or among European countries[27]. Some studies consider some section of Europe like Eurozone, Eastern Europe, Northern Europe[28], while others study bilateral trade between group of European countries or European Union and a country or group of countries[29].

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[25] Ketenci and Uz (2011)

[26] Hsing (2009), Bahmani–Oskooee and Hosny (2012), Yazici and Islam (2012), Verheyen (2012)

[27] Hacker and Hatemi-J (2003), Cantavella-Jordá and Suárez-Burguet (1998)

[28] Nikiforos (2005), Verheyen (2012), Bahmani-Oskooee, and Kutan,(2009)

[29] Hsing (2009), Ketenci and Uz (2011), Nazlioglu and Erdem (2011), Yazici and Islam (2012), Bahmani–Oskooee and Hosny (2012), Verheyen (2012)

CHAPTER 3

MODEL AND DATA DESCRIPTION

3.1 Introduction

As reviewed in previous chapter, all the previous studies in Nigeria used aggregate data to test the J-curve phenomenon. To the best of our knowledge, this is the first study that uses bilateral trade data between Nigeria and its trading partners. The study chooses the Nigeria's major trading partner, E.U.27 (as a single economic union) to fill the gap.

The E.U.27 has overcome the U.S. to become the Nigeria's major trading partner in recent years. Observations of Table 3.1 and Table 3.4 show that in 2010, Nigeria's major exports partner was U.S.A (34.4% of Nigeria's exports goes to U.S) followed by E.U.27 with 23.1%, although the overall major trading partner to Nigeria was U.S.A busting the trade volume of $37,692.48m between them, but the major import partner in that year was E.U.27. (with 21.8% of the Nigeria's import coming from E.U.27). In 2011 and 2012 E.U.27 happen to be both the major import and major export partner to Nigeria. This can be seen from Table 3.2 below which portraits Nigeria's imports from E.U. as $15,632.7m and export as $35,759.8m in 2011, while Table 3.3 shows the same (import from and export to E.U.27) for 2012 as $8,355.1m and $50,942.9m respectively.

Table 3.1: Nigeria's Top Five Major Trading Partners (values in mil. U.S.D) in Year 2010

Major Import Partner				Major Export Partner			
s/n	Partner	Mil. $	%	s/n	Partner	Mil. $	%
	World(Total)	44,235.3	100.0		World(Total)	84,000	100.0
1	E.U. 27	9,632.8	21.8	1	U.S.A	29,755.9	34.4
2	U.S.A	7,936.5	17.9	2	E.U. 27	19,405.9	23.1
3	China	7,324.4	16.6	3	India	9,068.5	10.8
4	Antigua & Barbuda	2,479.5	5.6	4	Brazil	6,042.0	7.2
5	India	2,377.3	5.4	5	Equatorial Guina	2,675.2	3.2

Source : World Trade Organisation(WTO)-International Trade and Market Access Data

Table 3.2: Nigeria's Top Five Major Trading Partners (values in mil. U.S.D) in Year 2011

Major Import Partner				Major Export Partner			
s/n	Partner	Mil. $	%	s/n	Partner	Mil. $	%
	World(Total)	56,000	100.0		World(Total)	114,500	100.0
1	E.U. 27	15,632.7	27.9	1	E.U. 27	35,759.8	31.2
2	U.S.A	11,517.3	20.6	2	U.S.A	28,326.6	24.7
3	China	9,447.7	16.9	3	India	12,7900	11.2
4	Antigu & Barbuda	4,537.7	8.1	4	Brazil	10,554.8	9.2
5	Brazil	3,550.1	6.3	5	Australia	4,671.4	4.1

Source : World Trade Organisation(WTO)-International Trade and Market Access Data

Table 3.3: Nigeria's Top Five Major Trading Partners (values in mil. U.S.D) in Year 2012

Major Import Partner				Major Export Partner			
s/n	Partner	Mil. $	%	s/n	Partner	Mil. $	%
	World(Total)	51,000	100.0		World(Total)	116,000	100.0
1	E.U. 27	8,355.1	16.4	1	E.U. 27	50,942.9	43.9
2	China	7,715.4	15.1	2	U.S.A	24,139.3	20.8
3	U.S.A	4,887.0	9.6	3	India	15,895.2	13.7
4	India	2,887.6	5.7	4	Brazil	10,791.5	9.3
5	Brazil	2,867.6	5.6	5	China	8,038.7	6.9

Source : World Trade Organisation(WTO)-International Trade and Market Access Data

Table 3.4: Nigeria's Top Two Major Trading Partners (values in mil. U.S.D) from Year 2008 – 2012

Nigeria's Trade with E.U 27				Nigeria's Trade with U.S.A		
Years	Imports	Exports	**Trade Volume**	Imports	Exports	**Trade Volume**
2008	8,208.67	17,516.65	**25,725.32**	2,313.08	34,758.31	**37,071.38**
2009	7,795.76	11,203.64	**18,999.39**	2,041.59	13,618.24	**15,659.83**
2010	9,632.84	19,405.89	**29,038.73**	7,936.54	29,755.94	**37,692.48**
2011	15,632.68	35,759.79	**51,392.47**	11,517.28	28,326.60	**39,843.88**
2012	8,355.13	50,942.90	**59,298.03**	4,886.97	24,139.34	**29,026.31**

Source : World Trade Organisation(WTO)-International Trade and Market Access Data

Table 3.5: Nigeria's Exports to and Imports from E.U.27 and E.U.15 (values in mil. euro) from Year 1999 – 2012

Years	Exports		Imports	
	E.U.27	E.U.15	E.U.27	E.U.15
1999	2,803.64	2,794.75	3,040.29	3,003.92
2000	6,415.69	6,412.63	3,976.42	3,860.98
2001	6,474.17	6,458.21	5,181.11	5,059.79
2002	5,026.80	5,000.82	5,215.47	5,130.05
2003	6,184.36	6,164.05	5,071.43	5,010.35
2004	5,233.89	5,223.77	5,276.90	5,184.69
2005	8,389.14	8,384.62	5,972.35	5,757.80
2006	10,808.49	10,802.12	7,013.26	6,710.56
2007	10,199.39	10,187.63	8,459.86	8,180.64
2008	15,723.17	15,697.99	10,906.59	10,515.55
2009	10,420.11	10,406.19	9,184.81	8,720.77
2010	14,505.19	14,492.56	10,654.25	10,205.56
2011	24,411.48	24,385.78	12,892.44	12,158.39
2012	32,965.02	32,934.07	10,067.53	9,555.99
Total	**159,560.55**	**159,345.19**	**102,912.73**	**99,055.04**

Source : Eurostat- http://appsso.eurostat.ec.europa.eu/nui/show.do?query

The study covers fifty-six quarters (1999-2012), so the data are generated from Nigeria and E.U.15 members from 1999:Q1 to 2012:Q4 [because this is the exact number of the union members as at 1st Jan., 1999 and the date also corresponds with Economic and Monetary Union (Euro-area) establishment date]. Using E.U.15 as a proxy of E.U. is also justified as they cover a larger share of the Nigeria's bilateral trade with E.U. From Table 3.5 above, the total exports of Nigeria to E.U.15 is $159,345.19m (which is 99.87% of $159,560.55m - total exports to E.U.27) from 1999-2012 while the total import from the E.U.15 is $99,055.04 (which is 96.25% of $102,912.73 - total imports from E.U.27) during the study period. Table 3.6 below, also shows the aggregated (E.U.15), as well as disaggregated bilateral exports to and imports from this group of countries. Observation of the below table shows that in recent trade, Spain is the major importer of Nigerian products while Nigeria imports more from Netherlands than any other country among this group. Luxembourg is the least trading partner with Nigeria among this group in recent trades.

The rest of the chapter covers trade balance model, and data description and sources of data.

Table 3.6: Nigeria's Exports to and Imports from E.U.15 Members (values in mil. euro) for Year 2011 and 2012

Partner	Nigeria's Exports to		Nigeria's Imports from	
	2011	2012	2011	2012
E.U.15	24,385.78	32,934.07	12,158.39	9,555.99
Austria	773.27	905.86	107.27	108.60
Belgium	98.58	57.72	1,433.13	1,261.75
France	4,312.35	3,705.59	1,481.12	1,251.14
Finland	1.76	0.71	23.43	54.87
Germany	3,446.44	4,403.63	1,273.00	1,131.56
Ireland	257.89	734.67	288.31	283.71
Italy	1,574.95	1,696.29	818.20	784.90
Luxembourg*	0.00	0.01	3.40	14.56
Netherlands	3,672.39	7,814.87	3,850.12	2,169.02
Portugal	1,528.66	925.45	76.11	86.58
Spain	6,070.19	7,056.60	274.61	316.83
Greece	21.87	34.84	77.32	77.80
Denmark	0.43	74.05	107.40	108.87
Sweden	21.23	853.02	635.06	343.08
U.K.	2,605.76	4,670.74	1,709.89	1,562.71

Source : Eurostat- http://appsso.eurostat.ec.europa.eu/nui/show.do?query

*The export to Luxembourg in 2011 was €4,661.00

3.2 Trade Balance Model

The trade balance proposed by Rose and Yellen (1989) later used by Bahmani-Oskooee (1991), and echoed by Bahmani-Oskooee and Brooks (1999) which models the real trade balance to be a direct function of the real domestic income, real foreign income and real effective exchange rate, is closely followed in this study as it has become popular among researchers.[30] While some researchers use bilateral real exchange rate (*REX*)[31] others use bilateral real effective exchange rate (*REEX*),[32] depending upon the nature of the data and the study under consideration. Looking at the nature of Nigeria's trading partner (E.U.15) national currencies diversity, the special procedure is followed to come up with unbiased $REEX_t$ [as determined in equation (11) and (12) below].

Following Yazici and Islam (2012) closely, the model can be derived as follows

Nominal Trade Balance (*B*) in domestic currency is equal to export revenue minus import expenditure:

$$B = P_x\, S_x - E\, P_x^*\, D_m \qquad (9)$$

Where P_x is domestic price of exports, S_x is domestic supply of exports, *E* is nominal exchange rate defined as domestic currency price of foreign currency, P_x^* is foreign price of foreign exports and D_m is domestic import

[30] Bahmani-Oskooee and Brooks (1999), Arora, et al (2003), Bahmani-Oskooee, and Goswami, (2003), Bahmani-Oskooee, and Ratha (2004b), Narayan (2004), Bahmani-Oskooee, et al (2006), Halicioglu, (2007), Ardalani and Bahmani-Oskooee (2007), Bahmani-Oskooee and Kovyryalova (2008), Bahmani-Oskooee and Bolhasani (2008), Baek et al (2009), Bahmani-Oskooee, and Kutan,(2009), Nazlioglu and Erdem (2011), Šimáková, J. (2012), Soleymani, and Saboori, (2012), and Umoru and Eboreime (2013) all used the similar trade balance in their study.

[31] Such as Bahmani-Oskooee and Brooks (1999), Arora, et al (2003), Bahmani-Oskooee, and Goswami, (2003), Bahmani-Oskooee, and Ratha (2004b), Oskooee and Kovyryalova (2008), Bahmani-Oskooee and Bolhasani (2008), Baek et al (2009), Nazlioglu and Erdem (2011), Šimáková, J. (2012), and Soleymani, and Saboori, (2012).

[32] Narayan (2004), Ardalani and Bahmani-Oskooee (2007), Bahmani-Oskooee, and Kutan (2009), and Umoru and Eboreime (2013) used REEX.

demand. Since in equilibrium domestic export supply (S_x) is equal to foreign import demand (D_m^*), we can replace S_x with D_m^* in nominal trade balance equation. Also because demand for imports depends on real income and relative price of imported goods to domestically produced goods (under the assumption that foreign and domestic goods are substitutes for each other), therefore, nominal trade balance can be rewritten as

$$B = P_x D_m^* \ (P_x/P^* E, Y^*) - E P_x^* \ D_m \ (E \ P_x^*/P, Y) \tag{10}$$

Where Y^* is foreign real income, P^* is foreign general price level, P is domestic general price level and Y is domestic real income.

Relative price of imports locally and abroad can be expressed in terms of real exchange rate ($RER = E \ P^*/P$) as follows

$$\frac{E \ P_x^*}{P} = \left(\frac{EP^*}{P}\right) \frac{P_x^*}{P^*} = RER\frac{P_x^*}{P^*} \text{ and } \frac{P_x}{P^*E} = \left(\frac{P}{P^*E}\right) \frac{P_x}{P} = \frac{1}{RER} \ \frac{P_x}{P} \tag{11}$$

Real Trade Balance in domestic currency ($TB=B/P$) is equal to

$$TB = \frac{P_x}{P} D_m^* \ \left(\frac{1}{RER} \ \frac{P_x}{P}, Y^*\right) - \frac{E \ P_x^*}{P} D_m \left(RER\frac{P_x^*}{P^*}, Y\right) \tag{12}$$

$$TB = \frac{P_x}{P} D_m^* \ \left(\frac{1}{RER} \ \frac{P_x}{P}, Y^*\right) - \frac{EP^*}{P} \frac{P_x^*}{P^*} D_m \left(RER\frac{P_x^*}{P^*}, Y\right) \tag{13}$$

Assuming export price level and general price level both at home and abroad are equal to each other so that ($P_x/P = 1$ and $P_x^*/P^* = 1$) Real Trade Balance (TB) can be rewritten as

$$TB = D_m^* \ \left(\frac{1}{RER}, Y^*\right) - RER \ D_m \left(RER, Y\right) \tag{14}$$

This equation shows that Real Trade Balance depends on real exchange rate, as well as real domestic income and real foreign income. Hence, we can restate Real Trade Balance equation in the following general form.

$$TB = TB\,(RER, Y, Y^{*}) \tag{15}$$

Taking the natural logarithm of both sides and using a log-linear approximation for right-hand side, the following trade balance model for estimation (note that *RER* is replaced by *REEX*) is obtained:

$$\ln TB_t = \alpha + \lambda \ln REEX_t + \beta \ln Y_{N,t} + \gamma \ln Y_{EU,t} + \varepsilon_t \tag{16}$$

Where the measure of the trade balance at time t (TB_t) is defined as the ratio of Nigeria's nominal exports from E.U.(15) over her nominal imports to the same group of countries,[33] The ratio is used to make the measure of trade balance unit free (Bahmani-Oskooee, 1991). He argues that this method is sensitive-free to units of measurement, and that it also detects the rate of change of either nominal or real trade balance. The method also helps one to present the model in log specifications, thus the first differenced variables can quantify and measure the rate movement or change, and ln is a log linear form. Y_{Nt} is the Nigeria's real GDP, Y_{EUt} is the real GDP of Nigeria's trading partner (EU15), and $REEX_t$ is the real bilateral effective exchange rate defined in a way that an increase reflects a real depreciation of the naira against the currencies of a trading partner and ε_t is an error term. Considering the signs in equation (16), we expect the estimate of λ to be positive implying that real depreciation of naira (i.e increase in $REEX_t$) encourages Nigeria to export more and imports less, hence, improvement in its trade balance. This positive sign of λ is an indication that the ML condition is satisfied in the long-run. But for β and γ, we

[33] In quarters (periods) where no export or imports is made 1€ is assumed to be the value of export/import in order not to lose the information. This is because when the value is zero the value of the ratio will also be zero or undefined when taken as logarithm.

expect their estimates to be either positive or negative, implying that supply side factors may dominate the demand side or the reverse may be the case. That is to say, if the increase in the domestic income is due to increase in production of locally manufactured substitutes of foreign goods, the estimate of β is to be positive indicating improvement in Nigeria's trade balance, but if the increase in the domestic income is to encourage importation of foreign goods, the coefficient will be negative, signifying deterioration of trade balance. On the other hand, the estimate of γ shall be positive if the increase in the national income of a partner encourages importation from Nigeria, or be negative if the increase of the partner's national income is due to increase in production of locally manufactured substitutes. It is very important at this point to note that to detect the J-curve phenomenon we expect the values of λ to be negative and significant at the lower level and then followed by the positive ones at higher levels in the short-run. For us to test the phenomenon, we incorporate the short-run dynamics into the long-run model. Therefore, we employ bounds testing approach to cointegration that is Autoregresive Distributive Lag – ARDL approach to cointegration introduced by Pesaran et al. (2001). This approach has econometric superiority over other procedures of single cointegration. First, the estimates from small sample sizes are super consistent (Narayan 2004). Second, "the approach allows us to distinguish the short-run effects from the long-run effects simultaneously" (Bahmani-Oskooee, and Kovyryalova 2008). It also has the advantage of avoiding the classification of variables into I(1) or I(0), hence, there is no need for unit root pre-testing (Bahmani-Oskooee and Brooks 1999). The ARDL error correction model specifications of the variables in (16) is

$$\begin{aligned}\Delta \ln TB_t = {} & \alpha_0 + \sum_{j=0}^{k} \lambda_j \Delta \ln REEX_{t-j} + \sum_{j=0}^{l} \beta_j \Delta \ln Y_{N,t-j} \\ & + \sum_{j=0}^{m} \gamma_j \Delta \ln Y_{EU,t-j} + \sum_{j=1}^{n} \theta_i \Delta \ln TB_{t-j} \\ & + \delta_1 \ln REEX_{t-1} + \delta_2 \ln Y_{N,t-1} + \delta_3 \ln Y_{EU,t-1} \\ & + \delta_4 \ln TB_{t-1} + \varepsilon_t\end{aligned} \tag{17}$$

In the above model, *k,l,m,n* stand for the lag lengths. Thus, we detect the short-run effect of real depreciation of naira on Nigeria's trade balance by the sign and significance of λs that is we can obtain the evidence of J-curve if negative estimate(s) of λs at earlier lags preceded the subsequent positive one(s), while the sign and significance of δ_1 normalised on δ_4 indicates the long-run effect. The ARDL procedure then involves two stages. Firstly, the null hypothesis of 'non-existence of the long-run relationship' defined by H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ is tested against the alternative of H_1: $\delta_1 \neq 0$ or $\delta_2 \neq 0$ or $\delta_3 \neq 0$ or $\delta_4 \neq 0$. The relevant statistic to test the null is the familiar F-statistic. The distribution of this F-statistic is non-standard irrespective of whether the variables are I(0) or I(1) (Bahmani-Oskooee and Brooks 1999). Therefore, we compare our computed F-statistic results with critical values provided in Pesaran *et al* (2001 Table CI (iii) Case III pp.300) to accept or reject H_0. In this table, there are two separate sets of values in which one assumes the variables to be I(0) and the other assumes them to be I(1). To test cointegration, we reject the null hypothesis of no cointegration (H_0) if the computed F-statistics results are greater than the upper critical bounds values, and accept it if the result is less than the lower critical values, while if the computed F-statistics results is in between the two bounds, they results become in conclusive, thus we may use error correction model (ECM) suggested by Kremers *et al*. (1992) to detect cointegration in such an inconclusive case. A general error correction model (ECM) of equation (17) is

$$\Delta \ln TB_t = \alpha_0 + \sum_{j=0}^{k} \lambda_j \Delta \ln REEX_{t-j} + \sum_{j=0}^{l} \beta_j \Delta \ln Y_{N,t-j}$$

$$+ \sum_{j=0}^{m} \gamma_j \Delta \ln Y_{EU,t-j} + \sum_{j=1}^{n} \theta_i \Delta \ln TB_{t-j} + \mu EC_{t-1} + \varepsilon_t \qquad (18)$$

Where EC is the residual result of the estimated cointegration model of equation (16) and μ is the adjustment parameter's speed. Bahmani-Oskooee and Brooks (1999) argued that even though cointegration may be obtained from equation (17) but that is not a confirmation that the coefficients estimated

are stable. Thus, we apply Cumulative sum and cumulative sum of squares stability tests of Brown *et al*. (1975). Halicioglu (2007) asserts that "The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points of the model. Providing that the plot of these statistics fall inside the critical bounds of 5% significance, one assumes that the coefficients of a given regression are stable".

3.3 Description and Sources of Data

The data used in this study is the quarterly bilateral trade data between Nigeria and E.U.15 for the period of 1999:1-2012:4. The bilateral exchange rate between naira and euro, naira and Danish krone, naira and sterling pound, naira and Greek drachma, and naira and Swedish krona for the study period are used. The Nigeria's GDP and CPI and that of respective E.U members are equally sourced.

3.3.1 Import, Export and Trade Volume Data

The import, export and trade volume data for both Nigeria and respective E.U members (all values in euro) covering the study period are sourced from Eurostat. This can be observed graphically below.

