An Empirical Investigation of capital inflow And Dutch Disease: Evidence from Ethiopia

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This is to certify that the thesis prepared by Mohammed Yimam, entitled as*: An Empirical Investigation of capital inflow And Dutch Disease: Evidence from Ethiopia*, and submitted in partial fulfilment of the requirements for the degree of Master of Science in Economics (International economics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABSTRACT

This study investigates the Dutch disease impact of capital inflow using a quarterly time series data from 2000/01 1st quarter to 2016/17 fourth quarter. The study employed three separate regressions to examine the impact of capital inflow on spending, resource movement and established the impact of real effective exchange rate shock on net export. Regression analysis was carried out using auto regressive distributed lag (ARDL) approach to examine the impact of Capital inflow on real effective exchange rate and traded to non-traded sector ratio and then applied Bayesian Vector Auto-regressive to find the impact of real effective exchange rate changes on net exports of Ethiopia. The findings reveal that, foreign direct investment and foreign aid inflow does not have Dutch disease impact through spending effect both in the short run and the long run model. In resource movement effect, foreign direct investment inflow does not have any impact on resource reallocation from the tradable agricultural and manufacturing sector to non-tradable service sector. But in the long run, foreign aid exerts a pressure on the movement of labor from the tradable to non-tradable sector ratio. The changes in real effective exchange rate have negative impact on net export in Ethiopia. While, real effective exchange rate respond positively to a unit shock in foreign direct investment and remittance inflow. Again, its response is also insignificant following a unit shock in foreign aid. Hence, there is lack of empirical support of Dutch disease in Ethiopia, suggests that Ethiopia has been able to effectively manage a surge capital inflows.

***Key words**: Capital inflow, Remittance, Foreign direct investment, Foreign aid, real effective Exchange Rate, Traded to non- traded sector ratio, Dutch Disease, ARDL, Bayesian VAR*

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Finally, I would like to say that the errors and idiosyncrasies of this study remain my own responsibility.

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List of Acronyms

ADB	African development bank
ADF	Augmented dickey fuller
AIC	Akaike information criterion
AR	Autoregressive
ARCH	Autoregressive conditional Hetroskedasticity
ARDL	Autoregressive distributed lag
BVAR	Bayesian vector autoregressive
CLMV	Cambodia, Lao PDR, Myanmar and Vietnam
CPI	Consumer price index
CUMSUM	Cumulative sum
CUMSUMSQ	Cumulative sum square
DF	Dickey Fuller
DW	Durbin Watson
EEA	Ethiopian economic association
FDI	Foreign direct investment
FPE	Final Prediction Error
GDP	Gross domestic product
GOVC	Government consumption on non-tradables
HQIC	Hannan-Quinn information criterion
IFS	International financial statistics
IMF	International monetary fund
IOM	International organization for migration
LIC'S	Low income countries
LR	Likelihood ratio test
MENA	Middle East and North Africa
NBE	National bank of Ethiopia
NEER	Nominal effective exchange rate
NPC	National planning commission

OECD	Organization for economic co-operation
OLS	Ordinary least square
PPF	Production possibility frontier
PPP	Purchasing power parity
RER	Real exchange rate
REER	Real effective exchange rate
SBIC	Schwarz's Bayesian information criterion
SOE	Small open economy
SSA	Sub-Saharan Africa
TNT	Traded to non-traded sector ratio
TOT	Terms of trade
UNHCR	United nation high commissioner for refugees
UNDP	United nation development program
VAR	Vector autoregressive
VECM	Vector error correction model
WB	World Bank
WDI	World development indicator

CHAPTER ONE

Introduction

1.1 Background of the study

Developing economies in general, and African countries in particular, experienced a slow economic growth in 2017. Among the major factors for this sluggish level of economic growth is insufficient capital stock. Perhaps capital is believed to be the major scarce factor in developing countries. Thus, capital inflow from developed countries is crucial to fill the resource gap and to achieve sustained economic growth in capital recipient countries (Tassew, 2011).

International transfer of remittances, foreign aid and foreign direct investment have been playing an important role in the socio-economic development of many developing countries across the world. Although capital inflows have enormous positive impact on various socio-economic development of capital recipient countries, it is not without problems. Dutch Disease is one such problem.

The Dutch disease can occur when any expansion or economic development results in a large inflow of foreign currency that leads to the appreciation of the real exchange rate and the consequent loss of export competitiveness (Alemayhu, 2002). Such surge in foreign exchange inflow often takes the form of higher export receipts (e.g. following an increase in natural resource prices, foreign direct investment, worker's remittances or foreign aid inflows) and all this potentially can have Dutch disease effect.

The idea of Dutch Disease economics is widely known in the literature. Corden and Neary (1982) first formally model the Dutch Disease (Rabbi,2013).Corden and Neary (1982) explain this phenomena in their model the booming sector consists of natural resources (mining sector), while non-booming sector consists of agriculture and manufacturing sectors and due to the extraction of mineral, the booming sector has an adverse effect on non-tradable booming sector.