The series portrait in Figure 3.1, the Nigeria's import from E.U.15 was increasing at a relatively stable rate with major increase at the third quarter of 2008 followed by drastic decrease in the first quarter of 2009. This decrease is

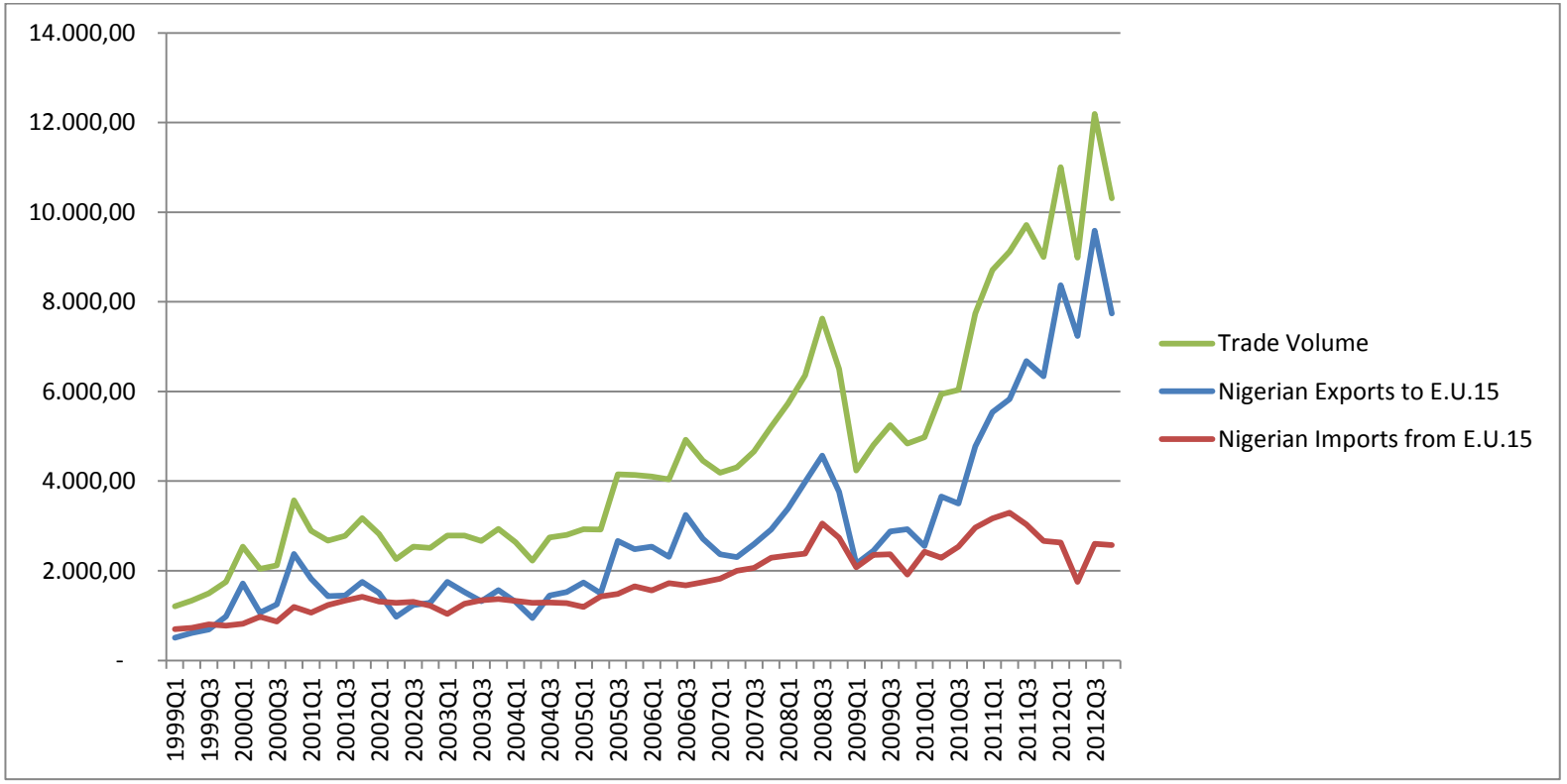

Figure 3.1: Nigeria's Exports to and imports from E.U.15 and Their Trade Volume series (values in mil. euro) - Data Source : Eurostat

caused by a corresponding decrease in Nigeria's real income which was caused by 2009 global financial crises. It can also be seen that the import figure continued to grow at an unstable rate (except in the fourth quarter of 2009) up to the first quarter of 2012 when we witnessed another shock also caused by a corresponding decrease in Nigeria's real income (this can be seen from figure 3.5 below). Similarly the export to E.U.15 was increasing at a very high volatile rate until the first quarter of 2009 when we witnessed a great downswing (corresponding decrease in E.U.15 real in income caused by 2009 financial crises) followed by high, stiff and volatile increase. The trade volume pattern almost followed the Nigeria's export pattern due to the fact that a substantial part of the trade volume is made up of Nigeria's export.

The above figure is aggregate in nature as it represents the group of 15 countries. To do away with aggregation bias, we now consider disaggregated series as can be observed from Figures below.

Figure 3.2 below displays the bilateral exports series between Nigeria and countries under E.U.15. One can observe that Nigeria's exports to Spain shares some similarity with that of aggregate displayed in Figure 3.1. This is not surprising because Spain is the major importer of the Nigeria's products among E.U.27. Exports to Greece, Luxembourg, Sweden and Denmark appeared to be stable over time with only unexpected spikes for Greece in the first quarter of 2012 and for Sweden in the third quarter of the same year respectively. The stability of these countries' series is due to the fact that these countries import less from Nigeria compared to other group members. The moderate importers from Nigeria among these countries are Germany, Netherlands and France and their series appeared a bit similar with only that of Netherland became higher in the last four quarters.

Similarly, imports data are also disaggregated to reflect less biased series of this group of countries as can be observed from Figure 3.3 below.

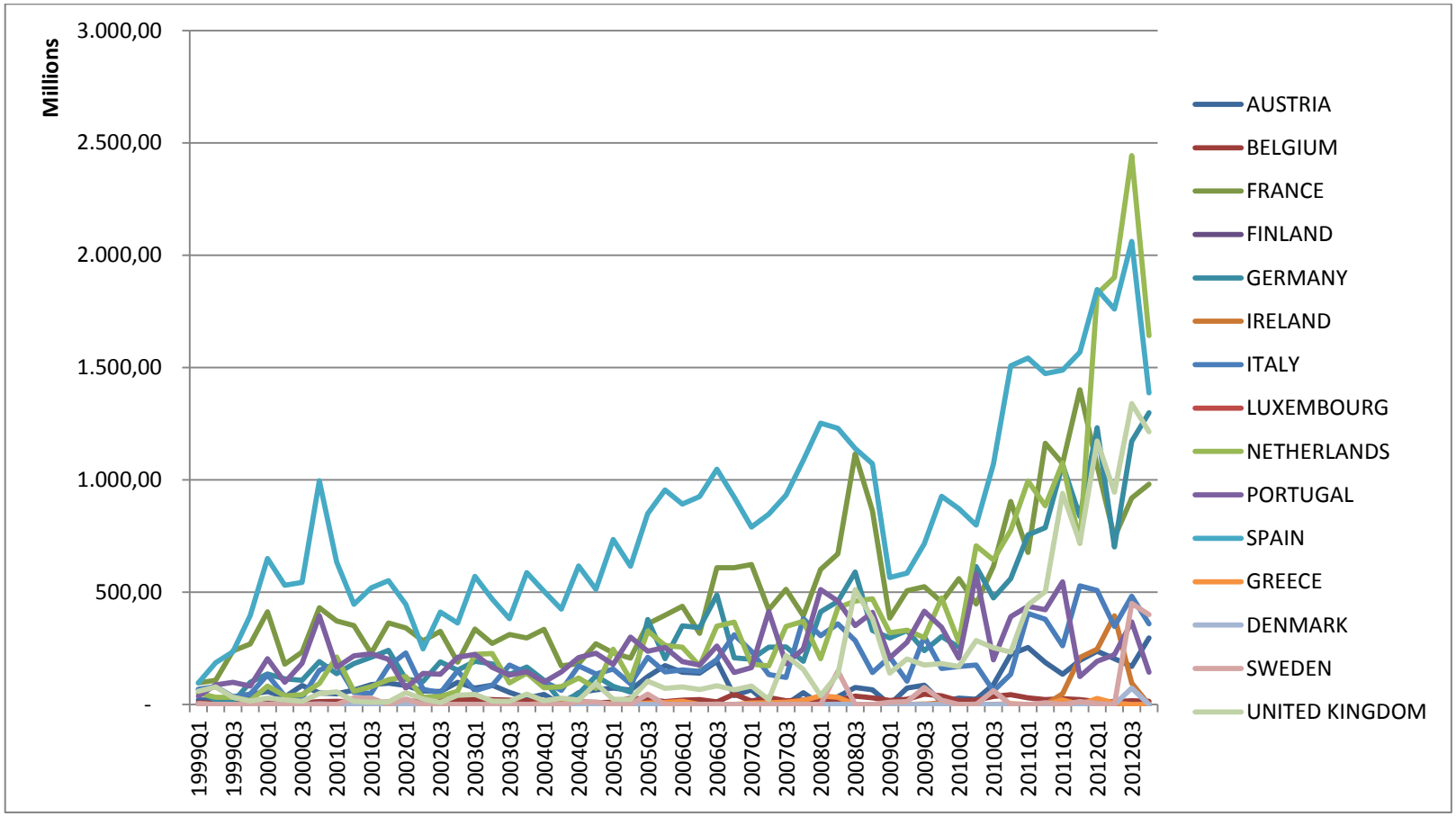

Figure 3.2: Nigeria's Bilateral Exports to countries under E.U.15 (values in mil. euro) - Data Source : Eurostat

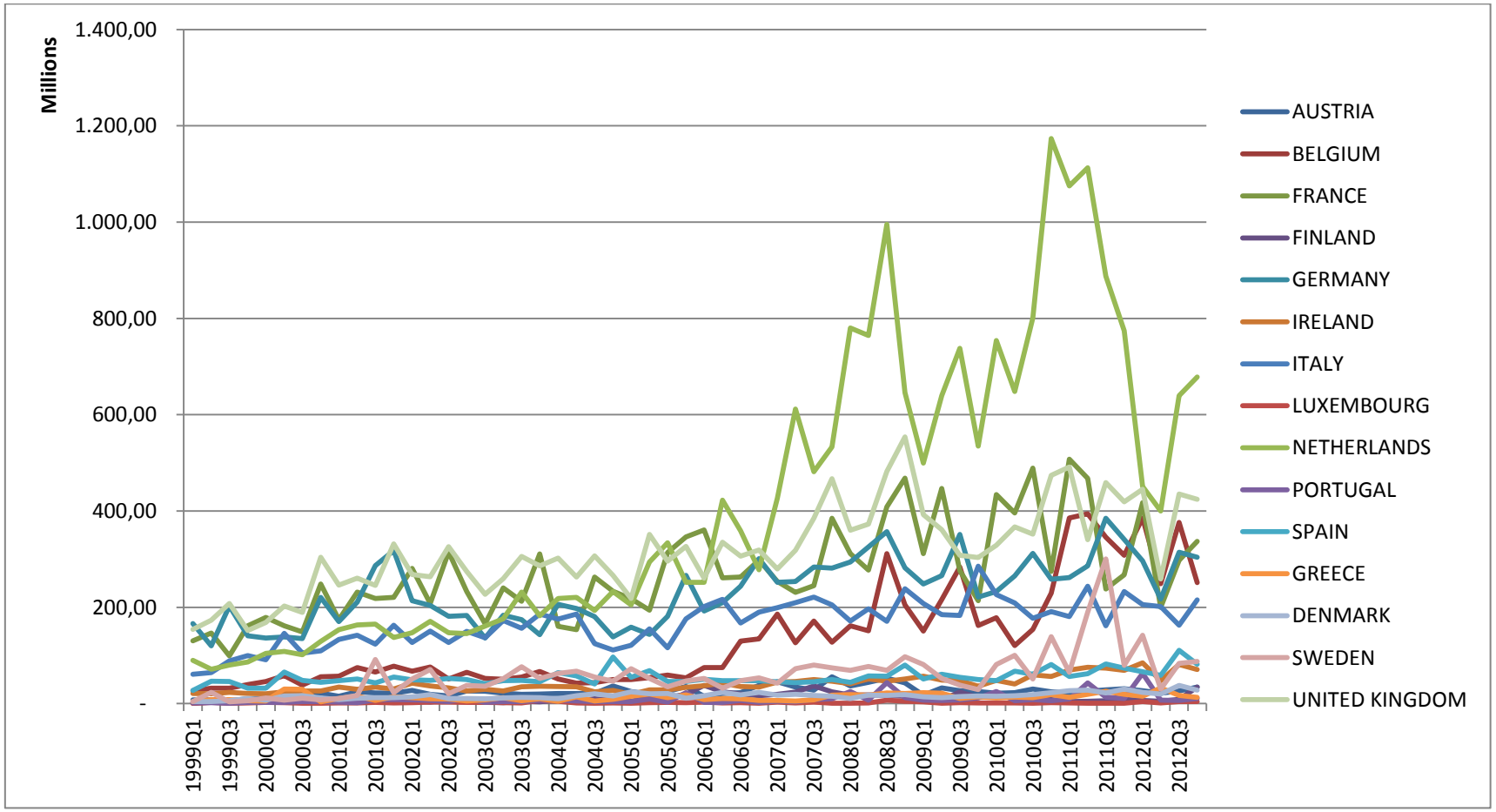

Figure 3.3: Nigeria's Bilateral Imports from countries under E.U.15 (values in mil. euro) - Data Source : Eurostat

Figure 3.3 above shows that Nigeria imports more from U.K up to the last quarter of 2005 but from the second quarter of 2006 henceforth, Nigeria imports more from Netherlands among E.U. countries (except in the last quarter of 2008 in which Nigeria imported more from U.K.). The above figure also indicates that Nigeria imports more from Netherlands, U.K, France, Italy, and Germany while less are imported from Sweden, Denmark, Greece, Spain, Portugal, Finland, Ireland, Luxembourg, Austria, and Belgium (but for Belgium, the importation increased from the first quarter of 2006).

For the trade balance, Figure 3.4 below, indicates that Nigeria enjoys the most favourable trade balance with Portugal (because it exports more to Portugal that it imports from there), but in few occasions Spain trade balance with Nigeria appears to be more favourable, (e.g 2004.q4, 2008.q3) than that of Nigeria-Portugal. The Nigeria's bilateral trade with Austria appears more favourable to Nigeria (after that of Portugal and Spain) among the members in this group throughout the study period. While in the cases of Belgium, Denmark, Finland, Greece, Ireland and Luxemburg the bilateral trade balances appeared to be unfavourable to Nigeria in most of the periods, in other cases (France, Germany, Italy, Netherlands, Sweden and U.K) the trade balance is favourable in most quarters.

3.3.2 GDP Data

The Nigeria's GDP (quarterly gross domestic product at current basic prices in $₦'m$) is sourced from the Central Bank of Nigeria (CBN henceforth), dividing it by Nigeria's CPI we get its real income as follows

$$Y_{N,t} = \frac{GDP_N}{CPI_N}$$

While that of E.U members are seasonally adjusted and adjusted data by working days at current basic prices in $€'m$, sourced from Eurostat. The EU real income is determined as follows

$$Y_{EU,t} = \frac{GDP_{EU}}{CPI_{EU}}$$

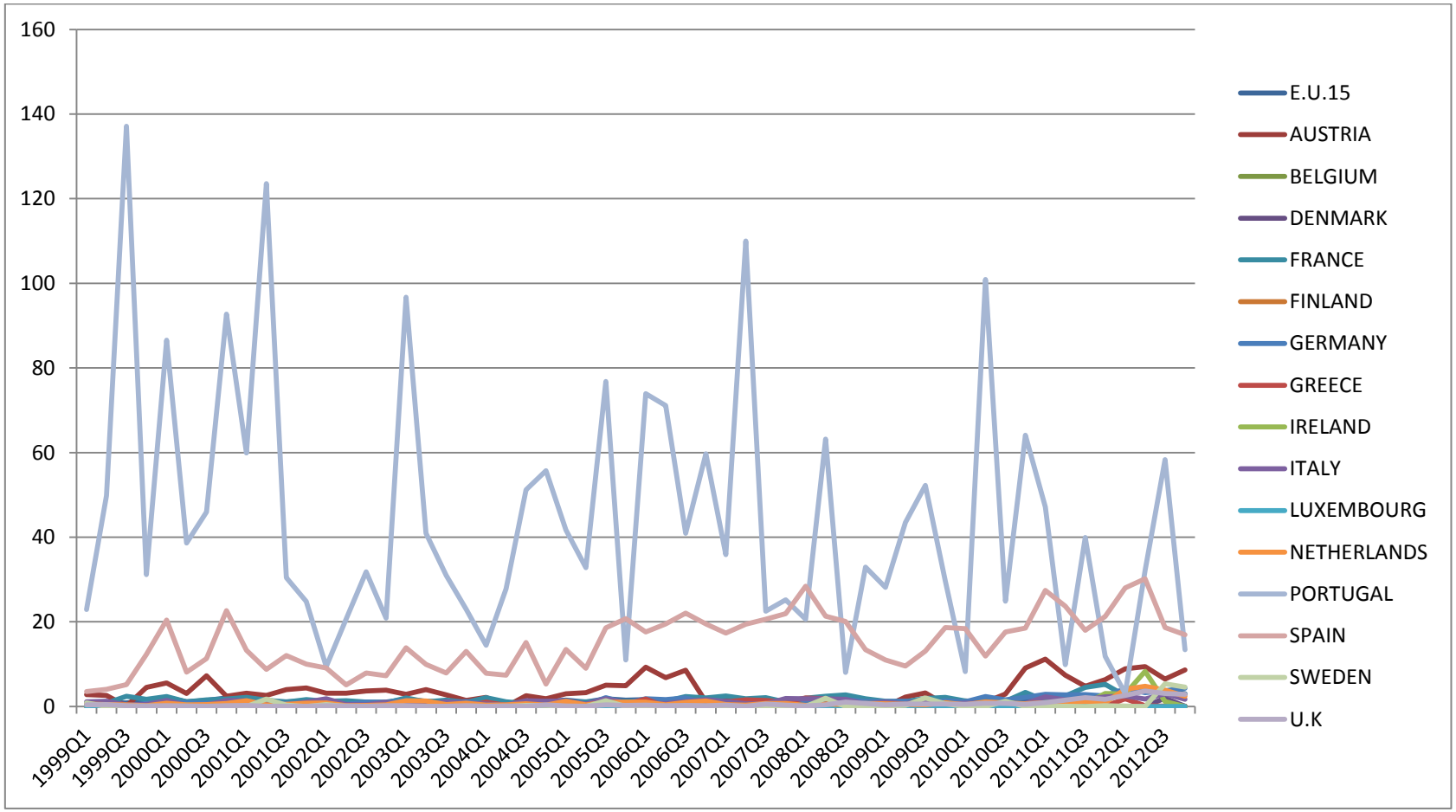

Figure 3.4: Bilateral Trade Balance between Nigeria and countries under E.U.15 - Data Source : Eurostat

The behaviour of both Nigeria's real income and that of E.U.15 can be observed in the figure 3.5 below. The Nigeria's real income ($\ln Y_{N,t}$) appeared highly volatile and increasing at a higher speed rate with no specific pattern. The major fluctuations occurred between the periods of 2001:2–2001:4 and 2009:1 – 2010:1. The later was sharper and caused by 2009 financial melt-down. The E.U.15 real income ($\ln Y_{EU,t}$) was increasing at a stable but low rate until the last quarter of 2008 and the beginning of 2009 when the sharp downswing set in due to the then financial crises, and then picked up at a very stable rate**.**

The disaggregated data of these countries real income is also considered in order to mitigate aggregation bias. Figure 3.6 below portraits the series of real income of respective members of E.U.15. The series indicate that all the countries in this group have relatively stable and increasing real income during the study period and that they are mostly affected by the so-called 2009 financial crises which the above figure shows as a major fluctuation in the first quarter of 2009 among these countries. The bigger economies suffer much in that period of crises as one can observe from the above figure that Germany, U.K, France, Italy, Spain, and Netherlands were the major victims of the crises while Sweden is the only economy that suffers much among the smaller economies.

3.3.3 CPI Data

The CPI for Nigeria is sourced from National Bureau of Statistics (Nigerianstat), and the source for E.U members is Eurostat, except Greek and Swedish CPIs. The Greek's for the first eight quarters (1999:1-2000:4) that are not available there, are sourced from Greek statistics page[34], while the Swedish which is also not available in Eurostat is sourced from Swedish statistics page[35] for the whole period under study. All the CPIs are indexed to year 2000.

[34] Hellenic Statistical Authority (EL. STAT.)
[35] Statistics Sweden

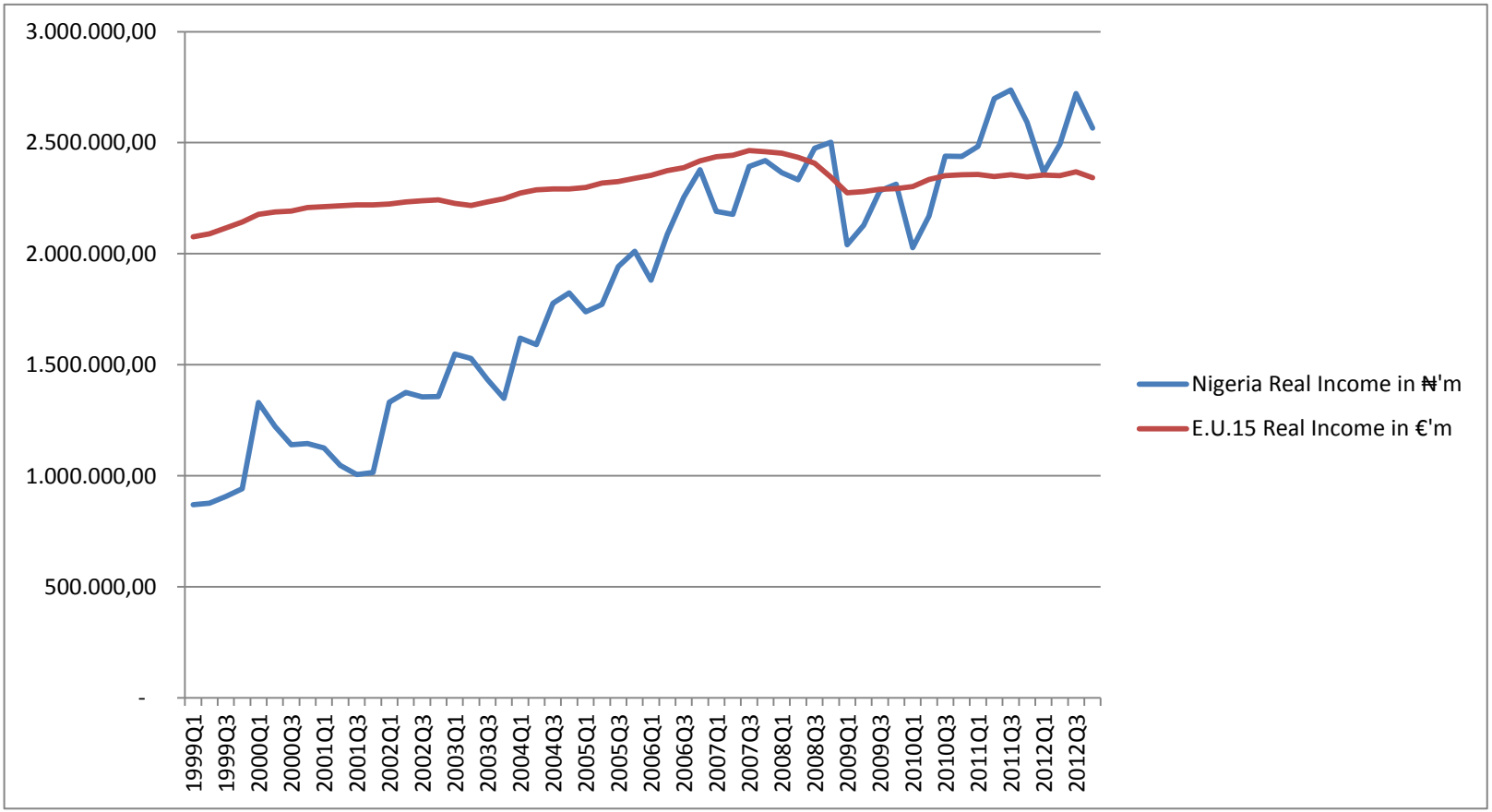

Figure 3.5: Nigeria's and E.U.15 Real Incomes' series - Data Source : Eurostat, C.B.N and Nigerianstat