Although the undesirable symptom of Dutch Disease hypothesis are mainly connected with natural resource discovery, a large surge of capital inflow such as official development assistance,

foreign aid , foreign direct investment, grant and remittance can also leads to this economic disease (Alemayhu,2002). It can occur when any expansion or economic development results in a large inflow of foreign currency through the appreciation of the real exchange rate and the consequent loss of export competitiveness (Rajan and Subramanian (2005). And also some researchers argue that on the similarities between discoveries of natural resource and capital inflow to the home country. Van Wijnbergen (1989) argue for similarities between the discovery of natural resources and a big capital inflows. They argue, this is because both increase foreign exchange availability and the impact of both is almost temporary. Nevertheless, at least partly, be spent on non-traded goods sector, thus leadings to real exchange rate overvaluation (Alemayhu, 2002).

The Dutch disease phenomenon is important from the economic perspective of a developing country like Ethiopia because such countries highly depend on external finance to fill their widening and persistence resource gaps. For example, Capital inflow necessary for macroeconomic stability as they affect a wide range of macro-economic variables such as exchange rates, interest rates, foreign exchange reserves, domestic monetary conditions as saving and investments. Capital inflows are used to increase accumulation and rate of investment to create conditions for accelerated economic growth (Edward 2004). It also contributes in filling the resource gap in countries where domestic saving are inadequate to finance the required investment (African Banker, 2013). Currently capital inflow in developing countries become a source of finance and brings an economic growth and development through reducing household poverty and increasing their consumption and further in building investment in both human and mental capital which results in less vulnerability from natural and economic shock (African Banker, 2013).The flow of foreign assistance, aimed at boosting the economy of the capital recipient country, if not managed optimally could actually boomerang and assert negative impacts making the economy worse-off. (Sy and Tabarraei, 2010). Over the years, the volume of capital inflow[1] in the country can be very substantial and eventually showed a positive trend such that, foreign direct investment increased from USD 207.6 million in 2000/2001 to USD 4,170.80 million by the year 2016/17, total foreign aid was USD 399.5 million in 2000/01 and increased to USD 1,428 million by 2016/17 similarly, Worker's remittances have grown over the years 460.3 million US dollars in 2000/01 which by

[1] In this study, capital inflows are defined as foreign aid, foreign direct investment and worker's remittance

the end of 2016/17 surged to USD 5,485.3 million (NBE,2017). The government of Ethiopia, in the recent past, offered various incentives to promote exports in line with its export led industrialization strategy. Export value increased from USD 315,373.70 thousand in 1980/81 to USD 464,736.29 thousand in 2000/01 and then to USD 2,904,203.49 million in 2016/17(NBE, 2017). With the immense importance of the foreign exchange earnings in the form remittance, foreign aid and foreign direct investment in Ethiopia, the question is whether those external transfers inflict cost in the form of loss of trade competitiveness in Ethiopian economy.

1.2 Statement of the problem

The question of whether or not a large inflow of foreign capital leads to economic growth in receipt developing countries is an ongoing debate. Both the theoretical and empirical literature on how capital inflow impact the economic growth of recipient countries is, however, inconclusive (Amin and Murshed, 2018).

Many empirical studies suggest that the positive impact of capital inflow in the capital receipt country such as poverty alleviation, household welfare, financial development ,create wealth for an economy and circumstances allowing, economic development more broadly(Stevens, 2003). And additionally Edsel (2010) found that there is no symptom of Dutch disease in the capital receipt country. However, the magnitude of these flows relative to the size of the receiving economies may also pose an important number of challenges. There are few studies on the negative aspects of large capital inflow in the host country such as real exchange rate appreciation and thereby loss of external competitiveness, premature deindustrialization, contraction of manufacturing sector, inequality etc. (the International Monetary Fund's World Economic Outlook 2005).Van Wijnbergen (1986),Alemayhu (2002*)* described that a rise in the inflow of foreign currency can stimulate a rise in the price of non-tradable goods relative to that of tradable goods of the receipt country, leading to an appreciation of the real Exchange Rate and a phenomena is the so called "Dutch disease."

Furthermore, many papers emphasis on the impacts of capital inflow on the real exchange rate varies across the types of capital inflow mainly in the form of remittance, aid and FDI. And their conclusion at the disaggregate level is also different. i.e. In case of remittance (Acosta, et al. (2008) ,Fazle Rabbi(2011), Makhlouf and Mighal (2011), and Lartey *et al.*, (2012)) found that the

big flow of remittance in the host country is appreciating the real exchange rate and decreasing the external trade competitiveness in the study area. While other studies (Izquierdo and Montiel, 2006), Bourdet and Falck (2007), Edsel (2010), Kemegue*et al*, (2011) and Efobi 2016)) find contradictory result and conclude remittance did not create the Dutch disease effect in the recipient economy. Regarding to aid, Barder (2006), Rajan and Subranian, (2009), and Teferi (2009)), find that a big inflow of aid is associated with the appreciation of real exchange rate in recipient country, following huge inflow of foreign currency whereby causing harm to the long run economic growth prospects of the nation. Whereas Sackey (2001), Isaa and Outtara (2008), Kallon (2012), Arhenful (2013)and Uddin (2015)) found that there was no evidence of Dutch disease problem following aid inflow in receipt country. Rather, it was evident that external flow of aid has had depreciation effects on the country's real exchange rate in the study area. Likewise remittance and aid, the impact of FDI on real effective exchange rate is also inconclusive across studies. Lartey (2008), Sy and Tabarrei (2010) and Sreelata and Byasdep (2012) found that the increasing capital inflows in terms of inward foreign direct investment appreciate the equilibrium real exchange rate in their study area and on the contrary, Athukorala and Rajapatirana, (2003) found that there is no significant evidence that inflow of foreign direct investment leads to real exchange rate overvaluation in the host country.