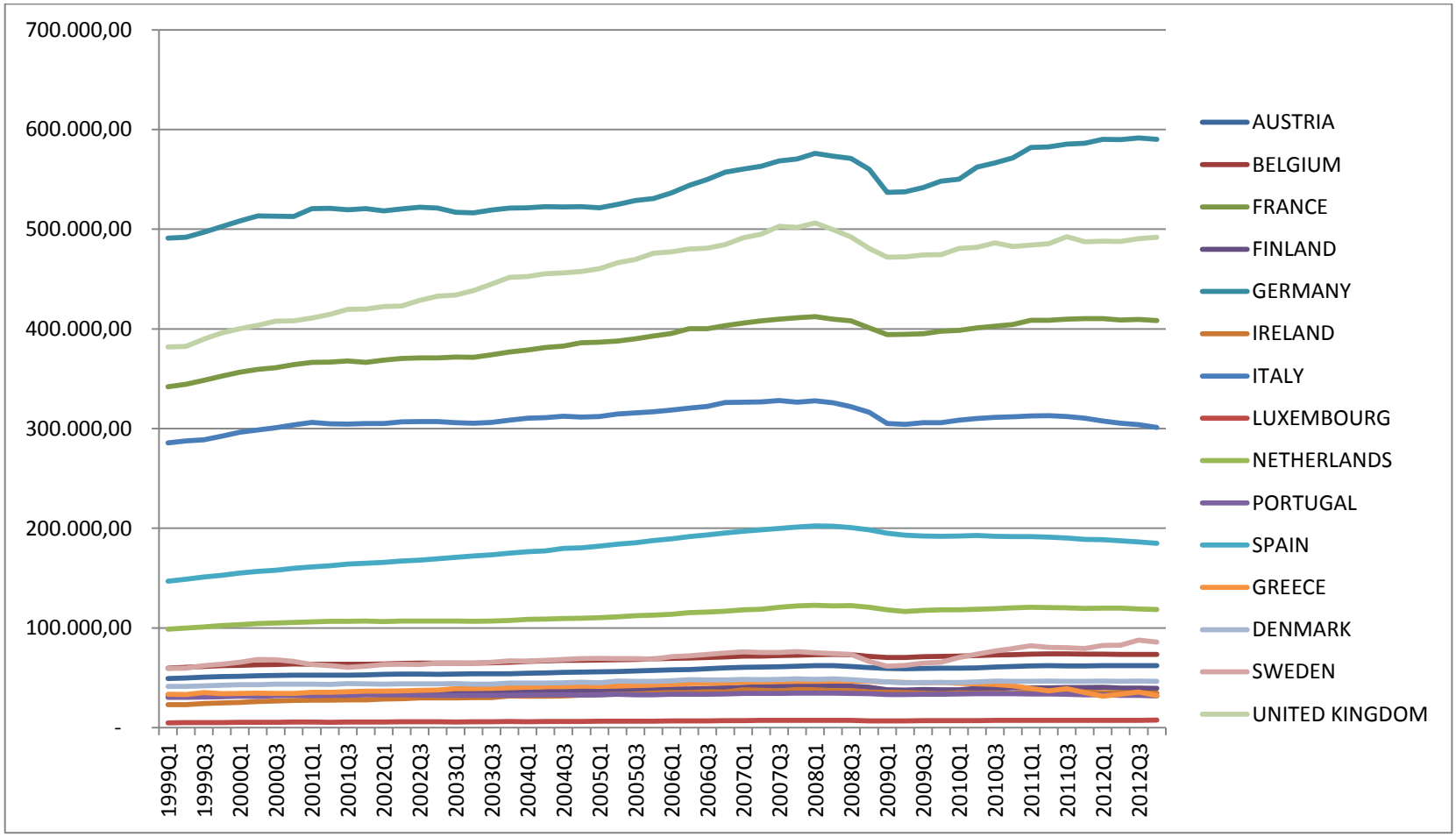

Figure 3.6: Real Incomes' series of countries under E.U.15 (values in mil. euro) - Data Source : Eurostat

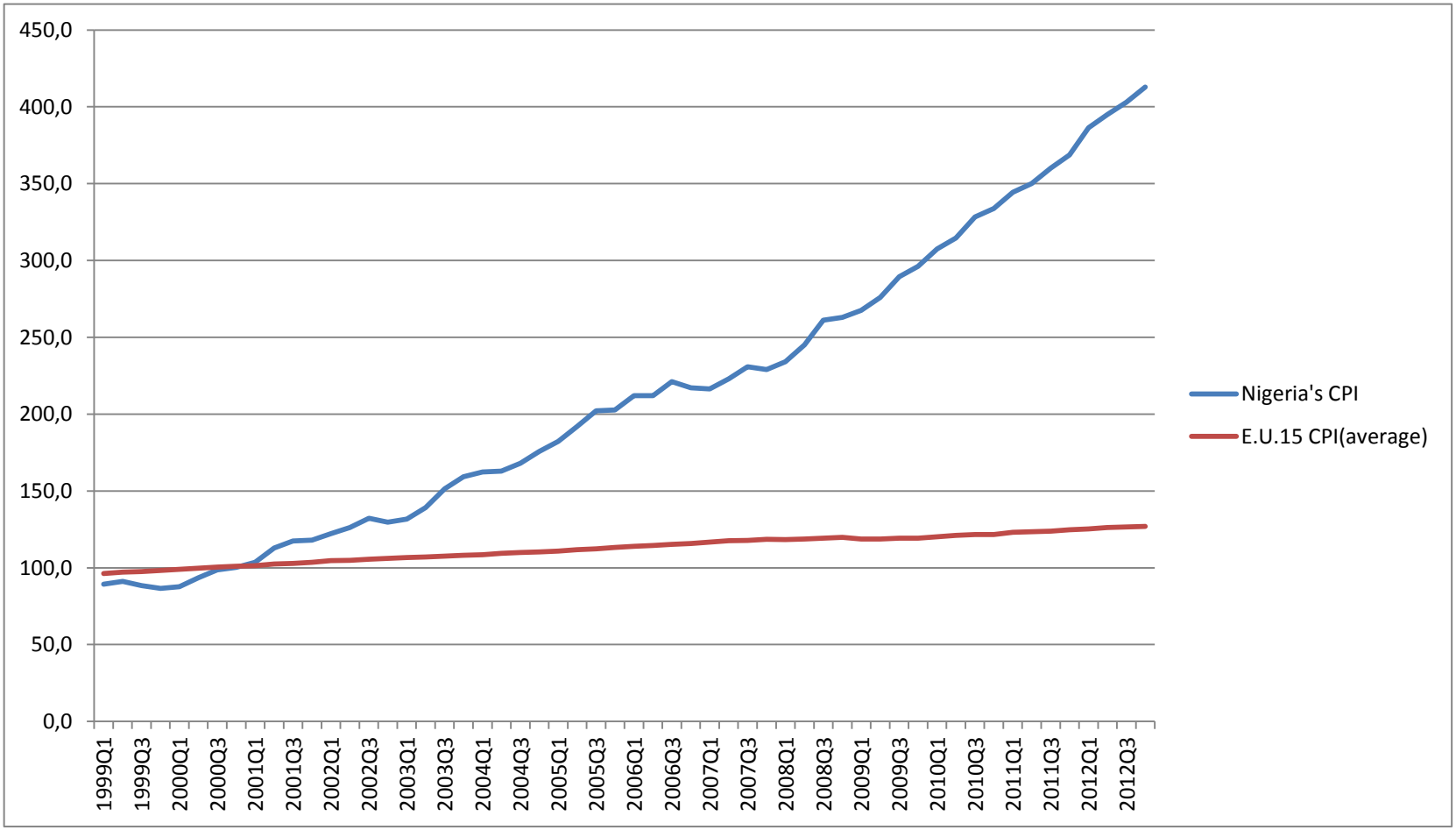

Figure 3.7: Nigeria's CPI and average E.U.15 CPI series - Data Source : Eurostat, C.B.N and Nigerianstat

These are presented in the Figure 3.7 above which portraits the trend of CPI (indexed to year 2000) for both Nigeria and E.U.15. The Nigeria's CPI is increasing at a very high rate due to constant double digit inflation rate, it increased by more than 300% during the study period, while that of E.U.15 increase but at a very low stable rate increasing by just 27% during the study period.

3.3.4 Bilateral Nominal Exchange Rate Data ($N.E_i$)

The bilateral nominal exchange rate between naira and euro, naira and Danish krone, and naira and sterling pound used for the study period were sourced from the CBN (CBN Exchange Rates), while the bilateral exchange rate data for naira and Swedish krona and naira and Greek drachma are limited but determined indirectly through GRD-USD and kr-USD exchange rates (at spot rate)[36] and naira-USD exchange rate (at CBN Exchange Rates). These bilateral nominal exchange rates are determined as follows.

i- Bilateral nominal exchange rate between naira(₦) and euro (€) – $N.E_{€} = \frac{₦}{€}$

ii- Bilateral nominal exchange rate between naira(₦) and Danish krone (kr) – $N.E_{kr} = \frac{₦}{kr}$

iii- Bilateral nominal exchange rate between naira(₦) and sterling pound (£) – $N.E_{£} = \frac{₦}{£}$

iv- Bilateral nominal exchange rate between naira(₦) and Swedish krona(skr) –

$$N.E_{skr} = \frac{₦}{skr} = \frac{₦}{\$} \times \frac{\$}{skr} = \frac{₦}{\$} \div \frac{skr}{\$}$$

[36] The spot rate used during the study period is sourced from Bank of England.

v- Bilateral nominal exchange rate between naira(₦) and Greek drachma ($\Delta\rho\chi$)[37] - $N.E_{\Delta\rho\chi} = \frac{₦}{\Delta\rho\chi} = \frac{₦}{\$} \text{ x } \frac{\$}{\Delta\rho\chi} = \frac{₦}{\$} \div \frac{\Delta\rho\chi}{\$}$

3.3.5 Bilateral Real Exchange Rate (REX_i)

The bilateral real exchange rate between Nigeria and EU15 is determined as follows.

$$REX_i = \frac{N.E_i \text{ x } CPI_i}{CPI_N}$$

Where $N.E_i = N.E_{€,}\ N.E_{kr,}\ N.E_{£,}\ N.E_{\Delta\rho\chi,}$ or $N.E_{skr}$

$CPI_i = CPI_{€,11,}\ CPI_{€,12,}\ CPI_{kr,}\ CPI_{£,}\ CPI_{\Delta\rho\chi,}$ or CPI_{skr}

CPI_N = Nigeria's CPI

3.3.6 Bilateral Real Effective Exchange Rate ($REEX_i$)

The bilateral real effective exchange rate between Nigeria and EU15 is determined as follows.

$$REEX_i = \sum_{i=1}^{n=11} w_{€,11} \text{ x } REX_{€,11} + w_{kr} \text{ x } REX_{kr} + w_{£} \text{ x } REX_{£} + w_{\Delta\rho\chi} \text{ x } REX_{\Delta\rho\chi} + w_{skr} \text{ x } REX_{skr} \quad (19)$$

$$REEX_i = \sum_{i=1}^{n=12} w_{€,12} \text{ x } REX_{€,12} + w_{kr} \text{ x } REX_{kr} + w_{£} \text{ x } REX_{£} + w_{skr} \text{ x } REX_{skr} \quad (20)$$

Where the weights (w_i) are determined as $\frac{Trade\ volume_i}{Trade\ volume_{EU,15}}$

and $w_i = w_{€,11,}\ w_{€,12,}\ w_{kr,}\ w_{£,}\ w_{\Delta\rho\chi,}$ or w_{skr}

[37] This bilateral exchange rate is used for the first twelve quarters only i.e from 1999:1-2001:4 because Greece join the Euro-zone on 1st Jan. 2002(thereafter it is replaced by naira and euro bilateral exchange rate), while all other bilateral exchange rates are used for the whole study period i.e 1999:1-2012:4.

To determine unbiased bilateral real effective exchange rate between Nigeria and EU15 equation (1) is used for the first twelve quarters – 1999:1 - 2001:4 that is when Greece was still using Greek drachma (Δρχ) as a national currency, while equation (2) is used from the 13th quarter to the last quarter – 2002:1 - 2012:4, after Greece start using euro (€) as national currency.

One special thing about this study (unlike previous studies) is that all the weights are determined separately every quarter using the respective trade volume of that quarter. The determined *REEX* using the above procedure is presented in Figure 3.8 below which displays the bilateral real effective exchange rate (ln$REEX_t$) between Nigeria and EU15 series during the study period. This *REEX* tells us how naira has frequently appreciated and depreciated/devaluated against Greek drachma, euro, Danish krone, sterling pound, and Swedish krona, during the study period. The movements of the real bilateral exchange rate do not seem to pursue any specific pattern, but mostly fluctuate till the end of the study coverage.

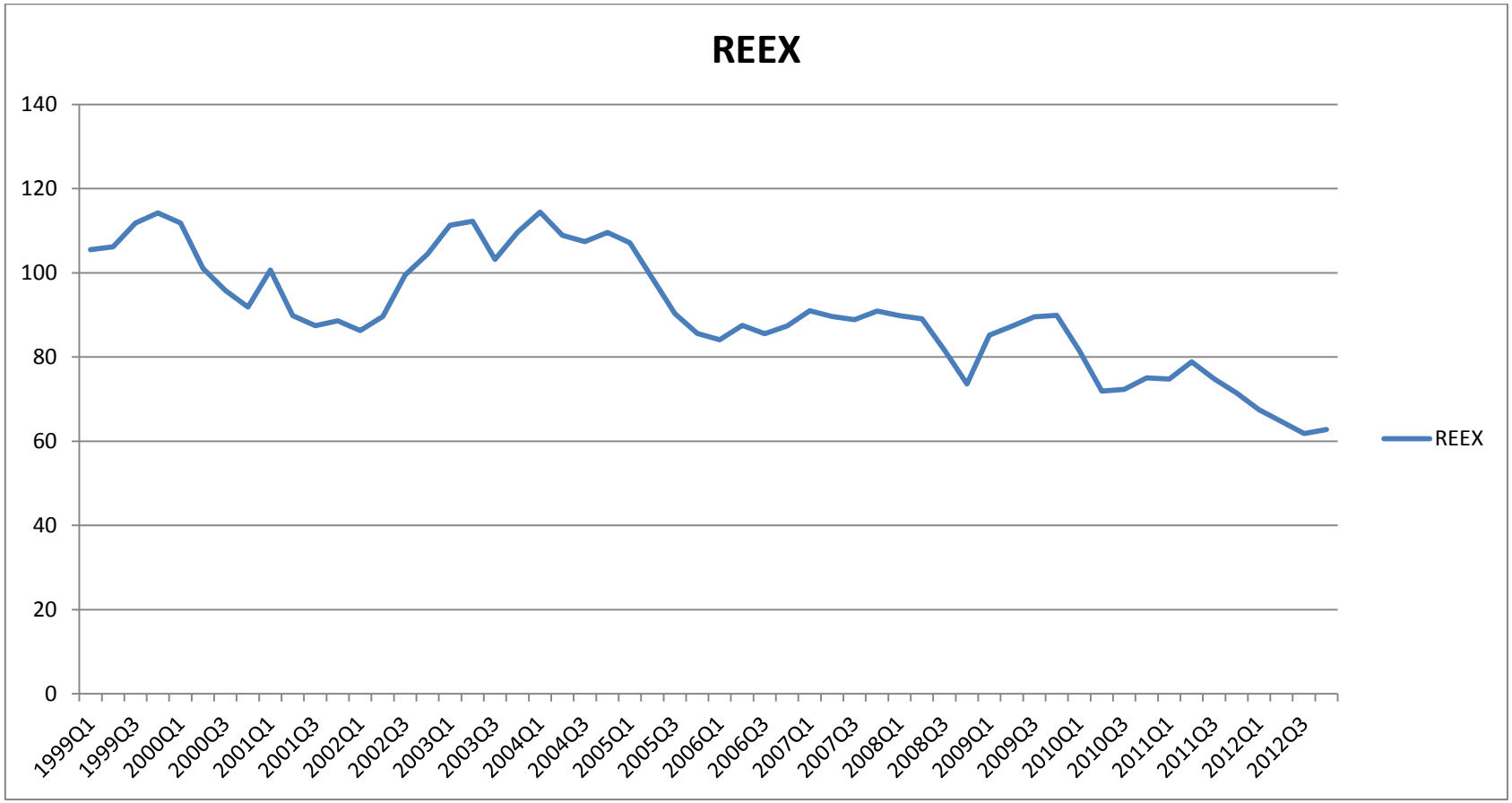

Figure 3.8: Nigeria and E.U.15 REEX series - Data Source : Eurostat, C.B.N and Nigerianstat

CHAPTER 4

THE EMPIRICAL ESTIMATION PROCEDURES, RESULTS ANALYSES AND INTERPRETATIONS

This chapter presents econometric analysis of trade balance dynamics and the results obtained from the empirical analysis are used to examine the existence of J-curve phenomenon at bilateral level.

As mentioned at the beginning, to the best of our knowledge this is the first study that employs trade data at bilateral level between Nigeria and its trading partners. Quarterly imports and exports data are used for the period 1999:Q1 to 2012:Q4 to investigate the existence of both J-curve and (ML) condition in Nigeria's bilateral trade with E.U.15 and also to investigate the same between Nigeria and those countries that made up the group of E.U.15 bilaterally at individual levels.

To achieve this, we need to detect the short-run as well as the long-run responses of the bilateral trade balance to real bilateral exchange rate changes by incorporating the short-run dynamics (outlined by equation 17) into the long-run model (outlined by equation 16). To do this, we have to use an econometric model that can solve these simultaneously (i.e a procedure that can make things easy for us to detect both the short-run and the long-run effects of real exchange rate depreciation on trade balance) and equally handle other obstacles associated with this study. For instance this study covers only 56 quarters, so we need an econometric model that is robust and powerful on small sample size of data. We also need a procedure that can handle variables with different integration orders, that is whether the variables in question are I(0) or I(1). In doing so we found that an ARDL approach for cointegration also known as bounds testing proposed by Pesaran et al. (2001) to be the appropriate one. In this set up Pesaran et al. (2001) demonstrate that testing for cointegration is reduced to testing whether $\delta 1$-$\delta 4$ are jointly significant.

Therefore, they recommend the F-test with new critical values that take into consideration the unit root properties of the variables. Thus, there is no need for unit root testing. Therefore, we follow them and specify equation (16) as an error-correction model as in equation (17), and then test the existence of cointegration among variables. What is normally done in the literature (e.g see Halicioglu 2007, Ardalani and Bahmani-Oskooee 2007) is that once cointegration is established, they employ a criterion in selecting the appropriate order of the VAR and estimate (17). The J-curve is detected when the estimate of λ is negative at lower lags and positive at higher lags. Whereas the long-run relation between the trade balance and the exchange rate is determined by the estimate of δ_1 normalized on δ_4. But in this study we follow a slightly different procedure using a new strategy[38] in finding the model for the estimation which is proposed and first put into use by Yazici and Islam (2011). Their new strategy in finding the model for the estimation works like this: the maximum lag length on each first differenced variable in the error correction version of the ARDL model (as in equation 9 in this study) is set at let's say 10. The model corresponding to each possible lag combination is to be estimated and then those combinations that satisfy the diagnostic tests of normality, no serial correlation and no heteroscedasticty at least at 10 % level should be selected. In case no cointegration is established for a combination, it is discarded. Then, in order to determine the optimal model, AIC is to be applied to the set of those lag combinations that satisfy diagnostic tests and at the same time indicate a cointegration. They also determined the optimal lag combinations that would have been selected had the method of the previous literature is adopted. Their report shows that out of 15 cases, it is only in three cases that all four conditions they impose are satisfied simultaneously. In other 12 cases at least one of the conditions fails with the previous literature.

In this study we start with applying the F-test, as it is the known fact that the number of lags imposed on the first differenced variables could influence

[38] An algorithm developed by M. Qamarul Islam (a professor of statistics) Çankaya University, Department of Economics, Ankara, Turkey, is used in this new strategy.

the results as demonstrated by Bahmani-Oskooee and Brooks (1999). Therefore, following Bahmani-Oskooee and Gelan (2006) and Ardalani and Bahmani-Oskooee (2007) we carry the F-test by varying the order of lag lengths from the minimum of four lags to a maximum of nine lags (which is the maximum lag order that can be accommodated by our data size) on each first-differenced variable and then follow the procedure of this new strategy to select the optimum number of lags in the model selection phase and select the optimal model from the set of those models that satisfy both diagnostic tests (of normality, no serial correlation and no heteroscedasticty at least at 10 % level) and cointegration, that is, ensure that a statistically reliable and cointegrated model is picked up for estimation. For each of these selected combinations, it is then checked whether there exists a cointegration or not. In case no cointegration is established for a combination, it is discarded. Then, in order to determine the optimal model, Akaike Information Criteria (AIC) has been applied to the set of those lag combinations that satisfy diagnostic tests and at the same time indicate a cointegration. It should be noted that lags are imposed without any pre-determined condition to determine maximum lag length, as argued by Bahmani-Oskooee, and Goswami (2003), that "lags are imposed arbitrarily without using any criterion to search for optimum length". As suggested by Pesaran et al. (2001) we select the orders of an ARDL model specified as ARDL (k,l,m,n) representing the lags belonging to four variables (TB, RER, Y_N, $Y_{E.U}$) by searching across $(p+1)^k = (p+1)^4$ ARDL estimations where k is the number of variables included in Equation 8, p is the lag order chosen in the previous stage and reported table in 4.2, spanning by p=0, 1, …9,.

It can be observed from table 4.1 below that as the number of lags are varied so the outcomes of the four conditions (tests), e.g when the maximum lag is set at four, out of sixteen cases, four cases (Austria, Denmark, Ireland and Sweden) failed the tests (diagnostic and cointegration tests), therefore, those that failed are discarded. But when the maximum lag is increased to six, only one case (France) failed the tests. At the maximum lag of eight and nine all the sixteen cases passed the tests suggesting that any of the two can be

chosen. In this study, the most meaningful result between the two (i.e 8 & 9) is picked for analysis, that is to say the result that appears likely predictable in theory is chosen from the two for analysis in this study except in the case of Luxemburg were the maximum lag of six appeared to be more stable than others. This can be observed from table 4.2 below.

After determining the optimal lag combinations above, our next step is to investigate the existence of J-curve by estimating the model in equation 17 corresponding to the optimal lag combinations presented in table 4.2 below. For brevity presentation we report the coefficient estimates of the lagged first differenced real exchange rate only, such that we can analyse the J-curve pattern in the short-run. The sign of the coefficient of the exchange rate determines the existence of the J-curve effect. That is, an initially (at least one lagged) negative coefficient that is significant at least at the 10% level followed by a significant positive one(s) on the lag coefficients would be consistent with the J-curve phenomenon.