Despite the immense importance of capital inflow for Ethiopian economy, there are very few quantitative studies of the possible effect of foreign assistance. Therefore, the objective of the paper is to examine the effects of capital inflow on real effective exchange rate and reallocation of resource between the tradable and non-tradable sector to assess whether the Ethiopian economy has been adversely infected by the Dutch disease.

The motivation for this study comes from the existence of ongoing debate with regard to the impact of external capital inflows on the real exchange rate of capital-receipt country. In Ethiopia, there are only two studies Tefri (2007) examined the impact of foreign aid on real exchange rate, hence undermining worker's remittance and foreign direct investment and Martins (2007) study the effect of remittance and foreign aid on real exchange rate not incorporating the foreign direct investment inflow. Even though a lot have been done on other developing countries.

This study improves the works of the earlier studies by trying to fill the following gap to address capital inflow and the Dutch disease problem exclusively in context of Ethiopia. Firstly, in order to fill the gap of the previous research concerning with the Dutch disease hypothesis, the researcher has been looked on the impact of three international capital flow; foreign aid, workers remittance and foreign direct investment on economic growth via the real effective exchange rate. The previous research only focus on only on the relationship between remittance and aid on real exchange rate, nevertheless this study will fill this research gap by incorporating foreign direct investment as a main interest variable. Secondly, no research has looked on the impact real effective exchange rate on export competitiveness (net export) in Ethiopian. Thirdly, the previous research has looked the impact of capital inflow on real exchange rate, however, this study emphasis on the impact of these inflow on real effective exchange rate because real exchange rate taken into account bilateral exchange rate only, but in reality, country's may have more than one trading partner. To counter this, the study employ real effective exchange rate, incorporates multiple exchange rate.Finally the previous studies put little or no emphasis on the resource movement effect. Focus is primarily given to spending effect only. This study will investigate both of these effects. I.e. investigate on the impact of the upsurge capital inflow on the real effective exchange rate appreciation and change in the composition of traded agriculture-al/manufacturing sector and non-traded service sectors. Therefore, this study will contributes to the debate by precisely defining the symptoms of Dutch Disease and testing whether the Ethiopian economy had each of the symptoms.

1.3 Research questions

This study has the following research questions:

1. Do inflow of capital lead to appreciation of the real effective exchange rate in Ethiopia (spending effect)?

2. Do inflow of capital decrease the ratio of traded to non-traded sector goods and services?

3. What is the impact of real effective exchange rate appreciation on net exports in Ethiopia?

1.4 Objective of the study

The main objective of this research is to find whether recent economic developments in Ethiopia are symptomatic of Dutch Disease. This hypothesis can be examined through three approaches:

- Appreciation of Real effective exchange rate,
- Decline in manufacturing output and employment, and
- Growth in the non-tradable sector (faster service sector growth),

This broad objective will be explored through the following sub-objectives:

- To examine the short run and long run relationship between capital inflow and real effective exchange rate in Ethiopia
- To examine the short run and long run relationship between capital inflow and traded to non-traded sector ratio in Ethiopia
- To establish the impacts of real effective exchange rate changes on net exports in Ethiopia.

1.5 Scope of the study

This paper primarily examines whether the inflow of the three international capital inflow remittance, aid and foreign direct investment brings Dutch disease effect or not in the Ethiopian economy and also to examine the impact of real effective exchange rate on net export in Ethiopia. To address the objectives, the study will examine both theoretical and empirical analyses.

1.6 Limitation of the study

The study has mainly the following limitations related to period of the study and data. First, the period of study is limited from 2000/01Q1 to 2016/17Q4 for of the availability of data. Second, data on national income accounts of Ethiopia are officially only available at annual frequency (low frequency data). Higher frequency data are required for the dynamic response of net export for its macroeconomic determinants. Because of the availability of only annual observations for some variables such as Real GDP, the researcher largely used by interpolating the annual data using Eviews10 to generate quarterly data (higher frequency). The study also uses relatively shorter observations of data due to the absence of well documented quarterly data on some variables.

1.7 Significance of the study

Capital inflows in the form of aid, FDI and remittance plays a great role in the economic activities of the receipt country. Nevertheless, the link between foreign inflow and economic growth via real exchange rate is one of the most debatable issues in modern academic scenario. Some argue in favor of it while others are against it. The inconclusive theoretical foundation along with the diverse empirical findings so far has put policy makers in a dilemma in explaining which way the relationship is working besides their benefits their possible potential negative consequences particularly their impact on the exchange rate, competitiveness, creating a Dutch disease and how the real effective exchange rate affect net export of the country will be examined. Hence, this study provided empirical evidence on the relationship between foreign capital inflows and real effective exchange rate in one side and the impact of foreign capital on the composition of the ratio of tradable to non-tradable sector in other side and as well to provide a hint which type of capital inflow create a Dutch disease symptom and how net export respond to the real effective exchange rate. Thus, the researcher believes that this study will contribute in clarifying the impact of capital inflow on real effective exchange rate in the case of Ethiopia and the existing literature on the area. Besides, the outcome of the study is expected to help policy makers, as an input, in decision making with regard to devising policies about inflow of capital inflow. Moreover, the study will serve as a basis for further research to be conduct on the issue in Ethiopia**.**

1.8 Organization of the study

This study is organized into six chapters. Chapter one introduced the study and its objectives. Chapter two presents the relevant theoretical and empirical literatures. In chapter three, we present the macroeconomic contribution of capital inflow in Ethiopian economy. Chapter four presents methodological approach to address the objectives of the study. In chapter five, empirical estimation, interpretation and discussion of the result are presented. And the final chapter contains conclusions and policy implication, which are drawn from the finding of the study.

CHAPTER TWO

Literature review

2.1 Theoretical literature review

2.1.1 The Dutch Disease

Historically, the theory of "Dutch Disease" originated to refer the unfavorable effects on the manufacturing sector of Netherlands following the discovery of natural gas (Mishkin, 2009). In the late 1950's, the Netherlands discovered a huge natural resource (natural gas) in the Groningen province. As a result of these gas discovery, the country began a rapid exploitation of the natural gas, becoming exporter of the natural resource gas, and the Netherland's economy generate a substantial economic gain, as well as other benefits such as an increased energy independence(Rudd,1996). Following the national wealth and overall general welfare increased. However, amidst the favorable results of the natural gas based export boom, the Netherland's witnessed several negative effects as well (Javid, 2009). First, the country's manufacturing sector declined throughout the year 1960's to 1970's. Second, manufacturing employment declined gradually during the same time. For instance, according to Labor Force Statistics data, in 1964 the Netherlands had 1,823,000 workers in the manufacturing industry but by 1986 the number had fallen to 1,381,000. Hence, a 25% reduction manufacturing industry jobs (cited in Kremers, 1986). Thus, the beneficial development in the natural resources sector is found to have undesirable consequences for the lagging manufacturing sector by making stronger the Dutch currency leads to the decline in manufacturing sectors gradually which became less competitive (Rabbi, 2011)

2.1.2 Models of Dutch disease

2.1.2.1 The core Dutch Disease model

The core model is described in Corden and Neary (1982) to investigate the de-industrialization aspect of Dutch Disease (Javid, 2009). The author assumes a small open economy with three sectors: 1.) the booming export sector (oil or the energy sector, 2.)The lagging export sector (manufacturing sector), and 3. A non-traded goods sector (services sector). The first two sectors, produce tradable goods and they are subject to international competition. Hence, their prices are determined by world demand and supply. Whereas, services are not subject to international competition, and then, their prices depend only on domestic demand and supply.

Corden and Neary (1982) describes the Dutch-disease effect of an export boom may be attributed to spending and resource movement effect.

A. **Spending effect**

Spending effect occurs as a result of the extra revenue brought in by the resource boom, this the extra incomes leads to an increase the expenditures on both tradable and non-tradable goods (CordenNeary and Van Wijnbergen (1984). The prices of tradable goods are fixed, since, it is determined in international markets, so the increase in incomes in this small country has no effect on the price of traded goods (the tradable sector shrinks).However, due to the increase in demand caused by the rise in income and expenditures, the prices of non-traded goods would rise, as it is determined in the domestic market (the non –traded sector intensify).Consequently, this spending effect brings the appreciation of the real exchange rate[2].

B. **Resource movement effect**

Besides, the spending effect, the resource movement effect occurs, if factors income increase in the booming sector, marginal product of labor in that sector tends to rise (Neary, 1984).This improvement in marginal productivity of labor raises profitability and the demand for labor in the booming sector. Therefore, labour will shift from lagging tradable sector to the booming sector. According to Corden and Neary (1982), this resource movement effect happens in two ways. First, the movement of labor from the lagging sector to the booming sector, will push wages up and eventually the fall in employment and output in the lagging tradable sector. This effect on lagging sector is termed as direct de-industrialization. The second aspects of the resource movement effect is related to the movement of labor from Non-tradable sector to the booming sector, the supply of Non-tradable goods tends to decline and these leads to a rise in the price of Non-tradable goods. This change in price brings the real appreciation of exchange rate. The resource again will reallocate from lagging tradable sector to Non-tradable sector, and this effect is called indirect de-industrialization (Corden and Neary, 1982).Through, these two effects the traditional export sector is

[2] The real exchange rate is defined as the ratio of relative price of tradable and Non-tradable.

crowded -out by the other two[3] sectors (Ebrahim,2003). This core model can be developed to realize the potential impact of a surge in capital inflows (Aid), rather than the boom in the energy sector (Nkusu, 2004).