Table 4.1: Calculated Diagnostic and Cointegration Tests Results for Different Lag Length Imposed on the First-Differenced Variables.

Trading Partner	Tests	t_{-4}	t_{-6}	t_{-8}	t_{-9}
E.U. 15 (Aggregate)	NORML	1.587(0.452)	1.332(0.514)	3.654(0.161)	3.458(0.177)
	SCORR	6.686(0.153)	4.576(0.334)	6.817(0.146)	4.433(0.351)
	HTSCD	0.007(0.933)	0.584(0.445)	0.008(0.928)	0.015(0.902)
	COINT	4.045*	3.848*	6.324***	6.529***
Austria	NORML	discarded	4.135(0.127)	0.313(0.855)	0.083(0.959)
	SCORR	discarded	5.067(0.281)	7.519(0.111)	7.649(0.105)
	HTSCD	discarded	2.660(0.103)	0.025(0.875)	0.023(0.878)
	COINT	discarded	5.140***	5.959***	6.049***
Belgium	NORML	0.397(0.820)	1.787(0.409)	0.423(0.810)	0.251(0.882)
	SCORR	1.507(0.825)	3.796(0.434)	3.709(0.447)	7.014(0.135)
	HTSCD	1.091(0.296)	0.812(0.367)	0.084(0.772)	1.628(0.202)
	COINT	3.919*	4.039*	4.975**	4.081*
Denmark	NORML	discarded	4.401(0.111)	2.313(0.315)	3.908(0.142)
	SCORR	discarded	4.229(0.376)	6.149(0.188)	6.963(0.138)
	HTSCD	discarded	0.388(0.533)	0.008(0.929)	0.129(0.719)
	COINT	discarded	4.196*	8.373***	9.514***
Finland	NORML	0.518(0.772)	0.016(0.992)	0.158(0.924)	0.092(0.955)
	SCORR	4.669(0.323)	0.811(0.937)	5.285(0.259)	5.455(0.244)
	HTSCD	0.099(0.753)	0.094(0.759)	0.284(0.594)	0.686(0.408)
	COINT	3.913*	3.795*	6.703***	5.726***

Table 4.1 Continues					
France	NORML	0.046(0.977)	discarded	3.226(0.199)	1.762(0.414)
	SCORR	6.546(0.162)	discarded	6.999(0.136)	6.273(0.180)
	HTSCD	0.013(0.911)	discarded	0.567(0.452)	0.509(0.476)
	COINT	4.188*	discarded	5.392**	6.087***
Germany	NORML	1.153(0.562)	0.042(0.979)	1.492(0.474)	0.310(0.856)
	SCORR	3.460(0.484)	1.885(0.757)	7.201(0.126)	7.587(0.108)
	HTSCD	1.505(0.220)	2.195(0.138)	0.001(0.973)	0.003(0.953)
	COINT	6.296***	6.788***	6.049***	4.928**
Greece	NORML	0.959(0.619)	1.064(0.588)	1.028(0.598)	0.588(0.745)
	SCORR	7.430(0.115)	7.307(0.121)	6.753(0.150)	3.568(0.468)
	HTSCD	0.313(0.576)	0.434(0.510)	0.000(0.987)	0.005(0.942)
	COINT	6.070***	4.595**	4.686**	5.902***
Ireland	NORML	discarded	2.771(0.250)	2.047(0.359)	0.177(0.915)
	SCORR	discarded	3.920(0.417)	7.067(0.132)	4.768(0.312)
	HTSCD	discarded	1.260(0.262)	1.789(0.181)	0.000(0.995)
	COINT	discarded	21.087***	17.617***	13.814***
Italy	NORML	1.226(0.542)	1.765(0.414)	1.300(0.522)	0.535(0.765)
	SCORR	7.207(0.125)	7.026(0.135)	4.356(0.360)	7.014(0.135)
	HTSCD	0.737(0.391)	2.207(0.137)	2.207(0.137)	0.321(0.571)
	COINT	9.177***	12.676***	6.535***	9.359***
Luxemburg	NORML	1.127(0.569)	1.295(0.523)	0.121(0.941)	0.200(0.905)
	SCORR	7.437(0.115)	6.691(0.153)	6.289(0.179)	6.413(0.170)
	HTSCD	0.803(0.370)	0.000(0.992)	0.068(0.794)	0.040(0.841)
	COINT	10.460***	6.595***	9.960***	9.592***

Table 4.1 Continues					
Netherlands	NORML	1.047(0.593)	1.657(0.437)	0.730(0.694)	0.644(0.725)
	SCORR	3.611(0.461)	5.904(0.206)	7.371(0.118)	7.117(0.130)
	HTSCD	1.807(0.179)	0.003(0.959)	2.285(0.131)	0.013(0.908)
	COINT	9.844***	9.707***	5.193**	6.934***
Portugal	NORML	0.558(0.757)	1.269(0.530)	1.225(0.542)	0.399(0.819)
	SCORR	6.914(0.141)	5.278(0.260)	4.699(0.320)	7.136(0.129)
	HTSCD	0.697(0.404)	2.693(0.101)	2.569(0.109)	0.011(0.915)
	COINT	7.083***	6.013***	4.948**	10.571***
Spain	NORML	1.364(0.506)	3.071(0.215)	0.775(0.679)	0.733(0.693)
	SCORR	5.817(0.213)	5.894(0.207)	4.911(0.297)	4.478(0.345)
	HTSCD	1.004(0.316)	0.046(0.829)	1.406(0.236)	1.622(0.203)
	COINT	7.493***	4.533**	5.632***	4.274*
Sweden	NORML	discarded	0.261(0.878)	2.734(0.255)	2.382(0.304)
	SCORR	discarded	7.518(0.111)	3.884(0.422)	1.453(0.835)
	HTSCD	discarded	0.476(0.490)	1.903(0.168)	1.816(0.178)
	COINT	discarded	4.954**	6.084***	6.165***
U.K	NORML	0.612(0.736)	0.019(0.990)	1.668(0.434)	0.771(0.680)
	SCORR	0.813(0.937)	0.937(0.919)	2.777(0.596)	7.317(0.120)
	HTSCD	0.326(0.568)	0.001(0.973)	0.018(0.895)	0.166(0.683)
	COINT	4.611**	4.668**	4.104*	9.193***

Notes: Figures in parentheses indicate p-values of the relevant statistic. NORML= Normality, SCORR= No Serial Correlation, HTSCD= No Heteroscedasticity, and COINT= Cointegration at least at 10 % level. F statistic is the result of the test statistic for the null hypothesis of no cointegration, where the critical value bounds are (2.72, 3.77) for 90%, (3.23, 4.35) for 95%, (4.29, 5.61) for 99% confidence levels obtained from Table CI(iii) Case III (p.300) in Pesaran et al. (2001). Rejection of the null hypothesis is denoted by * for 90%, by ** for 95%, and by *** for 99% confidence levels. Discarded = the model that do not satisfy the diagnostic and cointegration tests.

Table 4.2 :Optimal Lag Orders Selection

Trading Partner	**Optimal Lags**	**Chosen Max. Lag**
E.U. 15 (Aggregate)	9, 0, 7, 1,	9
Austria	9, 6, 8, 4,	9
Belgium	6, 1, 8, 8,	8
Denmark	1, 5, 8, 0,	8
Finland	5, 8, 4, 8,	9
France	2, 4, 4, 5,	8
Germany	4, 6, 8, 0,	8
Greece	7, 0, 3, 9,	9
Ireland	6, 6, 3, 6,	8
Italy	9, 5, 0, 7,	9
Luxemburg	1, 0, 5, 1,	6
Netherlands	9, 5, 8, 5,	9
Portugal	6, 7, 8, 2,	9
Spain	7, 8, 3, 4,	9
Sweden	1, 9, 0, 0,	9
U.K	9, 9, 2, 7,	9

Table 4.3: Short-Run Coefficient Estimates of Exchange Rate Variable

Trading Partners	t	t_{-1}	t_{-2}	t_{-3}	t_{-4}	t_{-5}	t_{-6}	t_{-7}	t_{-8}	t_{-9}
E.U. 15 (Aggregate)	-0.637 (-0.823)									
Austria	-47.370** (-4.053)	48.509* (1.916)	32.520 (1.350)	71.738** (3.670)	-8.403 (-0.794)	13.758 (1.633)	20.316** (2.718)			
Belgium	0.550 (0.510)	-3.073* (-2.581)								
Denmark	-8.845** (-2.140)	8.928* (1.843)	2.817 (0.608)	2.467 (0.565)	-1.621 (-0.380)	13.982** (3.550)				
Finland	4.050 (0.570)	7.417 (1.230)	-4.663 (-0.689)	15.099** (2.342)	-14.432** (1.933)	20.570** (3.390)	-1.332 (-0.194)	2.911 (0.468)	-8.581 (-1.499)	
France	0.247 (0.212)	3.460** (3.211)	1.910 (1.598)	2.655** (2.415)	1.394 (1.503)					
Germany	-3.338* (-1.929)	6.892** (2.908)	3.538 (1.664)	6.277** (3.740)	0.431 (0.275)	2.406 (1.529)	2.385* (1.791)			

Table 4.3 Continues

Greece	-1.786** (-2.147)									
Ireland	-6.717 (-1.670)	-4.147 (-1.273)	-7.864** (-2.671)	-1.330 (-0.460)	-4.194 (-1.423)	-9.410 ** (-2.961)	-10.263** (-2.888)			
Italy	-4.687** (-2.841)	-0.759 (-0.512)	-0.790 (-0.561)	1.179 (0.884)	2.117 (1.539)	2.385* (1.812)				
Luxemburg	11.969 (1.166)									
Netherlands	-0.375 (-0.225)	8.445** (2.571)	12.501** (3.409)	5.611* 2.090	1.376 0.695	4.662** 2.715				
Portugal	1.961 (0.737)	1.087 (0.355)	-5.571* (-2.015)	-6.078** (-2.209)	-5.741** (-2.299)	-6.516** (-2.573)	-4.512* (-2.023)	-5.055* (-2.122)		
Spain	-1.621 (-1.570)	1.744 (1.279)	3.194 ** (3.084)	2.333* (1.954)	0.821 (0.663)	-0.923 (-1.143)	1.564* (1.828)	0.801 (0.931)	1.258 (1.284)	
Sweden	3.775 (0.487)	-7.042 (-0.913)	10.050 (1.458)	2.196 (0.336)	-1.397 (-0.216)	-0.172 (-0.864)	13.871** (2.202)	3.509 (0.536)	12.615* (2.005)	12.065* (1.931)
U.K	6.344** (2.294)	-12.318** (-3.349)	-7.362** (-2.883)	-8.889** (-2.907)	0.613 (0.234)	6.931** (2.279)	-1.339 (-0.580)	10.684** (3.299)	2.136 (1.186)	8.560** (3.654)

Notes: *, **, indicate significance levels at 10%, and 5% respectively. Figures in parentheses before each coefficient indicate the value of the t-statistic.

From the above table, we start with the aggregate (E.U 15) results in our short-run analysis. We can observe that the lagged coefficient of the real exchange rate ($\Delta \ln REEX$) is neither negative nor significant signifying that the real depreciation of naira against the currencies of this group of countries has no short run effects on the bilateral trade balances between Nigeria and this group of countries. Therefore with this result the J-curve is said to be unobservable between Nigeria and E.U.15. To do away with the aggregation bias, these countries are considered at individual levels to observe whether the phenomenon exists.

In the case of Austria, movements in the value of $\Delta \ln REX$ variable results in significant changes in its bilateral trade balance with Nigeria in many of the subsequent lags. In the first quarter following a real depreciation of naira, the trade balance depreciates immediately with 5% level of significance, and consequently this effect reverses and turns to positive effects in the 2^{nd}, 4^{th} and 7^{th} lags respectively. The 3^{rd}, 5^{th} and 6^{th} lags are not considered in the decision criteria building as they are insignificant. This result forms a typical text book J curve as the negative impact on trade balance is preceded the positive sequent ones. Similarly, the same trade balance behaviour is detected in the bilateral trade between Nigeria and Germany, that is as naira depreciates against euro trade balance deteriorates from the first quarter and then improves immediately. A similar result is also detected in the case of Denmark, as deterioration starts right from the first quarter following the depreciation of naira against Danish krona and immediately starts improving in the second quarter suggesting that the phenomenon exists. The same story could be told on the bilateral trade between Nigeria and Italy. That the trade balance depreciates immediately following the real depreciation of naira against euro but subsequently improves at the sixth lag. This result is also consistent with the phenomenon.

One may be tempted to form the opinion on the existence of the phenomenon in the cases of Netherlands, Spain and Sweden. Observing Table

4.3 above shows that the results of the coefficients in these cases start with negative and then turn into positives at subsequent lags, but one should not be carried away due to the fact that the coefficients are not statistically significant at the earlier lags even at the 10 percent level (and therefore should not be considered in forming the opinion) suggesting that J-curve effect is not observable in Nigeria's trade with these countries.

Further observation of Table 4.3 above, indicates that in the cases of Finland and United Kingdom, there are no specific short-run pattern in that the significant figures start with positive then followed by negative and end with positive again. Thus, this behaviour presupposes that the J-curve does not exist in Nigeria's bilateral trade with these countries.

The J-curve phenomenon cannot be observed in the bilateral trade between Nigeria and Luxemburg, as the coefficient of $\Delta \ln REX$ appear to be insignificant following the naira depreciation against euro, implying that the real depreciation of naira has no effect on the bilateral trade balance between Nigeria and Luxemburg at least in the short run.

In the bilateral trade balance between Nigeria and each of the Belgium, Greece, Ireland and Portugal, the exchange rate carries at least one significant negative coefficient, indicating that exchange rate is a major factor in Nigeria trade to each of these countries' markets in the short-run, meaning that real depreciation of naira leads to the deterioration of Nigeria's bilateral trade balance with each of these countries in the short-run. Even though, the evidence of classical J-curve as explain by Maggi (1973), that the trade balance deteriorate and then improves following the real depreciation of currency in the short-run, cannot be detected in these cases but we can still detect the phenomenon if the J-curve is defined to reflect short-run deterioration and long-run improvement as put forward by Rose and Yellen (1989), therefore, we need to look at the long-run impact of currency depreciation and combine it with the short-run to form further opinions.

In the case of France the real depreciation of naira against euro improves Nigeria's trade balance in the short-run, contradicting the theoretical expectation as can observed from table 4.3 above.

These analyses highlight the significance of analysing bilateral data versus aggregate data because aggregate data may fail to reveal some of the important relationships that could have exist at bilateral levels.

On the other hand, the long run impacts of a real depreciation on the trade balances specified in (16) and incorporated in to (17) is inferred by the size and significance of δ_1 that is normalized on δ_4 (Ardalani and Bahmani-Oskooee, 2007, Bahmani-Oskooee and Bolhasani, 2008). Therefore, we report the estimates of δ_1, δ_2, δ_3, and δ_4 that were used to form the error-correction term from equation (17) in table 4.4 below.

As expected from the literature, the impact of real exchange rate depreciation on trade balance leads to a rise in the real exchange rate, paving the way for an improvement in the trade balance. An increase in real domestic income will stimulate imports and the coefficient of the domestic income is expected to be negative. If, however, the increase in the domestic income is due to an increase in the production of import-substitute goods, the impact on the trade balance of the domestic income will be positive. While a rise in the trading partner's real income will increase the exports and therefore the trade balance will improve. Like in the case of domestic income, if the rise in the partner's income is resulting from the increase in the production of import-substitutes, the effect on the trade balance will be negative.

From our analysis, the long-run results revealed that the real depreciation of naira against the currencies of those countries that made up the group of E.U 15 has an unfavourable impacts on the Nigeria's trade balance with this group of countries in the long-run as can be observed from the above table that the *lnREEX* has negative and significant coefficient after the real devaluation of naira against the currencies of these countries implying that at least at the bilateral trade level with this group of countries, exchange rate is a significant determinant of the corresponding trade balance. This result reveals that the

Table 4.4: Long-Run Coefficient Estimates

Trading Partner	Constant		ln RER		ln Y_N		ln $Y_{E.U.15}$	
E.U. 15 (Aggregate)	-0.949**	(-6.927)	-1.797**	(-3.537)	0.711*	(1.778)	-5.261*	(-1.765)
Austria	-2.198	(-1.302)	-26.062**	(-3.968)	13.155	(1.674)	-105.751**	(-2.288)
Belgium	1.323**	(3.998)	0.968	(1.647)	5.624**	(3.787)	-34.736**	(-39.56)
Denmark	-4.808**	(-6.794)	-6.201**	(2.313)	-1.871	(-1.170)	6.454	(0.603)
Finland	2.795**	(2.878)	0.958	(0.240)	16.261**	(3.882)	-65.842**	(-4.821)
France	-0.841**	(-3.144)	-2.265**	(-5.198)	0.835	(0.860)	-4.101	(-0.621)
Germany	-1.388**	(-8.536)	-5.378**	(-6.480)	-0.382	(-1.361)	-3.614	(-1.227)
Greece	2.842	(1.190)	-0.506	(-1.026)	12.578**	(2.565)	-27.707	(-1. 683)
Ireland	-0.245	(-0.776)	-2.055**	(-5.624)	2.206**	(2.776)	-9.483 **	(-4.953)
Italy	-0.848**	(-10.764)	-0.596**	(-2.588)	0.812**	(2.743)	-1.859	(-0.659)
Luxemburg	5.062**	(2.733)	11.189**	(2.737)	21.361**	(3.010)	-60.173**	(-2.905)

Table 4.4 Continues

Netherlands	1.090**	(2.785)	-6.318**	(-5.622)	7.283**	(4.769)	-48.430**	(-4.773)
Portugal	-1.295**	(-17.398)	0.041	(0.171)	-0.660**	(-4.625)	8.935**	(6.190)
Spain	-1.501**	(-8.456)	-2.510**	(-5.343)	0.237	(0.543)	3.706**	(2.596)
Sweden	-1.704**	(-2.070)	-8.255**	(-2.461)	-1.443	(-0.646)	-6.758	(-1.303)
U.K	-5.661**	(-5.910)	-6.179**	(-9.934)	-15.907**	(-5.183)	57.284**	(5.102)

Notes: *, **, indicate significance levels at 10%, and 5% respectively. Figures in parentheses after each coefficient indicate the value of the t-statistic.

Marshall-Lerner (ML) condition does not hold.

This aggregate result is not surprising looking at the fact that real depreciation of naira against the currencies of those countries deteriorates Nigeria's tradebalance in ten out of fifteen bilateral cases, while in one case the trade balance appears favourable to Nigeria, the other four cases remained unaffected by changes in real exchange of naira against euro.

To put it in details, our results show that in the long run, the real depreciation of naira exchange rate against these currencies is significantly effective on the bilateral trade balances of Nigeria with 11 countries in this group. But while in the 10 cases out of the 11 (Austria, Denmark, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden, and United Kingdom) the real depreciation of naira brings unfavourable outcome on the Nigeria's trade balance contradicting the literature, in the remaining case (of Luxemburg) it leads to favourable balance of trade as presupposes theoretically and equally satisfies the Marshall-Lerner (ML) condition. While for the remaining four bilateral cases (Belgium, Finland, Greece and Portugal), the Nigeria's trade balance does not respond to real exchange rate changes in the long run, indicating that exchange rate policy can't be used effectively here to improve the bilateral trade balance with this group of four countries.

If we are to form our opinion based on the 'new definition', we can detect the 'inverse J-curve' in the cases of France, Netherlands, Spain and Sweden. Examining their cases in both Table 4.3 and Table 4.4 above reveals that the coefficients appeared to be positive and statistically significant at 10% or 5% at 2^{nd} and 4^{th} lags for France, 2^{nd}, 3^{rd}, 4^{th}, and 6^{th} for Netherlands, 3^{rd}, 4^{th} and 7^{th} for Spain and 7^{th}, 9^{th} and 10^{th} for Sweden respectively in the short run, while in the long-run the result turns to be negative and significant in all case, thus combining the two results suggests that the inverse phenomena are also observable in these cases.

The Nigeria's (domestic) real income plays a significant role in the determination of Nigeria's bilateral trade balance with E.U.15 in the long-run, as increase of Nigeria's domestic income is mostly as a result of increase in domestic production of substitute goods as suggested in the literature, leading to the improvement in trade balance. But this result is biased at

aggregate level. We therefore minimise this bias and re-examine these countries bilaterally as can be observed from Table 4.4 above. It appears that it is only in the cases of Portugal and United Kingdom that increase in Nigeria's real income encourages importation resulting in deterioration in its bilateral trade balances in the long run, but in other seven cases (Belgium, Finland, Greece, Ireland, Italy, Luxemburg and Netherlands) increases in domestic real income brings about improvements in the trade balances. This might be resulted from an improvement in the domestic production of the foreign goods substitutes as explained in the theory. Whereas, in the remaining cases (i.e Austria, Denmark, France, Germany, Spain and Sweden), Nigeria's (domestic) real income does not play any significant role in the determination of Nigeria's bilateral trade balance with these countries because the results of the coefficients are statistically insignificant, thus, does not have any significant effect on trade balance in the bilateral trade.

The results of the impact of foreign real income (of E.U 15) on the Nigeria's trade balance portrays as $lnY_{E.U.15}$ in Table 4.4, suggest that foreign income is one of the most important factors that influence the Nigeria's bilateral trade especially with the group of E.U.15. To give lucid explanation, we re-examine the results at bilateral level, the Nigeria's bilateral trade balances respond to the foreign real income in 9 out of 15 countries, while it remains unimportant factor in other 6 cases. Increase in the real income of Portugal, Spain and United Kingdom cause improvement in Nigeria's bilateral trade balance with these countries as they are expected to import more from Nigeria implying that income-effect is relevant here, while on the other hand, the increase in the real domestic income of Austria, Belgium, Finland, Ireland, Luxemburg and Netherlands worsen the Nigeria's trade balance with these countries. This may be due to a theoretical explanation that, an increase in real foreign income in these countries is caused due to the improvement in the domestic production of the products they import from Nigeria thus import less, hence deteriorates the Nigeria's bilateral trade balances, that is substitution-effect is more considerable in these cases.