To examine the impact of aid on the real exchange rate, (Corden and Neary, 1982) uses a Salter-Swan framework with two sectors[4]under the assumptions of the core Dutch disease model: i.e. full and efficient employment of production factors, perfectly elastic demand for tradables associated with a small-country assumption, and a mobile production factor transferable between sectors. The figure below presents the core Dutch disease model (figure 1).

As previously, the economy produce two types of commodities: namely, tradables and non-tradables. Hence, a large aid inflows, entail an increase in aggregate expenditure that goes to tradable as well as non-tradable goods, thereby influencing the Real exchange rate. For a better understanding of the Core Dutch disease model.

The upper-right quadrant represents the non-tradable market, while the upper-left quadrant of denotes the tradable market besides, the lower-right quadrant represents the production possibility frontier (PPF) and the left panel provides the setting for the core Dutch disease model. The economy produces and consumes at "B" on the production possibility frontier (PPF)[5] and on the indifference curve. In the tradable sector, a perfectly elastic demand curve (DT), in line with a small country assumption, where price is exogenous. At point (C) production and consumption of the tradable sector are equal, therefore, the initial trade balance is zero. In the market for non-tradables, the initial equilibrium is at (M).Hence, due to a large inflow of aid, the demand for non- tradable will shift upward from DNT to DNT' leading to an increase its price from PNT to PNT'.

[3] The non- tradable and the booming energy sector

[4] Tradable and non- tradable sector

[5] When a country produce on the PPF, There is full and efficient employment of production factors i.e. no idle resource during the production process, hence there is efficient attainable production

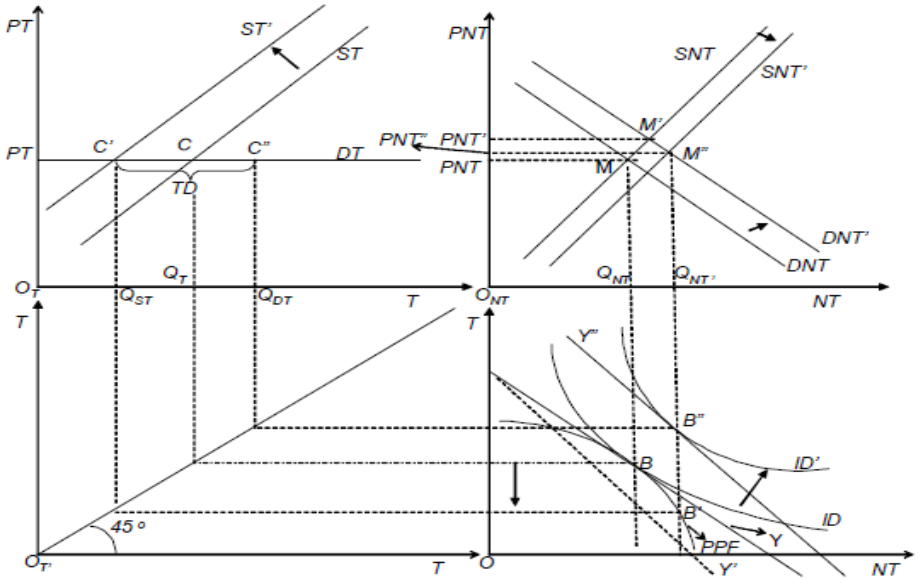

FIGURE 2. 1 THE CORE DUTCH DISEASE MODEL

SOURCE: NKUSU (2004:9)

Thus, in figure2.1, the market for non -tradable shift from initial equilibrium (M) to the upper right quadrant(M') where as the price of tradable remains fixed leads to the RER appreciate. The appreciation of the RER discourages the production of tradables. This is usually referred to as the spending effect. Moreover (Nkusu, 2004) also placed two other effects related to the appreciation of real exchange rate: the resource transfer effect and the expenditure-switching effect. The resource transfer effect refers to, due to the relocation of labor from the tradable to the non-tradable sector, the supply of non-tradable will increase (SNT to SNT') .This will occur at the expense of the tradable sector, which diminishes from ST to ST'.

The upward shift in income (Y to Y''), together with the increase in the relative price of non-tradables brought by the upsurge of aid inflows, and consequently, the shift from indifference curve ID to ID' will be consistent with a higher demand for non-tradables, which leads to a deterioration of the trade balance, which moves from zero to a deficit of C 'C ".This a disincentive to buy non-tradables induced by the RER appreciation is referred to as the expenditure-switching effect.

2.1.2.2 The Modified Dutch Disease model

To analyze the relationship between boom in capital inflow and the Dutch disease phenomenon, the core model grounded on a number of unrealistic assumptions, as note by(Nkusu,2004) modified by relaxing the assumptions to capture the specific features of different countries.

Nkusu (2004) argue that the assumptions of a country producing on its PPF is not holding for low income countries rather many LICs, produce below their potential. Since many LICs suffering from supply-side constraints: high structural unemployment and inefficient use of production factors looks a more credible assumption.

In contrast to the core model in figure 2.1, in the modified Dutch disease model given production below the PPF in figure 2, the country produces within the PPF at *(A*) and consumes at (*B*).As an inflow of capital increase, it tends to raise demand for both tradable and non-tradable. The increase in available resources from the capital inflow allows the economy to consume higher and to increase its use of existing resource. This responds through expanding production to the additional demand prevents an appreciation of exchange rate from capital inflow of the spending effect. Furthermore, the small-country assumption is also not applicable with regard to many domestically produced importable's in LIC's.