Furthermore, at the last stage of our analysis, we investigate the stability of the short-run as well as long-run coefficients. Although we have required in the model selection stage that diagnostic tests (for normality, no serial

correlation and no heteroscedasticy) be satisfied at least at 10% confidence level, but the evidence of coinegration found in equation (17) is not a confirmation that coefficients estimated are stable as argued by Bahmani-Oskooee and Brooks (1999). Therefore, we follow (Bahmani-Oskooee, and Goswami, 2003) and apply cumulative sum (CUSUM) and cumulative sum of the squared (CUSUMSQ) tests proposed by Brown et al. (1975) for parameter stability tests, as they explain that "The CUSUM and CUSUMSQ statistics are updated recursively and plotted against break points. To ensure stability of all coefficients, the plot of these two statistics must stay within the 5 percent significance level portrayed by two straight lines whose equations are given in Brown et al., 1975, Section 2.3". When the CUSUM and CUSUMSQ statistics are stable they suggest that the parameters of trade balance equation are stable over sample period so that estimated coefficients can be considered stable enough for forecasting and policy analysis as argued by Yazici and Islam (2012). The graphical presentations of these tests can be observed in appendix 4.1 while the summary of the inspection of the plots where the resultant statistics are depicted versus the study period can be observed from Table 4.5 whether CUSUM and CUSUMSQ are stable or unstable, are summarised with letters *S* and *U* representing that the coefficients derived from the bounds testing approach.

As reflected in Table 4.5 below, clearly the stability of coefficient estimates is supported in the case of aggregate because the plots of both CUSUM and CUSUMSQ fall within the critical values. The results for the individual seven countries (Belgium, Denmark, France, Luxemburg, Spain, Sweden and U.K) yielded similar outcomes. In other eight cases (Austria, Finland, Germany, Greece, Ireland, Italy, Netherlands, and Portugal), either the CUSUM test or the CUSUMSQ test appeared unstable.

Now that our results establish that, in 15 cases, only 47% of the cases appeared to be stable in both CUSUM and CUSUMSQ tests. But 87% are stable in CUSUM test while 60% are stable in CUSUMSQ test implying that the parameters of trade balance equation are reasonably stable over sample period so that estimated coefficients can be considered for forecasting and policy analysis.

To summarise the chapter, although the real depreciation of naira against the currencies of the countries that made up E.U. 15 has no any significant impact on the Nigeria's bilateral trade balance in the short-run such that the J-curve phenomenon is not observable in the bilateral trade between the two, but in the long-run it has an unfavourable impacts on the Nigeria's trade balance with this group of countries, suggesting that the bilateral trade between the two could not satisfy the Marshall-Lerner (ML) condition.

Table 4.5 : summary of cumulative sum and cumulative sum of the squared tests

Trading Partner	**CUSUM**	**CUSUMSQ**
E.U. 15 (Aggregate)	*S*	*S*
Austria	*S*	*U*
Belgium	*S*	*S*
Denmark	*S*	*S*
Finland	*S*	*U*
France	*S*	*S*
Germany	*S*	*U*
Greece	*U*	*S*
Ireland	*S*	*U*
Italy	*S*	*U*
Luxemburg	*S*	*S*
Netherlands	*S*	*U*
Portugal	*U*	*S*
Spain	*S*	*S*
Sweden	*S*	*S*
U.K	*S*	*S*

While the 'J-curve' is not observable at aggregate level, we can detect the phenomenon in the cases of bilateral trade between Nigeria and each of Austria, Denmark, Germany and Italy in the short-run. While in some cases the impact of real depreciation of naira against partner's currencies causes deterioration, in some it contradicts the theory by causing improvement in the short-run, and in the other cases remained unaffected by the movement of real exchange rate in the short-run. The Marshall-Lerner (ML) condition is only satisfied in the case of Luxemburg while in all other cases it cannot be detected in the long-run.

Combining the short-run and long-run results allowed us to detect the inverse phenomenon in the cases of France, Netherlands, Spain and Sweden, where improvements in trade balance in the short-run preceded the consequent deteriorations in the long-run following real depreciation of naira against euro.

The income and substitutions effects are among the important factors in the determination of the Nigeria's bilateral trade with E.U.15 at least at aggregate level. But at individual bilateral levels the domestic income effect is only prevalent in the case of Portugal and United Kingdom while in the cases of Belgium, Finland, Greece, Ireland, Italy, Luxemburg and Netherlands substitution effect play an important role. The foreign income effect is observable in the cases of Portugal, Spain and United Kingdom while increase in income in Austria, Belgium, Finland, Ireland, Luxemburg and Netherlands worsen the Nigeria's trade balance.

Finally, CUSUM and CUSUMSQ tests indicate that the parameters of trade balance equation are reasonably stable over sample period so that estimated coefficients can be considered for forecasting and policy analysis.

CHAPTER 5

SUMMARY AND CONCLUSION

All previous researches that investigate the relationship between the trade balance and its determinants in Nigeria employed aggregate data and provided inconclusive results. We are therefore tempted to argue that these inconclusive results could be due to aggregation. In this study we investigate the existence of J-curve phenomenon between Nigeria and her largest trading partner - European Union. To minimise the aggregation bias we employed disaggregated bilateral data of Nigeria and each of these counties that form E.U.15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, U.K) for the period covering fifty-six quarters (1999:Q1 – 2012:Q4) to investigate the short-run and the long-run response of the trade balance to naira depreciation against the currencies of these countries. The relationship is modelled using the commonly adopted partial reduced form model of Rose and Yellen (1989). The trade balance as a dependent variable is defined as nominal exports over nominal imports while the independent variables are real bilateral exchange rate (defined as unit of naira per unit of partners' currencies), domestic and foreign real incomes. A depreciation of naira against partners' currencies is expected to improve the bilateral trade balance in the long run, indicating that the ML condition holds, while the J-curve phenomenon according to the classical definition portrays an initial negative relationship between these two key variables followed by an improvement in the short run, but the new definition of the phenomenon expects negative relationship in the short-run combined with positive long-run link between these key variables. The relationship between other two variables - domestic and foreign real income variables, and trade balance in the long-run are

expected in the literature to be positive and negative respectively but no priori expectations are assigned to their coefficients due to the fact that they can have either sign depending upon the dominance of demand or supply side factors in the Nigeria's bilateral trade with its partner.

To investigate J-curve phenomenon, we need an appropriate method of estimation that can detect both short-run and long-run simultaneously and also give us powerful, robust and consistent results despite the finite size of our data. An Autoregressive Distributed Lag (ARDL - bounds-testing) approach to cointegration and error correction modelling developed by Pesaran et al (2001) is chosen. Another advantage of this approach is that it does not require the variables to be integrated of the same order, thus suitable for stationary I(0), integrated of order one I(1) or a combination of both.

The findings have been mixed when the aggregate and bilateral results are considered, both in the long-run and short-run. The empirical results indicate that there exists no relationship in the Nigeria's bilateral trade balance with E.U.15 in the short-run but in the long-run impact of real depreciation of the naira is found to be unfavourable.

This result is considered to be biased as it explained the bilateral relationship between Nigeria and a group of 15 countries. When this result is disaggregated we found that in the case of Austria, Denmark, Germany and Italy, the trade balance worsened immediately following the real depreciation of naira against euro but subsequently improved. Therefore we termed the behaviours as 'J-curves'. While in the cases of United Kingdom and Finland, there is no specific short-run pattern, the real depreciation of naira has no effect on the bilateral trade balances between Nigeria and Luxemburg, at least in the short-run. This is because there is no any significant impact on Nigeria's bilateral trade balance following the naira depreciation against euro. However, in the cases of Belgium, Greece, Ireland, and Portugal, real depreciation of naira against euro leads to the deterioration of Nigeria's bilateral trade balance with each of these countries in the short-run. In the strange cases (which contradict the phenomenon) of France, Netherlands, Spain and Sweden the real depreciation of naira against euro improves Nigeria's trade balance in the short-run.

On the other hand, long-run effect of real depreciation of naira against the currencies of those countries that made up the group of E.U 15 has an unfavourable impact on the Nigeria's trade balance with this group of countries in the long-run, suggesting that this result is not consistent with the Marshall-Lerner (ML) condition. But investigation of the bilateral cases reveals that real depreciation of naira against the currencies of those countries worsens the Nigeria's trade balance in ten (Austria, Denmark, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden, and United Kingdom) out of fifteen bilateral cases, while it is only in one case (Luxemburg) the trade balance appears to be favourable to Nigeria in the long-run, the other four cases (Belgium, Finland, Greece, and Portugal) remained unaffected by changes in real exchange of naira against euro.

The study also found that both the Nigeria's (domestic) real income and that of E.U.15 (foreign real income) play a significant role in the determination of Nigeria's bilateral trade balance with E.U. 15 in the long-run at aggregate level.

Re-examination of bilateral cases reveals that it is only in the case of Portugal and United Kingdom that increase in Nigeria's real income encourages importation resulting in deterioration in its bilateral trade balances in the long run while in other seven cases (Belgium, Finland, Greece, Ireland, Italy, Luxemburg and Netherlands) increases in domestic real income brings about improvements in the trade balances suggesting improvements in the domestic production of the foreign goods (from these countries) substitutes as explained in the theory. However, an increase in real foreign income in six cases (Austria, Belgium, Finland, Ireland, Luxemburg and Netherlands) is caused due to the improvement in the domestic production of the products they import from Nigeria thus import less, hence deteriorates the Nigeria's bilateral trade balances while increase in the real income of Portugal, Spain and United Kingdom cause improvement in Nigeria's bilateral trade balance with these countries as they are expected to import more from Nigeria. Our findings also confirm that both domestic and foreign real incomes have insignificant effect on trade balance in the bilateral trade between Nigeria and four countries (i.e Denmark, France, Germany and Sweden) in this group.

Our results also disclosed that in the case of France, Netherlands, Spain and Sweden, their bilateral trade balance with Nigeria improves in the short-run and then deteriorates in the long-run. When we combine the results of short-run and long-run and adopt the 'new definition' put forward by Rose and Yellen (1989), we found the evidence of the inverse phenomenon in these cases.

To ascertain the stability of the short-run as well as long-run coefficients of bilateral trade balance relationships, CUSUM and CUSUMSQ tests were implemented. The outcomes reveal that 87% of the cases are stable in CUSUM test and 60% are stable in CUSUMSQ test while 40% of the cases are found to be stable in terms of both tests. We therefore maintained that parameters of trade balance equation are reasonably stable over sample period so that estimated coefficients can be considered for forecasting and policy analysis.

The main conclusions of this study are that, even though at the aggregate level, the J-curve pattern is not detected in the short-run, and that in the long-run real depreciation of the naira against the currencies of E.U.15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, U.K) has negative impact on Nigeria's trade balance with this group of countries and that the Marshall-Lerner (ML) condition does not receive any support. But at bilateral level, the evidence of the phenomenon is found in four cases, viz. Austria, Denmark, Germany and Italy in the short-run, while in the long run the Marshall-Lerner (ML) condition exists only in the case of Luxemburg, suggesting that naira depreciation against the currencies of these countries should not be considered as a good measure to control the Nigeria's bilateral trade balances in most markets of the countries in this group. Furthermore, both domestic and foreign real incomes play a significant role in the determination of Nigeria's trade balance with E.U.15. Therefore, for Nigeria to improve its trade balances against these countries, it should consider the production of import substitute products an important factor. Moreover, higher inflation rate may be one of the factors that contribute to the failure of currency depreciation to improve the Nigeria's trade balance in the long-run, therefore, naira appreciation against the currencies of these countries rather

than depreciation will favour Nigeria's bilateral trade balances against this group of countries in the long-run.

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APPENDICES

APPENDIX A: Mathematical Derivation of Marshall-Lerner (ML) Condition

The following derivation follows from Salvatore (2001)

Let:

P_X and P_M = foreign currency price of exports and imports, respectively,

Q_X and Q_M = the quantity of exports and imports, respectively, and

V_X and V_M = the foreign currency value of exports and imports, respectively.

Then the trade balance (B) is

$$B = V_X - V_M = Q_X \cdot P_X - Q_M \cdot P_M \qquad \text{(A-1)}$$

For a small devaluation, the change in the trade balance (∂B) is

$$\partial B = P_X \cdot \partial Q_X + Q_X \cdot \partial P_X - (P_M \cdot \partial Q_M + \quad Q_M \cdot \partial P_M) \qquad \text{(A-2)}$$

This was obtained by product rule of differentials ($\partial uv = v \cdot \partial u + u \cdot \partial v$). Since S_M is horizontal, P_M does not change (i.e., $\partial P_M = 0$) with a depreciation or devaluation of the currency, so that the last term in Equation (A-2) drops out. By then rearranging the first and third terms we get

$$\partial B = \partial Q_X \cdot P_X + Q_X \cdot \partial P_X - \partial Q_M \cdot P_M \qquad \text{(A-3)}$$

We now define Equation (A-3) in terms of price elasticities. The price elasticity of demand for exports (n_X) measures the percentage change in Q_X for a given percentage change in P_X. That is,

$$n_X = -\frac{\partial Q_X}{Q_X} \div \frac{\partial P_X}{P_X} = \frac{\partial Q_X}{Q_X} \div k\left(\frac{P_X}{P_X}\right) = \frac{\partial Q_X \,.\, P_X}{Q_X \,.\, k \,.\, P_X} \qquad \text{(A-4)}$$

Where $k = -\partial P_X/P_X$ (the percentage of depreciation or devaluation of the currency). Similarly, the coefficient of price elasticity of demand for imports (n_M) is

$$n_M = -\frac{\partial Q_M}{Q_M} \div \frac{\partial P_M}{P_M} = \frac{\partial Q_M \,.\, P_M}{Q_M \,.\, k \,.P_M} \qquad \text{(A-5)}$$

From Equation (A-4) we get

$$\partial Q_X \cdot P_X = n_X \cdot Q_X \cdot P_X \cdot k \qquad \text{(A-6)}$$

This is the first term in Equation (A-3). We can also rewrite the second term in Equation (A-3) as

$$Q_X \cdot \partial P_X = Q_X\,(\partial P_X/P_X)P_X = Q_X\,(-k)P_X = -\,Q_X \cdot k \cdot P_X \qquad \text{(A-7)}$$

Finally, from Equation (A-5), we get

$$\partial Q_M \cdot P_M = -\,n_M \cdot Q_M \cdot \partial P_M = -\,n_M \cdot Q_M \cdot P_M \cdot k \qquad \text{(A-8)}$$

Where $k = \partial P_M/P_M$. While $\partial P_M = 0$ in terms of the foreign currency, it is positive in terms of the domestic currency. Equation (A-8) is the third term in Equation (A-3).

Substituting Equation (A-6), (A-7), and (A-8) into Equation (A-3), we get

$$\partial B = n_X \cdot Q_X \cdot P_X \cdot k - Q_X \cdot P_X \cdot k - (-\,n_M \cdot Q_M \cdot P_M \cdot k) \qquad \text{(A-9)}$$

Simplifying algebraically, we get

$$\partial B = k[Q_X \cdot P_X\,(n_X - 1) + n_M \cdot Q_M \cdot P_M] \qquad \text{(A-10)}$$

If to begin with

$$B = Q_X \cdot P_X - Q_M \cdot P_M = 0 \quad \text{(A-11)}$$

Then

$$\partial B = k[Q_X \cdot P_X (n_X + n_M - 1)] \quad \text{(A-12)}$$

And $\partial B > 0$ if

$$n_X + n_M - 1 > 0 \text{ or } n_X + n_M > 1 \quad \text{(A-13)}$$

Where both n_X and n_M are positive.

If the devaluation or depreciation takes place from the condition of $V_M > V_X$, n_M should be given proportionately greater weight than n_X, and the Marshall–Lerner condition for a stable foreign exchange market becomes more easily satisfied and is given by

$$n_X + (V_M/V_X)\, n_M > 1 \quad \text{(A-14)}$$

If the price elasticities of the foreign supply of the country's imports (e_M) and it's supply of exports (e_X) are not infinite, then the smaller are e_M and e_X, the more likely it is that the foreign exchange market is stable even if

$$n_X + n_M < 1 \quad \text{(A-15)}$$

The Marshall–Lerner condition for stability of the foreign exchange market when e_M and e_X are not finite is given by

$$\frac{e_X(n_X - 1)}{e_X + n_X} + \frac{n_M(e_M + 1)}{e_M + n_M} \quad \text{(A-16)}$$

Or combining the two components of the expression over a common denominator

$$\frac{e_M e_X(n_M + n_X - 1) + n_M \cdot n_X(e_M + e_X + 1)}{(e_X + n_X)(e_M + n_M)} \qquad \text{(A-17)}$$

The foreign exchange market is stable, unstable, or remains unchanged as a result of a devaluation or depreciation to the extent that Equation (A-16) or (A-17) is larger, smaller than, or equal to 0, respectively. The mathematical derivation of Equation (A-16) is given in Stern (1973).

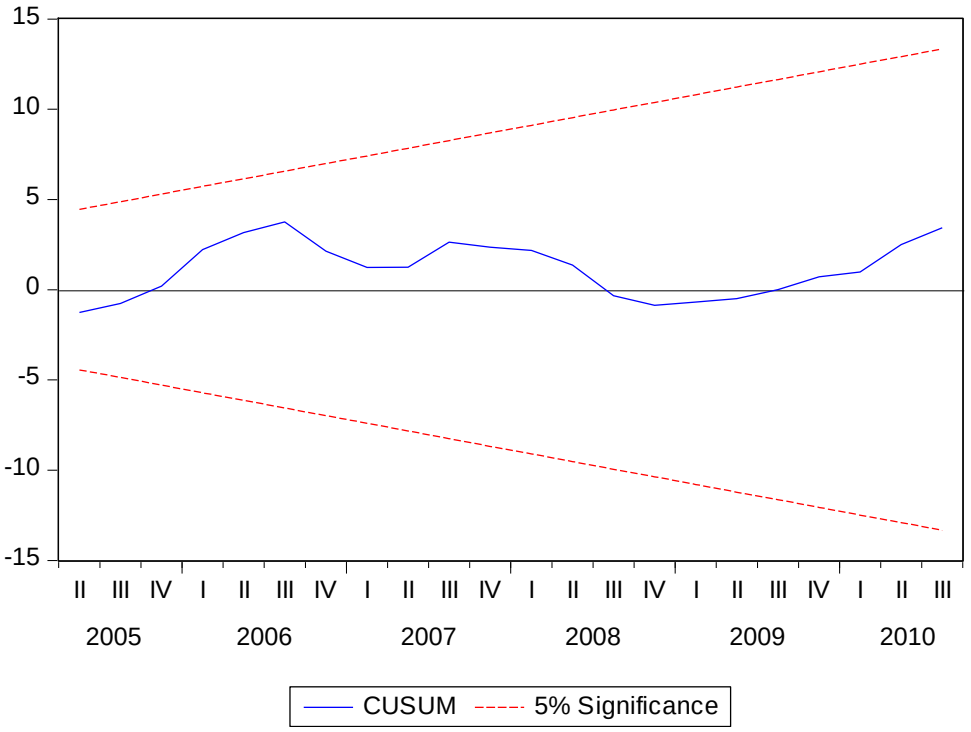
The condition for a deterioration in the terms of trade of the devaluing nation is also derived in Stern (1973) and is given by

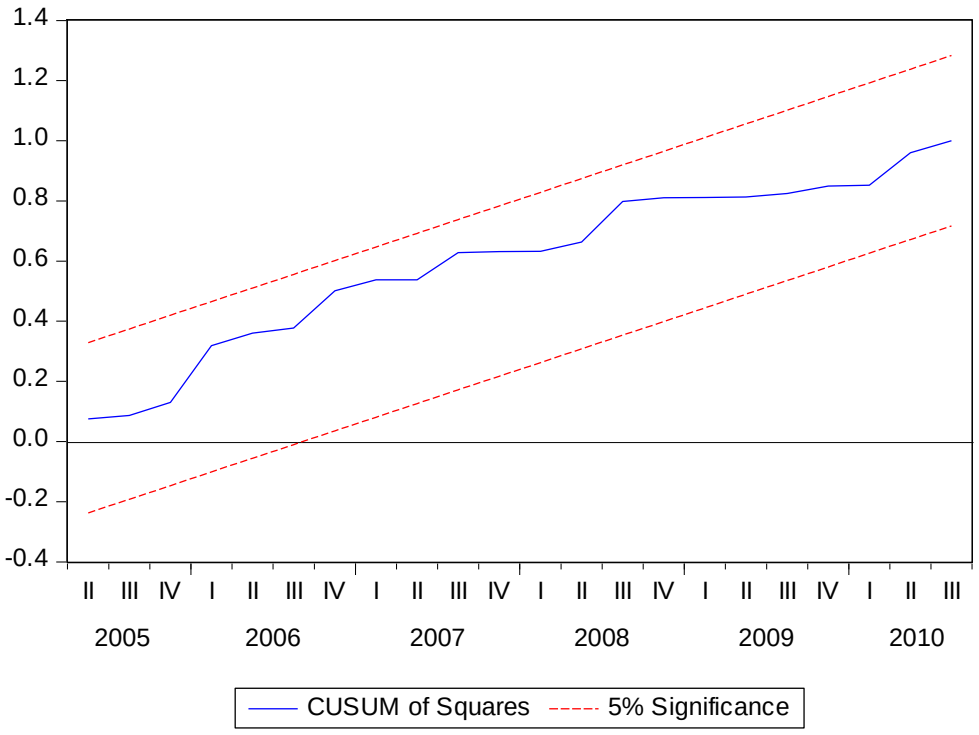
$$e_X \cdot e_M > n_X \cdot n_M \qquad \text{(A-18)}$$

If the direction of inequality sign in Equation (A-18) is the reverse, the devaluing country's terms of trade improve, and if the two sides are equal, the terms of trade will remain unchanged.

APPENDIX B: CUSUM and CUSUMSQ Diagrams

E.U.15 (AGGREGATE)





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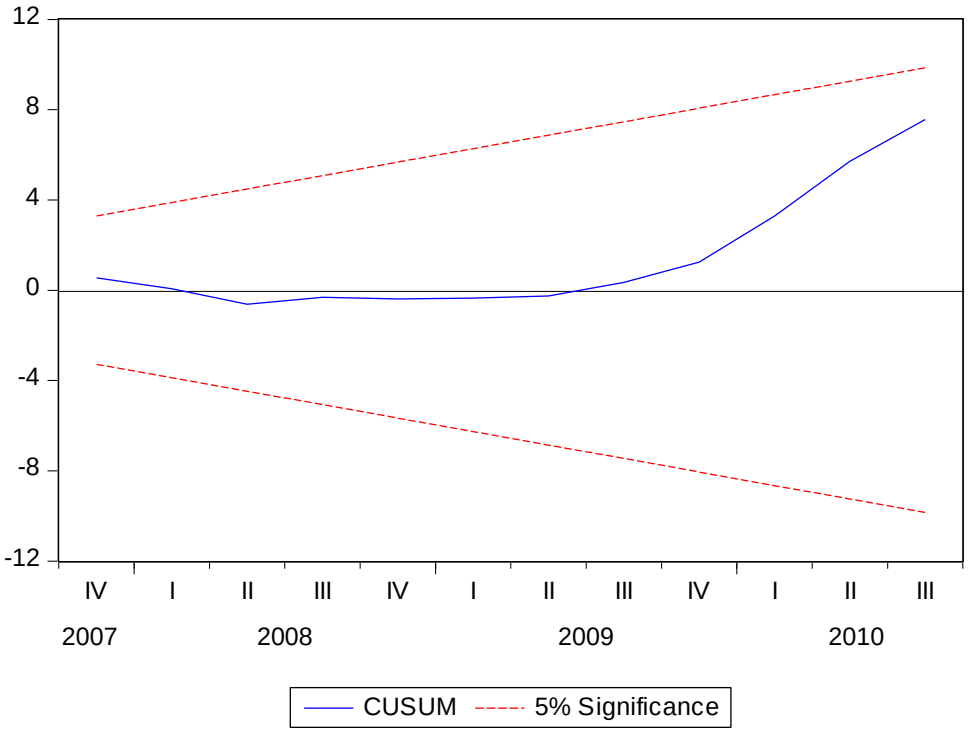
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CUSUM
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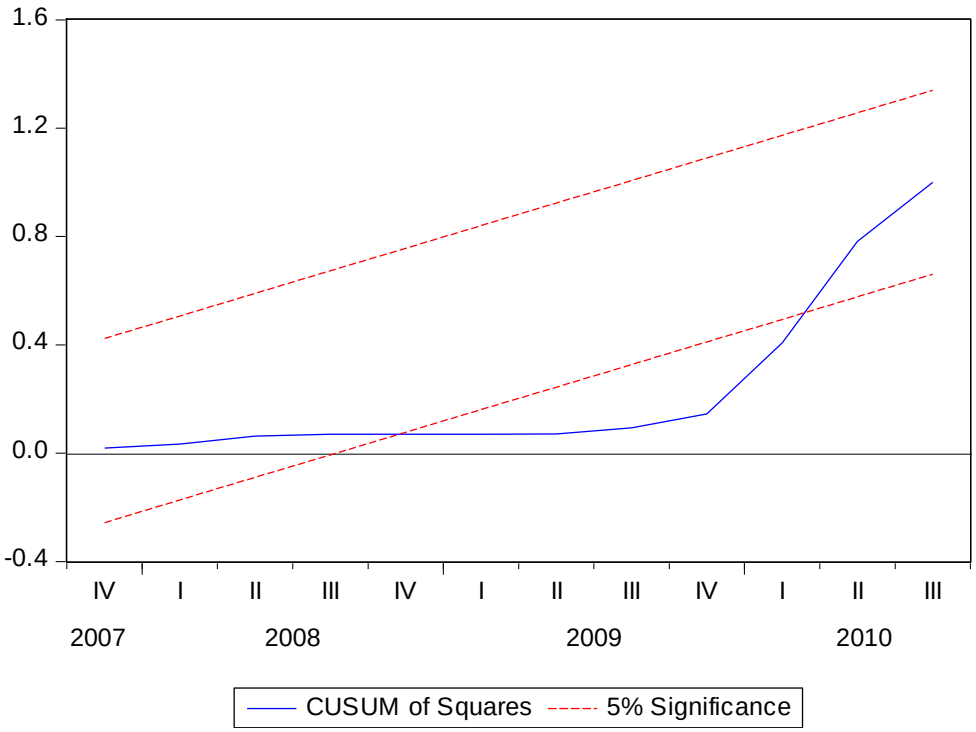
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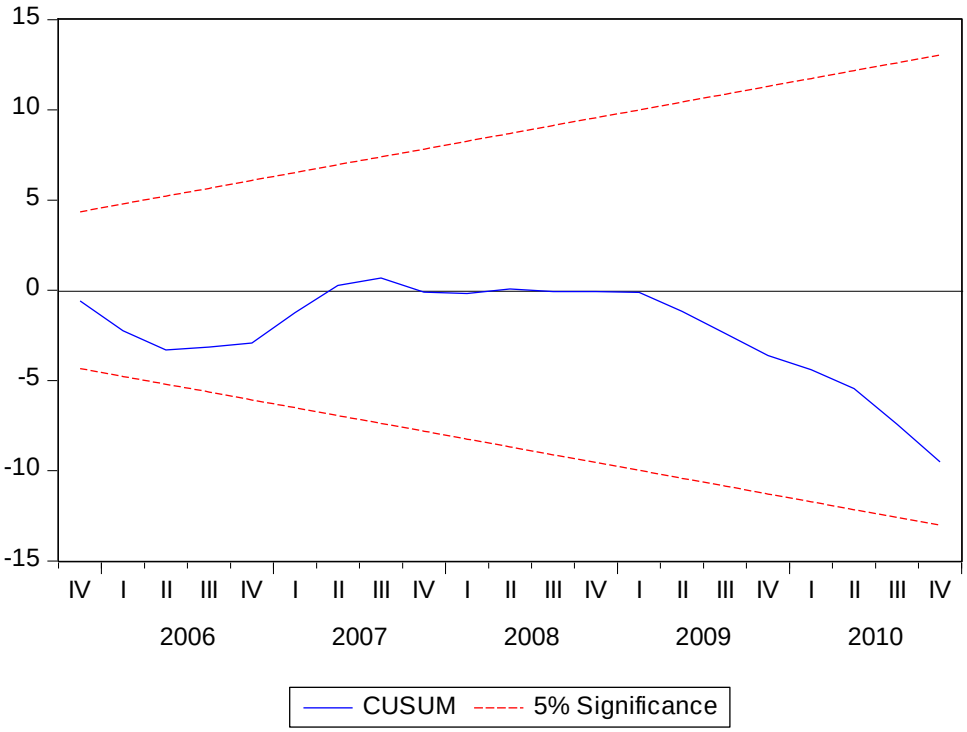
5% Significance