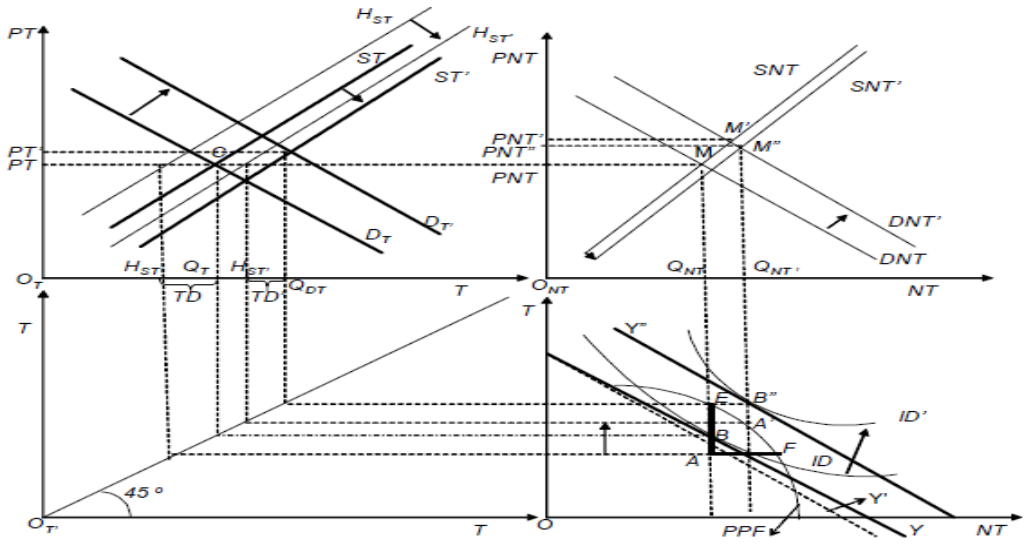

FIGURE 2. 2 THE MODIFIED DUTCH DISEASE MODEL

SOURCE: NKUSU (2004: 12)

After the relaxation of the small-country assumption, the demand for tradables, (*DT*), is downward sloping. The total supply of tradables, (*ST*), comprises the home supply, *(H_{ST})*, and imports equivalent to the trade deficit, (*TD*). The initial market clearing for the tradables is at point (C) and the initial market equilibrium for the non-tradables sectors is at point *(M*). The initial dynamic impact of an increase in capital inflows (Aid) is similar to the core model. The increase in the demand for non-tradables *(DNT*), and its respective price (*PNT*'), leads to an increase in supply (*SNT*). The country now produces at *A'* (on the PPF) and consumes at *B''*. On the contrary of the core model, the modified Dutch disease model the supply of tradables is essentially increased (no 'de-industrialization'), the trade balance can be improved and the RER may not appreciate.

2.1.3 The real exchange rate: definition and determinants

2.1.3.1 Concept of Real Exchange Rate

Exchange rate is one of the most important variable in the field of international Finance and it can be defined as the price of one currency in terms of another currency. Exchange rate movements therefore have widespread repercussions and have increasingly become a cause for public and official concern. Because of its pivotal importance, the exchange rate is, in most of the World's economies, a key instrument or target for monetary policy. At the very least, it is a prime policy indicator. In the literature, there are two type of definitions of exchange rate (Gandolfo, 2002). The first one is referred to as the price quotation system which defines the nominal exchange rate as the domestic currency price of a unit of foreign currency and the second is the volume quotation system which defines exchange rate as foreign currency per unit of domestic currency (Gandolfo, 2002). One is the reciprocal of the other and therefore appreciation of a currency in decreasing in exchange rate in the first definition while it is increasing in the second one. This definition of exchange rate are all nominal (bilateral) exchange rates. There is a real exchange rate that is more important in the discussion of exchange rates. It is measured by adjusting the nominal exchange rate by relative prices (that is, foreign prices relative to domestic prices), this definition is made in line with purchasing power parity (Macdonald, 2007). Afari (2004) noted that real exchange rate is derived from the (PPP) theory that compares two countries by way of the relative prices of a basket of goods produced (or consumed). Thus it is the nominal exchange rate (e) adjusted for price level differences between countries: that is, as the ratio of the aggregate foreign price (P^*) to

the home country's aggregate price denoted by (P) measured in a common currency. Then, mathematically the real exchange is defined by:

$$RER = \frac{eP^*}{P}$$

Where, RER: real exchange rate e: nominal exchange rate, p and p* are domestic and foreign price respectively. Although it seems clear and straight forward, the definition of real exchange rate is full of debates. There are also various versions that are used as a real exchange rate in the literature (Coresetti, 2012).

$$RER' = \frac{P^T}{P^{NT}}$$

Where numerator is the average price of the tradable and the denominator is the price of non-tradable goods of the country. the rationale of this definition is that, in a two-sector (tradables-non-tradables) model, the balance of trade depends on $\frac{P^T}{P^{NT}}$ because this relative price measures the opportunity cost of domestically producing tradable goods, and the ex-ante balance of trade depends on the ex-ante excess supply of tradables (Coresetti,2012).