BELGIUM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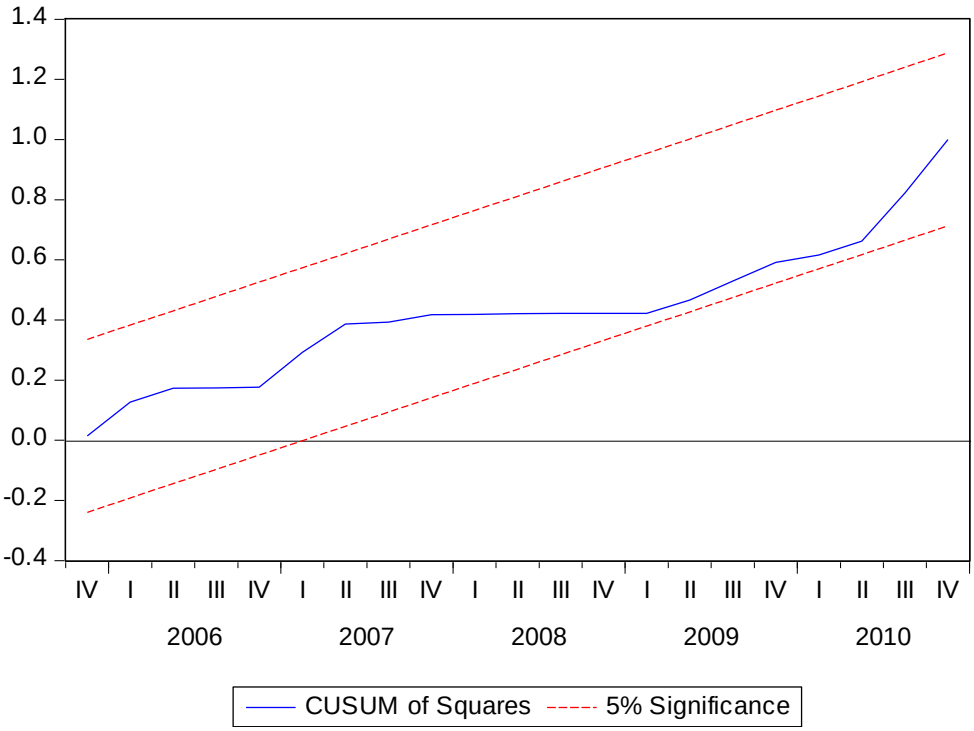
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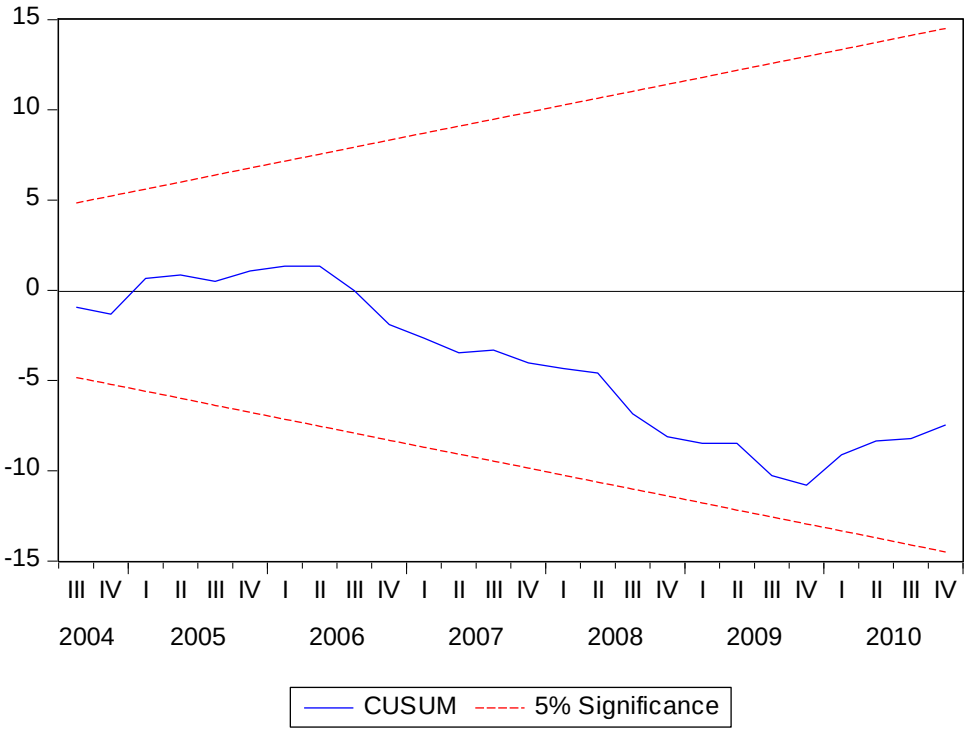
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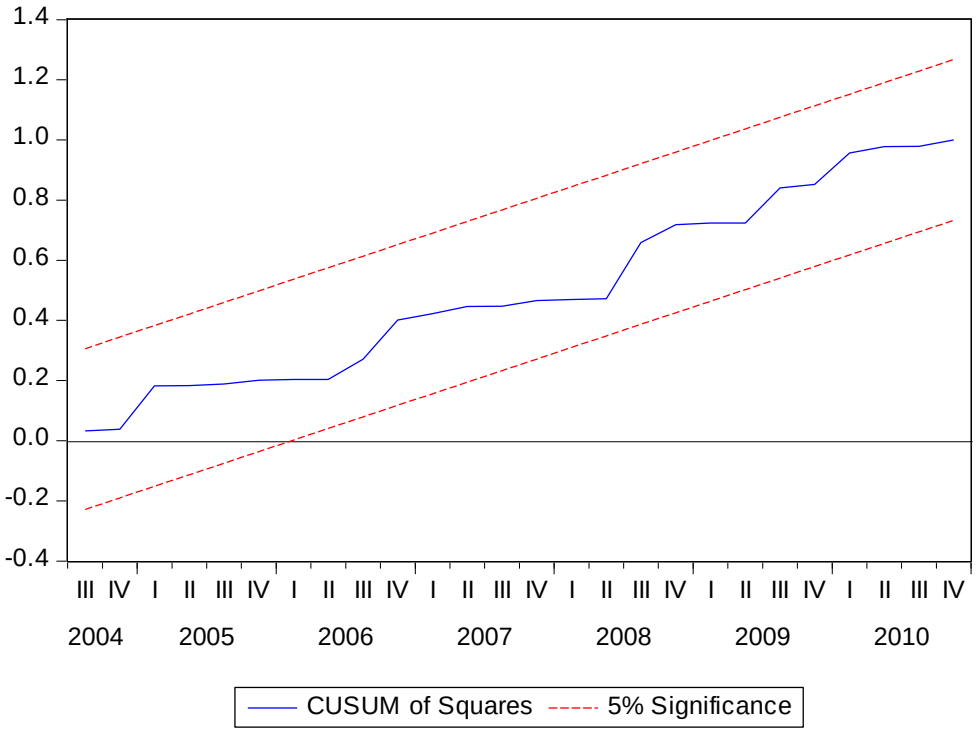
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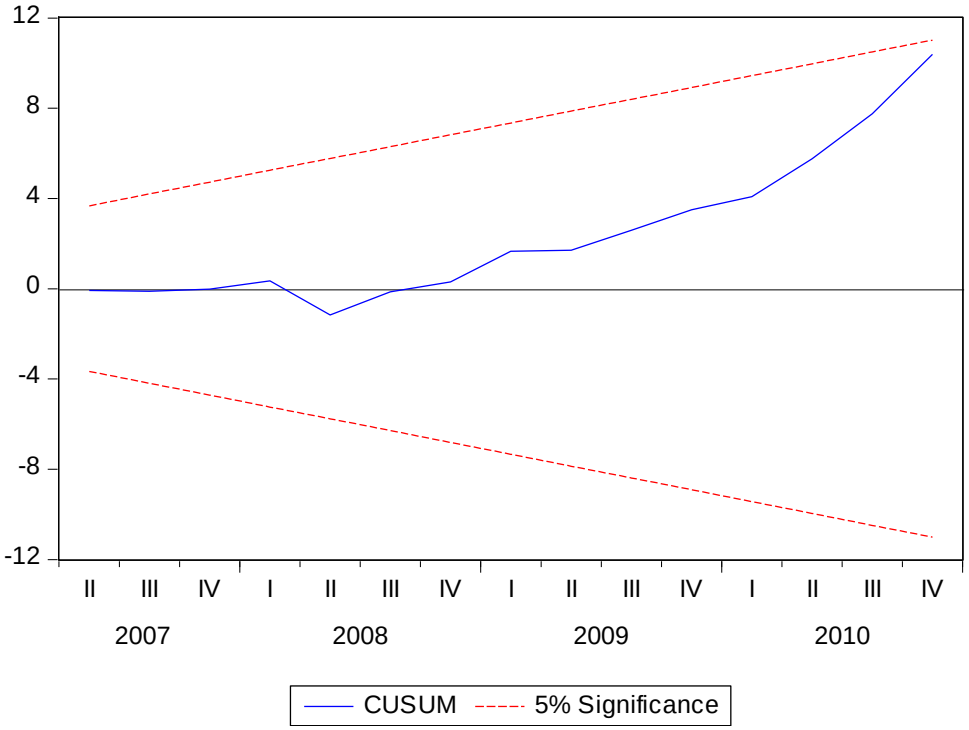
FINLAND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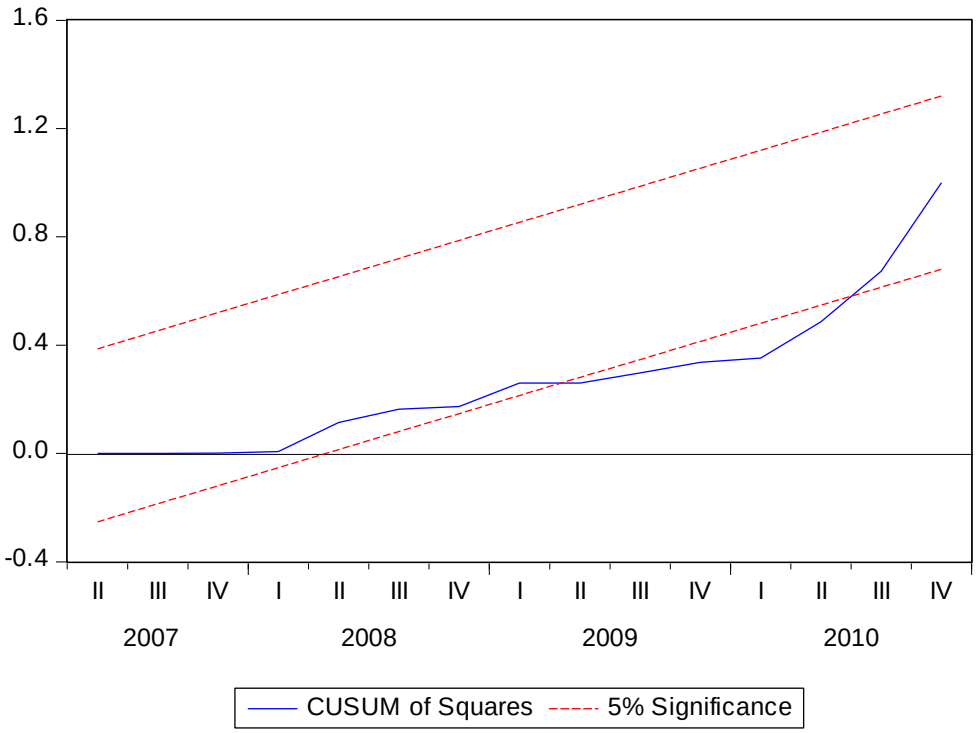
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CUSUM of Squares
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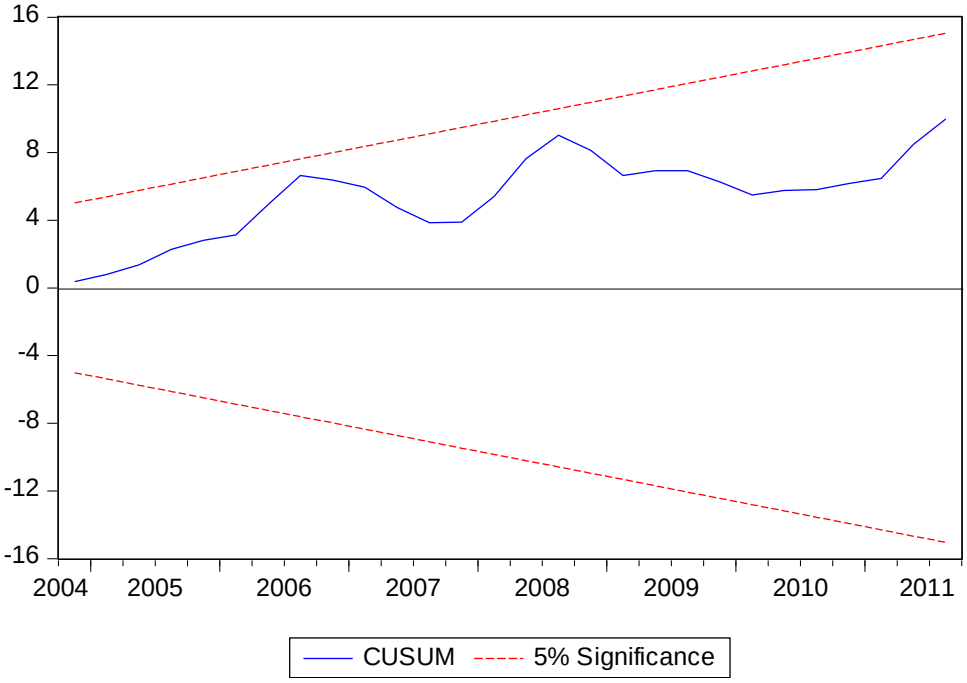
FRANCE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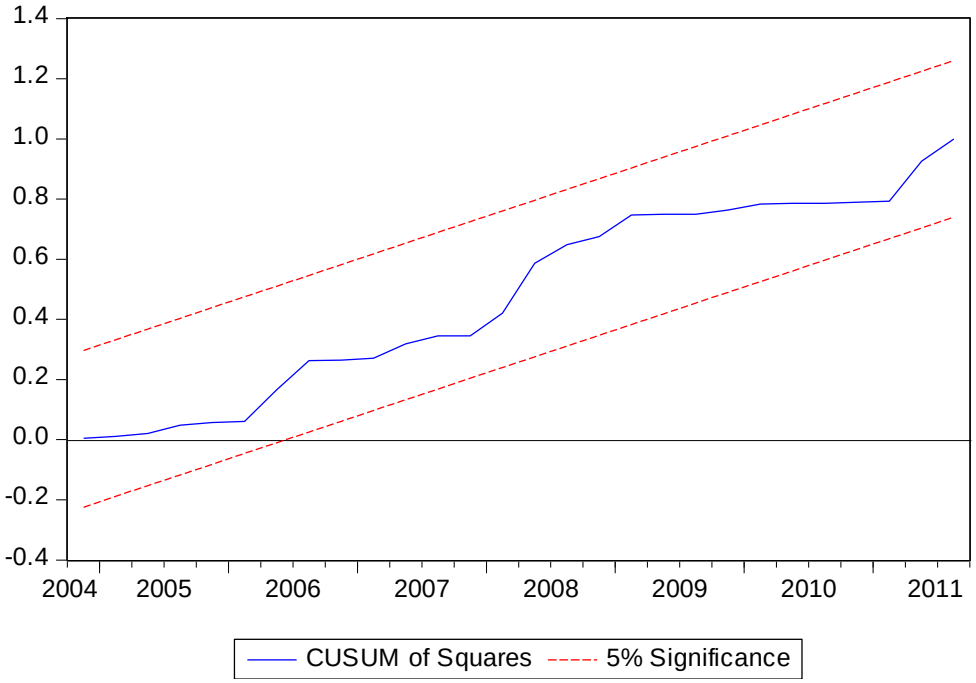
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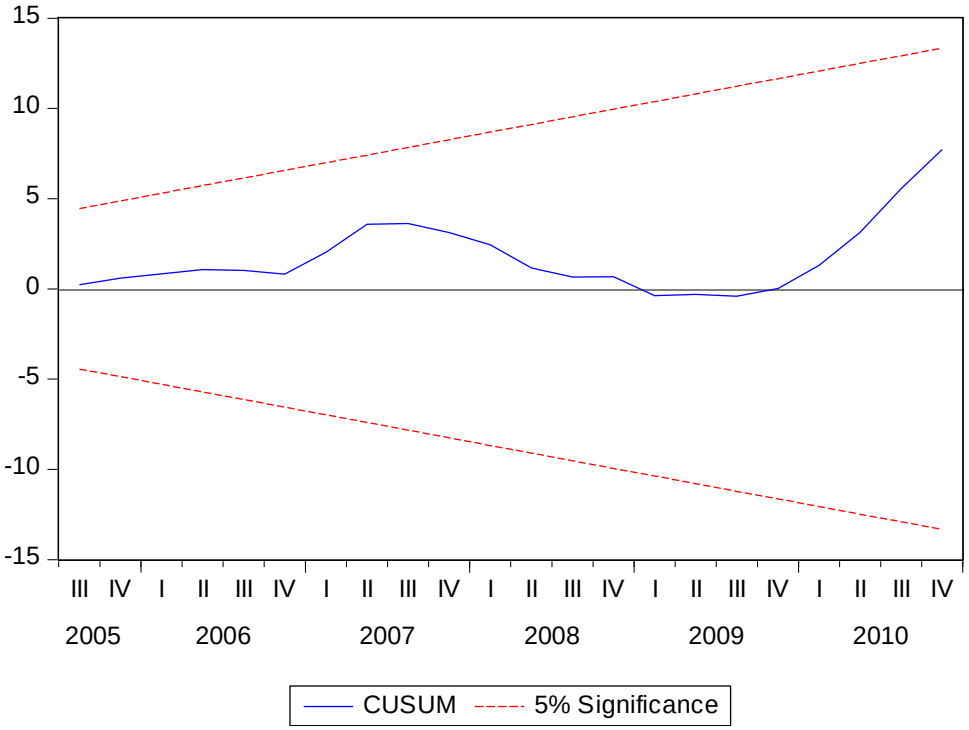
GERMANY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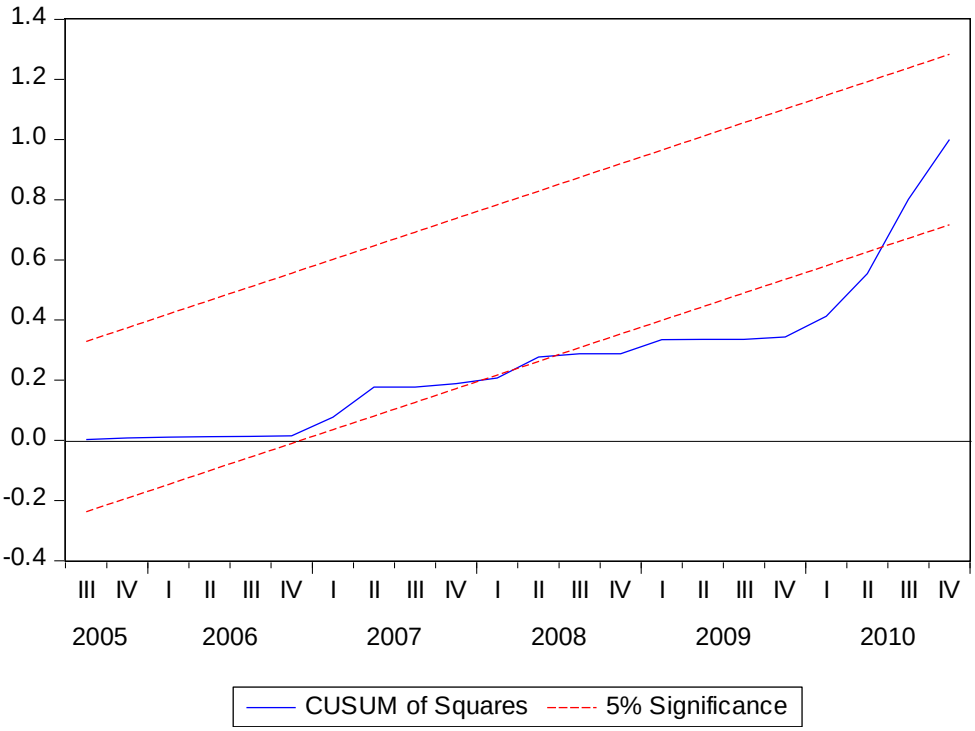
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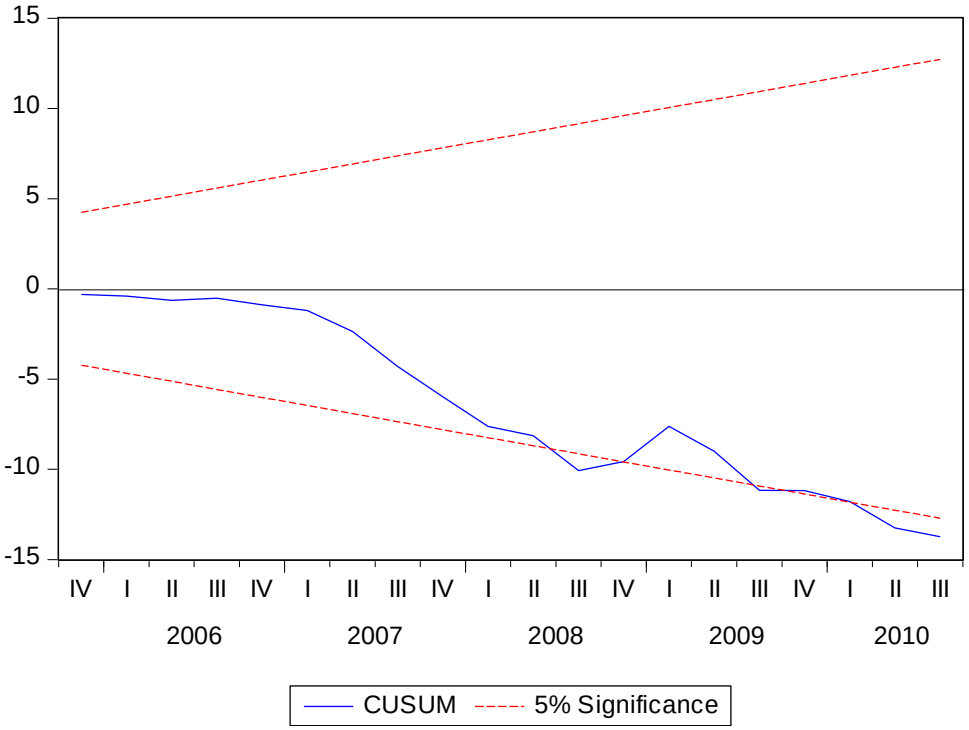
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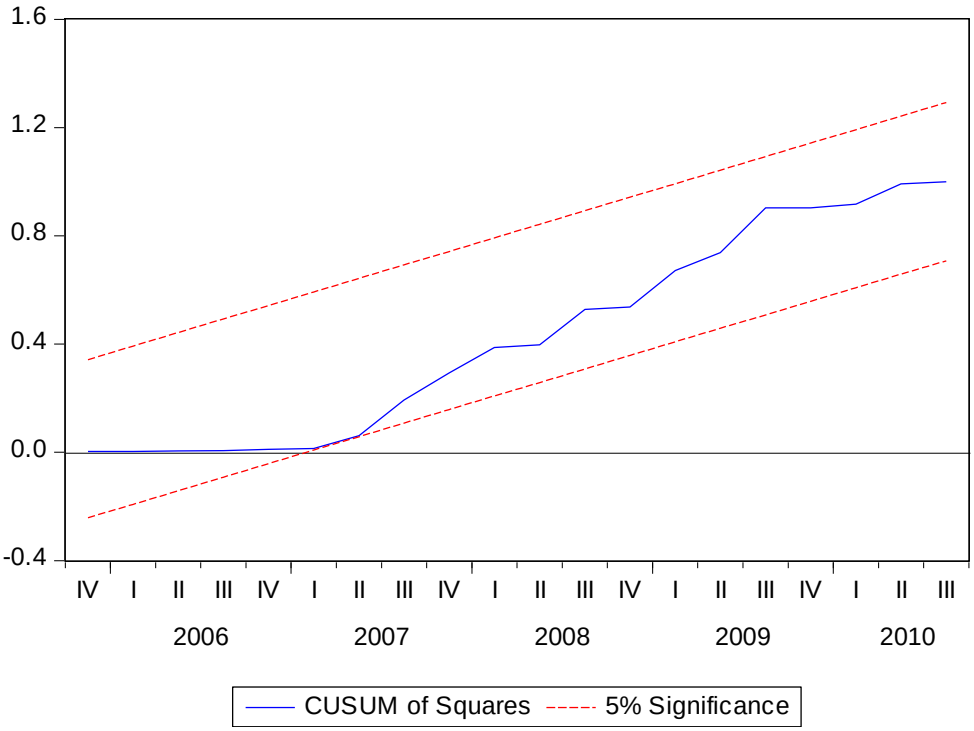
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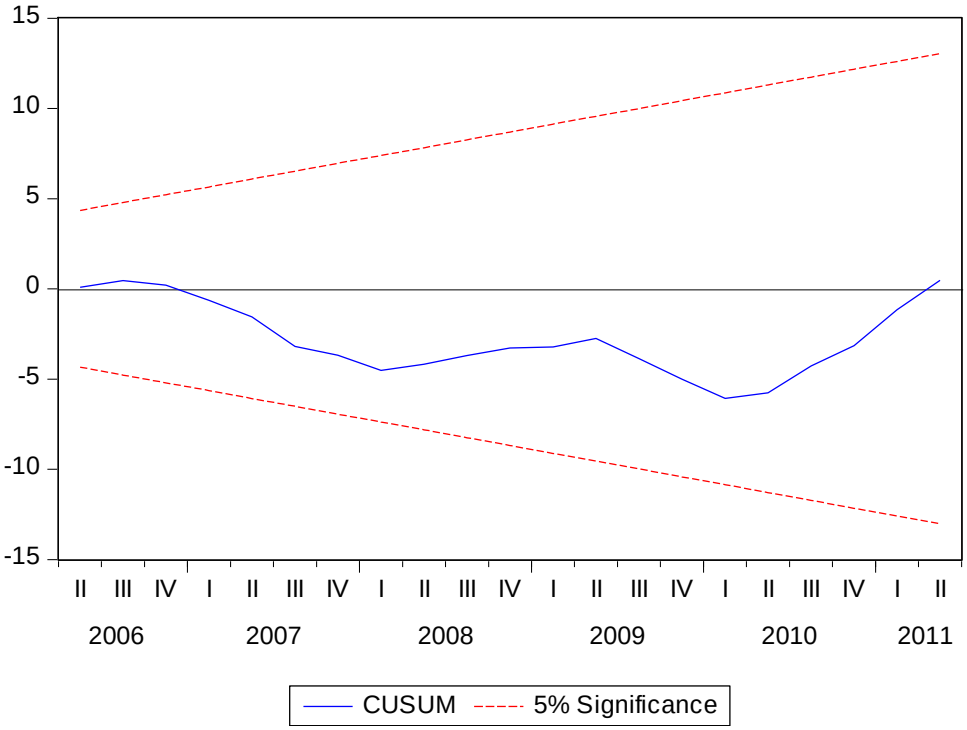
IRELAND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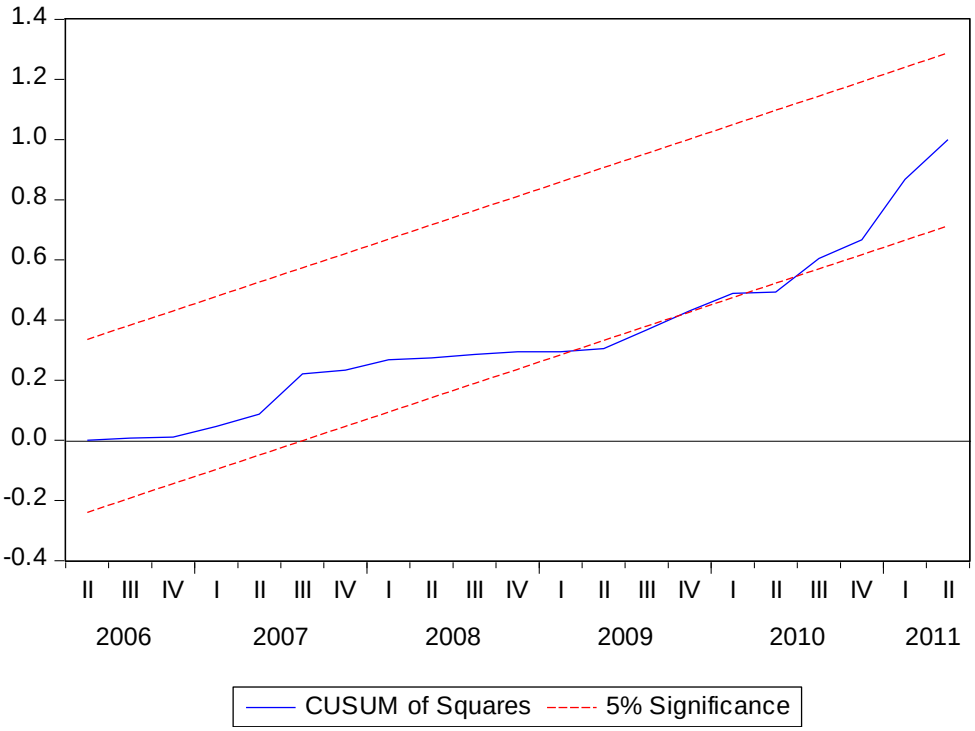
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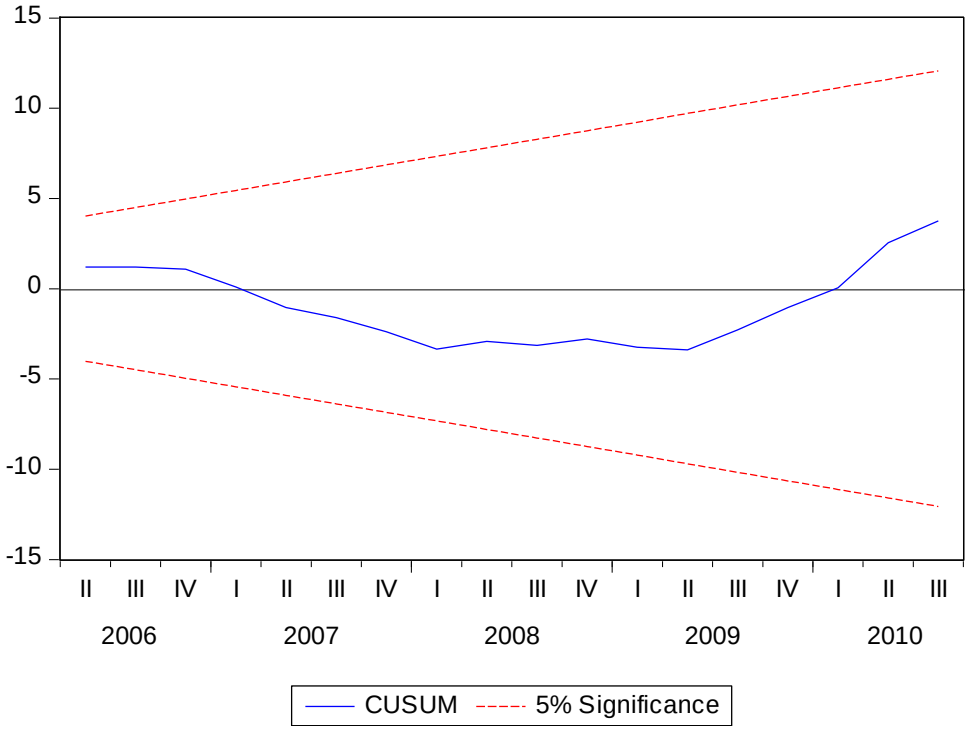
ITALY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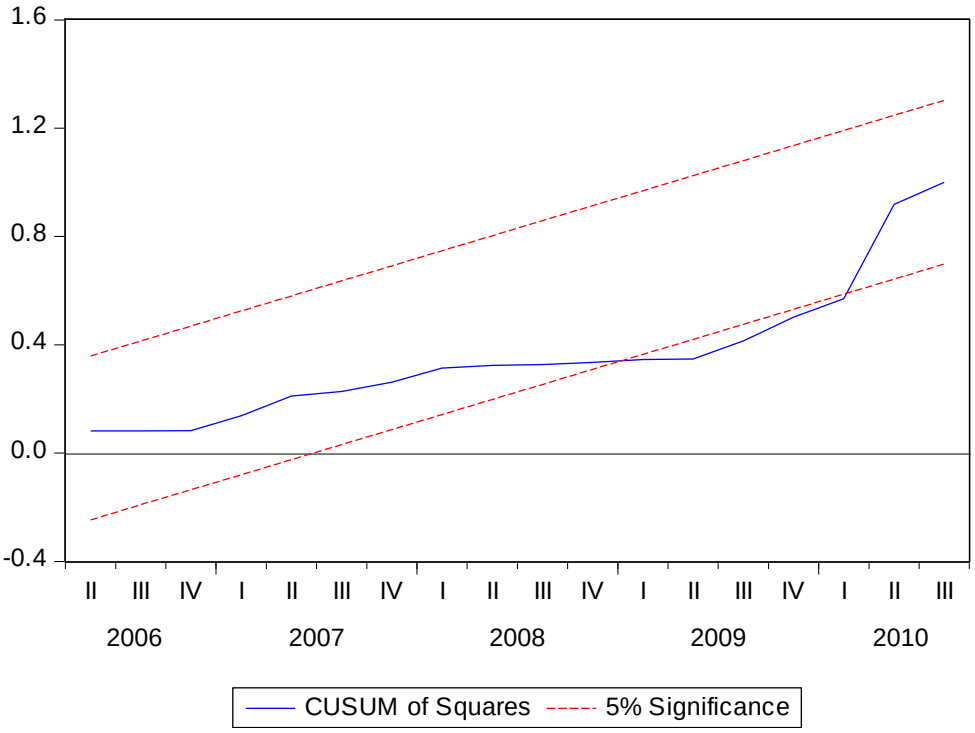
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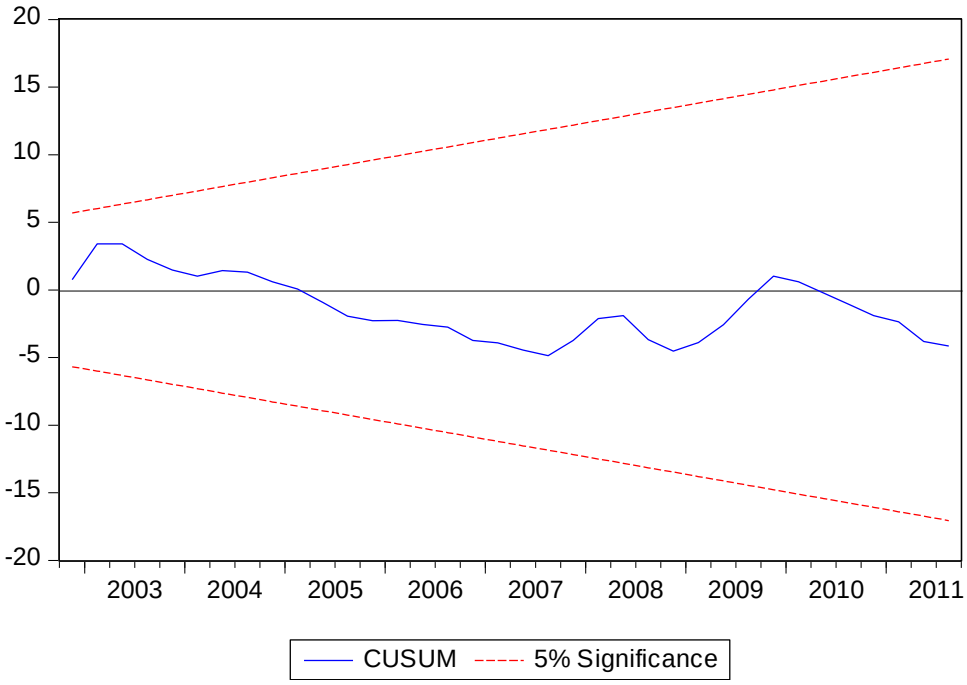
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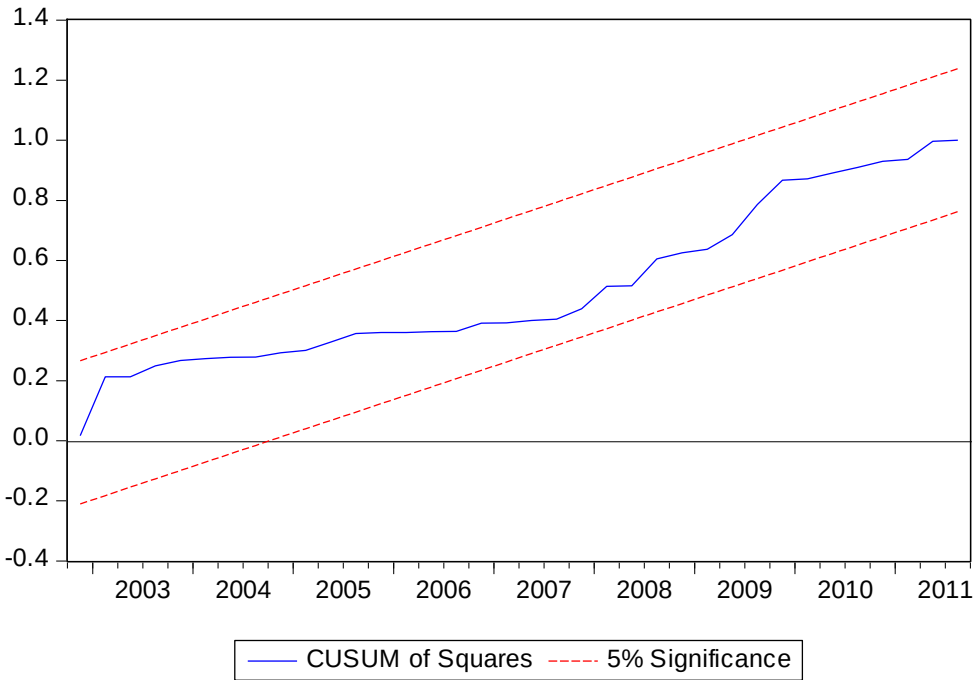
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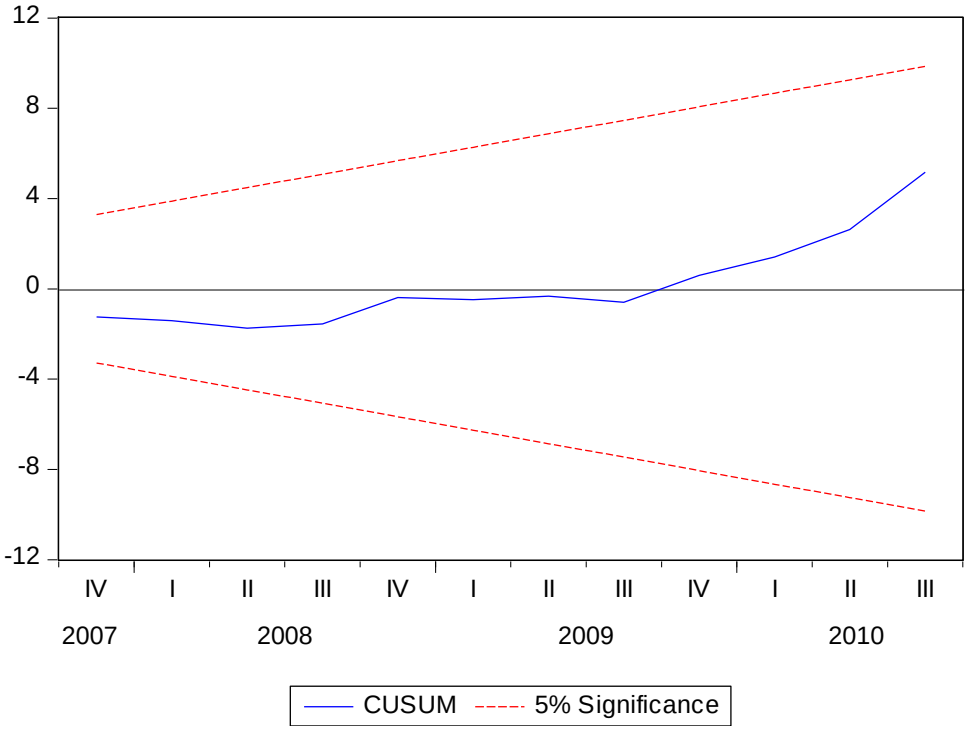
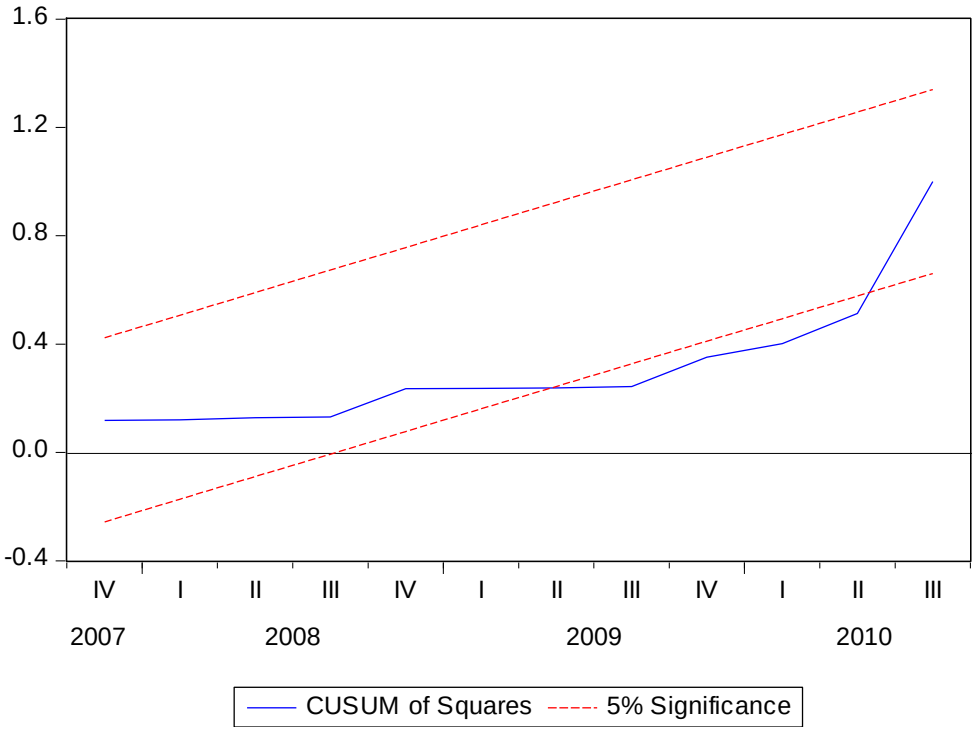
NETHERLANDS





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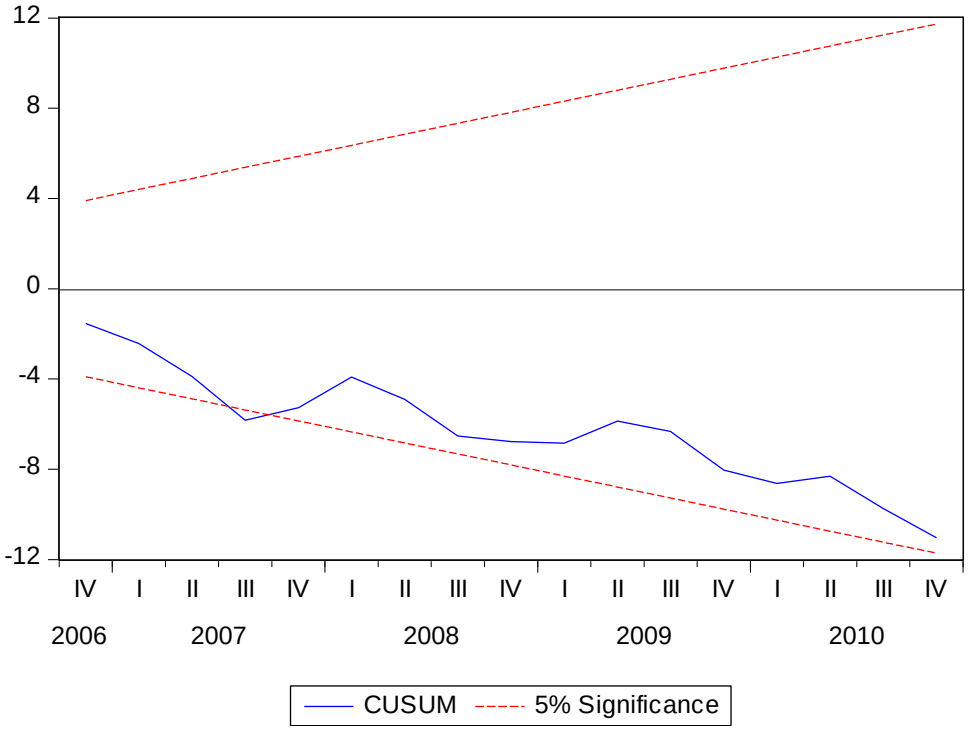
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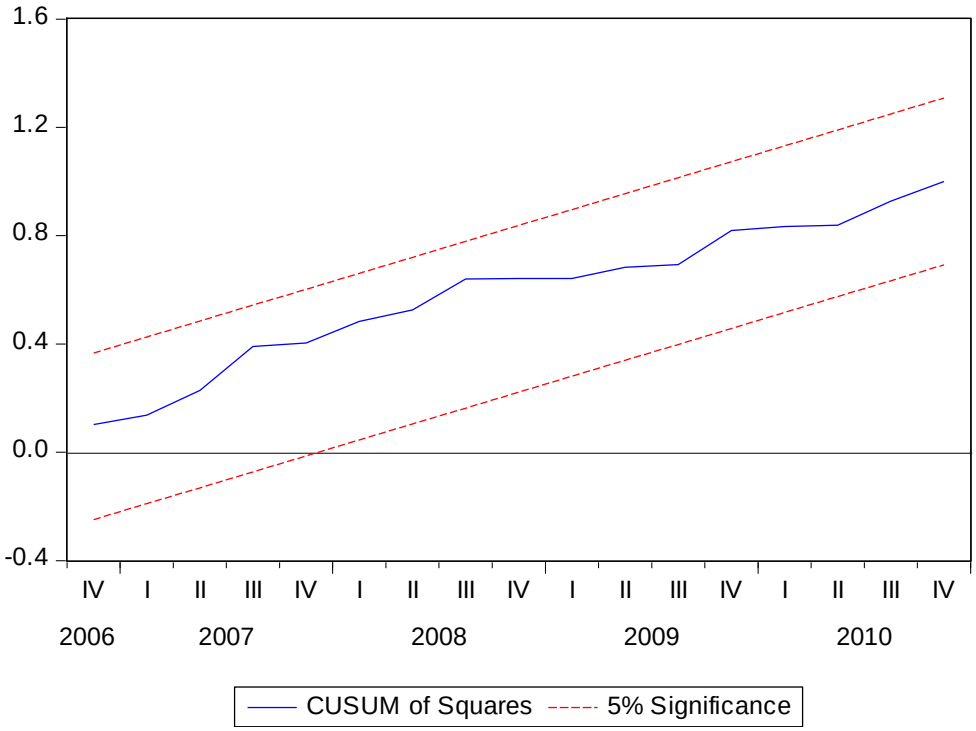
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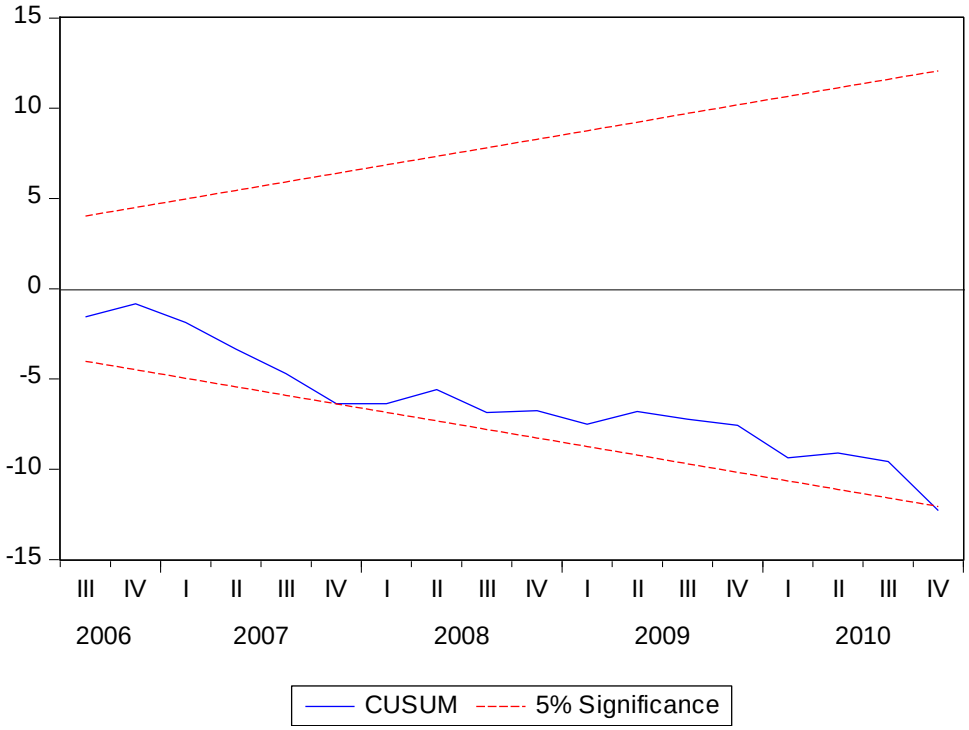
SPAIN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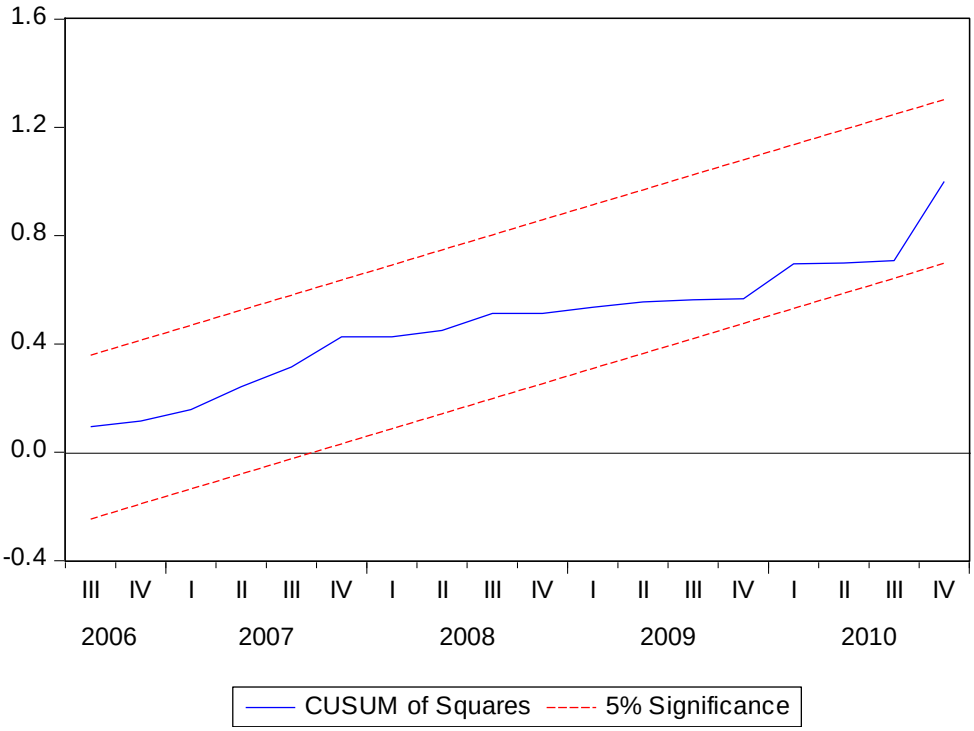
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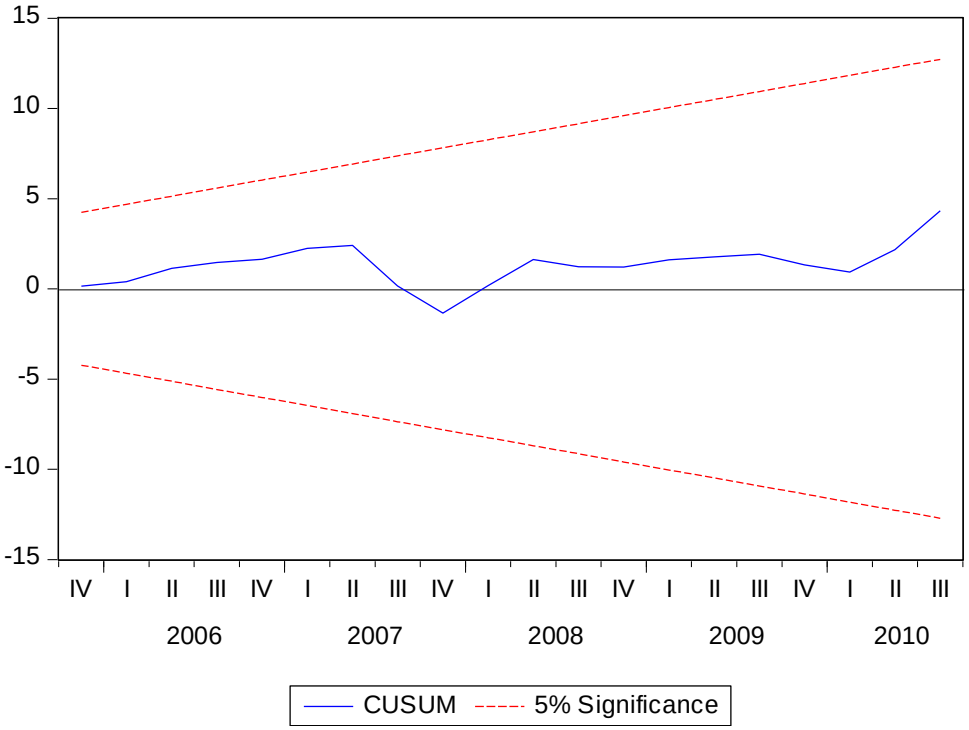
SWEDEN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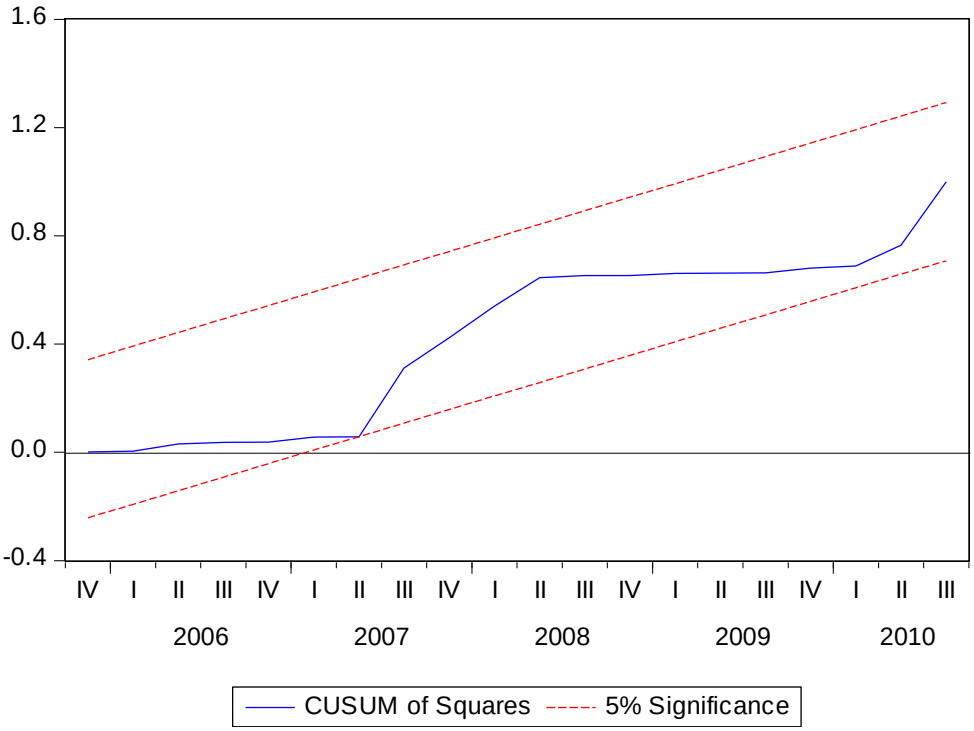
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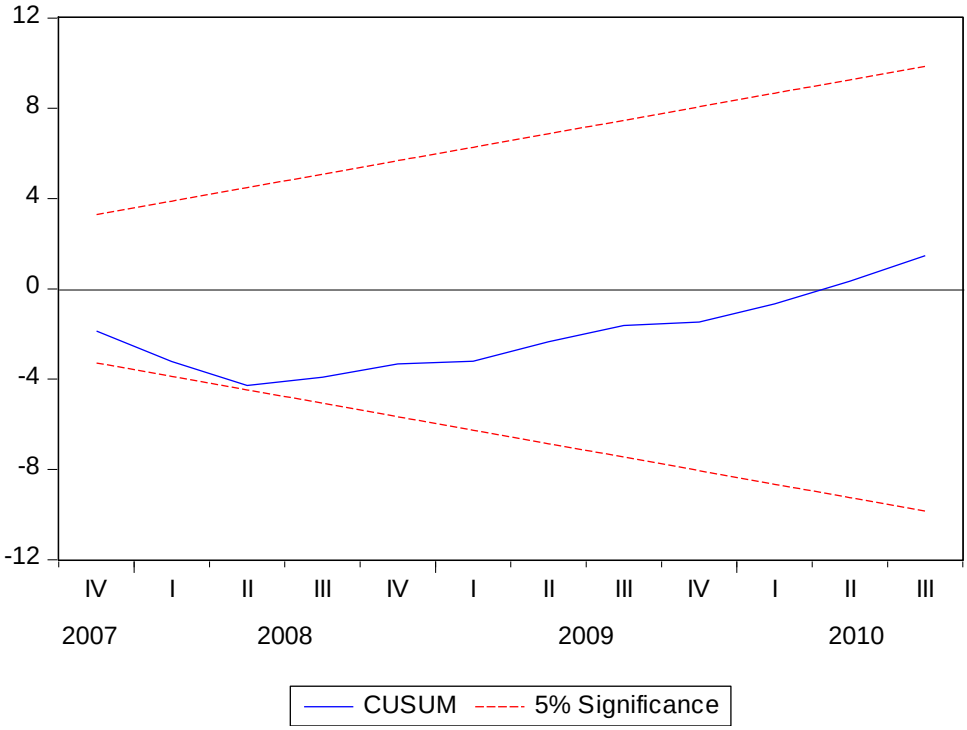
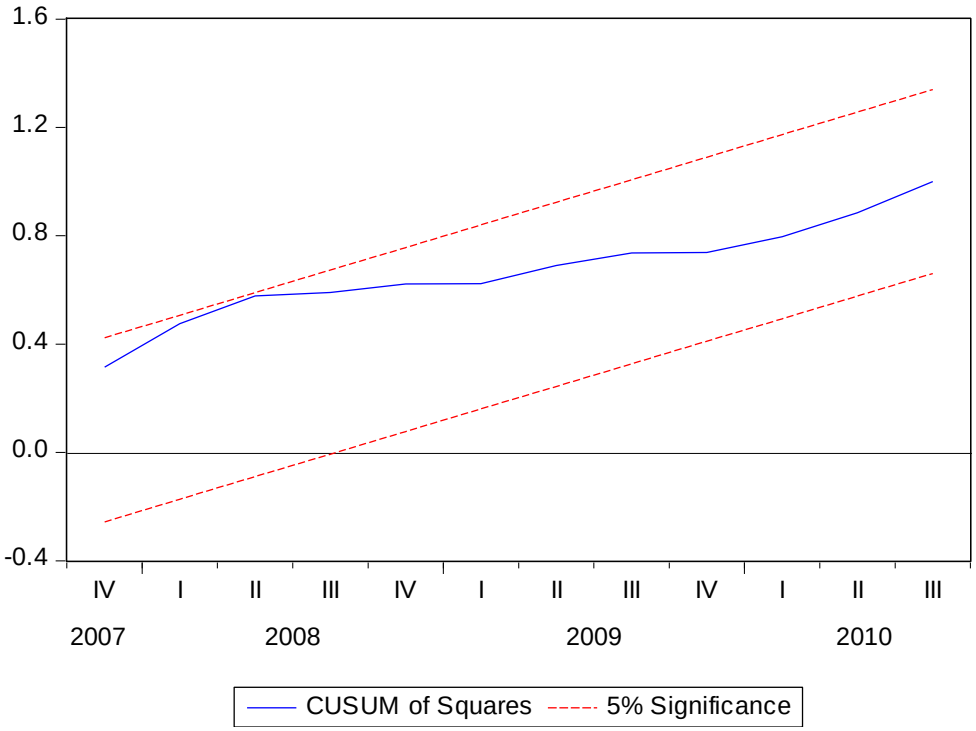
UNITED KINGDOM





C: CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: BABA, Abubakar Kabir
Nationality: Nigerian
Date and Place of Birth: 12 October 1985, Kano
Marital Status: Married
Phone: +90 538 030 13 74, +234 806 553 17 34, +234 812 078 77 10.
email: abubakarbaba123@gmail.com

EDUCATION

Degree	Institution	Year of Graduation
MS	Çankaya Univ. Financial Economics	2014
MS	Bayero Univ. Kano Masters in Treasury Management	2011
BS	Bayero Univ. Kano Accounting	2009
High School	Aminu Kano Commercial Collage, Kano	2002

WORK EXPERIENCE

Year	Place	Enrollment
2010- Present	Kano State Ministry of Finance	Civil Servant

FOREIGN LANGUAGE(S)

Advanced English

HOBBIES

Football, Reading Books, Internet Surfing.