Edward's 1989 (cited in Rabbi, 2011) noted that the above definition of RER focuses on the rate at which tradable goods are exchanged for non-tradable goods, or on the cost of domestically produced tradable goods. In this definition, the decline in real exchange rate indicates the real appreciation of the domestic currency.

The other definition expresses real exchange as a ratio of prices of exports and imports of a country both expressed in terms of the same country (Kipici and Kesriyeli, 1997).

$$RER'' = \frac{P_X}{eP_M}$$

Where, $P_X \; and \; P_M$ are price of export and price of import respectively.

The rationale behind this description of the real exchange rate is the argument that the real exchange rate should give a measure of the external competitiveness of a country's goods (if non-

traded goods are also present, only tradables should be considered), but even if we so restrict the meaning, it is by no means obvious which index should be taken.

There is also another definition of real exchange rate that is based on the unit labour cost across countries (Montiel, 1999).

$$RER''' = e(\frac{W_f}{W_h})$$

Where W_f and W_h are foreign and home wage respectively. The rationale behind this definition is that the competitiveness of a country depends primarily on its cost of production. Labor being the primary input of production, its cost determines the cost of production of a country. To sum up, Montiel (2003) points out, there is no single universally accepted definition of the real exchange rate that is widely accepted among economists, however in broad terms, the real exchange rate is simply the relative price of foreign goods in terms of domestic ones. He also argue that, the dilemma in defining the real exchange rate depends on the specific analytical framework (macroeconomic model) being used. In analytical macro models, the assumed production structure of the model is a fundamental element that affects the definition of the real exchange rate.

2.1.3.2 Measuring real effective exchange rate

There are also exchange rates that the home currency against a basket of foreign currencies and these are usually used when trying to obtain an overall measure of a country's external competitiveness, and especially when relating exchange rates to international trade balances. These are called effective exchange rates

Kurilenko (cited in Rabbi, 2011) explains Effective exchange rate, by assuming that a particular country trades with n foreign partners and Rit is the value of one unit of currency of partner i in units of national currency at time t (Rit is the directly quoted nominal exchange rate). By assuming Sit is the foreign currency reserve of country i per unit of national currency at time t (Sit is the indirect exchange rate), the relationship between the variables Rit and Sit can be expressed by the equation:

$$S_{it} = \frac{1}{R_{it}}$$

The adjustment in exchange rates relative to the base period in terms of R_{it} and S_{it} :

$R_{it}^{*} = \frac{R_{it}}{R_{io}}$ And

$S_{it} = \frac{S_{it}}{S_{io}}$

The indices of nominal effective exchange rates (NEER) can be calculated after adjusting for exchange rates and the weights for various trade partners. These indices actually depend on the particular averaging method used.

Kurilenko (1998) shows two methods using arithmetic means and two using geometric means:

ARITHMETIC MEANS: GEOMETRICAL MEANS:

$NEER1_t = \sum_{i=1}^{n} W_i S_{it}^{*}$ $NEER3_t = \prod_{i=1}^{n} S_{it}^{*wi}$

$NEER2_t = \frac{1}{\sum_{i=1}^{n} W_{i\, R_{it}^{*}}}$ $NEER4_t = \frac{1}{\prod_{i=1}^{n} R_{it}^{*wi}}$

Since, $S_{it} = \frac{S_{it}}{S_{io}}$ we have $NEER3_t = NEER4_t$: that is, the geometrical-mean effective exchange rate is independent of the particular nominal exchange rate used. We, thus, have at least three different definitions of nominal effective exchange rate. $NEER1_t$ is usually called the arithmetic-mean exchange rate and $NEER2_t$ is called the harmonic-mean exchange rate. Both may be called the geometrical-mean exchange rate.

The geometric average has influential in both theoretical and statistical support nevertheless the arithmetic average is probably more familiar (Rabbi, 2011). One of the reasons of the popularity of the geometrically averaged indices is that they do not have these properties and they treat movements in exchange rate symmetrically. The calculation of the nominal effective exchange rate requires determination of weights. Kurilenko (1998) mentions two methods:

- First, the weights represent the structure of currencies used in transactions of trade (currency weights);
- Second, the weights represent the structure of the foreign trade partners (trade weights).

Kurilenko (1998) noted that, the movement of nominal exchange rates does not provide information about the purchasing power of the currency. Means that, it does not reveal the scale of

changes in the competitiveness of domestically manufactured goods during the given time period. Hence, to estimate the change over time in the purchasing power of a domestic currency relative to the purchasing power of the partner countries, we need to calculate the index of the REER. Since, real effective exchange rate incorporates both the concept of NEER changes and inflation differentials, with the decisive goal of deflating the exchange rate indices by corresponding indices of relative prices.

The REER can be calculated using the arithmetic average approach:

$$REER_A = \sum_{i=1}^{n} W_i^* \left(\frac{S_{it}^*}{P_{it}^*}\right)$$

Where P_{it}^* is the ratio of the price index of trade partner *i* at time *t* to the domestic price index at time *t* , with the same base year for which S_{it}^* is calculated.

Again, Hinkle and Montiel (1999) show that using the geometric mean approach, the REER can be defined in domestic currency terms as follows:

$$REER_{Gdc} = \prod_{i=0}^{n} \frac{(e_{dc}\ P_{gi})wi}{P_{gd}}$$

Where, $REER_{gdc}$ = REER calculated using the geometric mean method and defined in domestic currency terms;

e_{dc} = index of the nominal exchange rate, defined as units of domestic currency per unit of foreign currency;

P_{gi} And P_{gd} = the foreign and the domestic aggregate price indices respectively;

wi = the weight assigned to the i[th] foreign currency and $\sum_{i=1}^{n} = 1$

Takaendesa (2006) shows that the REER can also be expressed in foreign currency terms $(REER_{fc})$as follows:

$$REER_{fc} = \left[\frac{e_{fc}}{p_{gi}}\right] wi * p_{gd} = \frac{1}{REER_{gdc}}$$

Where, e_{fc} is the index of the nominal exchange rate, defined as units of foreign currency per unit of domestic currency. From the above equation it is clear that the REER expressed in foreign currency terms is merely an inverse of the REER defined in domestic currency terms. Here, an

increase in $REER_{gdc}$ means depreciation of the domestic currency, while an increase in $REER_{fc}$ means an appreciation of the domestic currency.

2.1.4 Theoretical Models of Defining and Measuring the Real exchange rate

Montiel (2003) discusses some of the most widely used modelling frameworks, i.e. one-good models, Mundell-Fleming models, Swan-Salter and three-good models.

2.1.4.1 One (tradable) good model

Montiel (2003) summaries that, the one-good model deal with only a single tradable good and arbitrage is assumed to equalize its price everywhere. He also points out, such models are useful for the investigation of purely monetary phenomena (inflation, and also some specific approaches to explaining the determinants of the balance of payments).Montiel points out the demand for tradable good is more elastic .This is due to the fact that price of tradable good should remain stable.

2.1.4.2 Mundell-Fleming (Complete Specialisation) Model

The Mundell-Fleming model is an economic model that was developed by Robert Mundell and Marcus Fleming in 1960s (Korir, 2013). The model assumes the domestic economy and the rest of the world each specialise in the production of a single alternate good, which are not perfect substitutes but are traded internationally. It is applicable to countries whose trade consists mainly of manufactured goods because these tend to be imperfect substitutes for what the rest of the world produces. In this framework, real exchange rate refers to the number of units of the domestically produced good that has to be given up for each unit of the foreign good and their role is as well to determine the composition of absorption between goods produced domestically and those produced abroad. As such Montiel (2003) notes that, the real exchange rate determined the aggregate demand for the domestic good and also an essential determinant of the country's balance of trade. In Mundell-Fleming models, the Real exchange rate happens to overlap with the (inverse of the) country's terms of trade. This is due to the assumption of complete specialization in production.

2.1.4.3. Swan-Salter (Dependent – Economy) model

In the dependent economy model, the production framework consists of two goods: one is produced and consumed only at home (the non-traded good), while the other is produced and con-

sumed both at home and abroad (the traded). In this framework, the definition of RER is straight-forward, and states the number of units of the non-traded good required to purchase one unit of the traded good.

$$e = \frac{P_T}{P_{NT}}$$

Where, P_T and P_{NT} are the domestic currency prices of the traded and non-traded goods respectively. This is known as internal RER. Montiel (2003) notes that there are no terms of trade in this model, since there is only one type of foreign good in this framework. Therefore, this production framework is useful to analyze issues for economies whose terms of trade are exogenous, as well as the roles of exogenous change that are not important. For instance, the model is broadly used to investigate the effects of domestic macroeconomic policies in small countries.

2.1.4.4. Three-good (Exportable-Importable-Nontraded) model

Unlike the Swan-Salter model, in these types of model changes in the terms of trade do matter and are not exogenous. The production frame work consists of exportable and importable goods (both of which may be produced and consumed at home, but one of which is exported and the other imported), as well as non-traded goods. But in this framework, Montiel (2003) proposes two foreign goods and therefore suggests two Real exchange rates (RER): the exportable Real exchange rate and the importable Real exchange rate. And also provide a separate and distinct definition of the terms of trade. Let P_X denote the domestic currency price of the exportable good andP_M the domestic currency price of the importable good, then, we have the exportable real exchange rate $e_X = \frac{P_X}{P_{NT}}$ and as well as the importable real exchange rate,

$e_M = \frac{P_M}{P_{NT}}$.Therefore, the terms of trade (TOT) are defined as $TOT = \frac{P_X}{P_M}$. Hence, this model is useful to investigate the macroeconomic effects of an economy where the terms of trade change, as well as to analyze the effect on the domestic relative prices of exportables and importables due to changes in commercial policies (Montiel, 2003)

2.1.5. Models for capital inflow and Real exchange rate Relationship

The relationship between capital inflow and the real exchange rate always has been an interesting field of macroeconomic research. Researchers over the years have taken different stands regarding

the effect of capital inflow (including remittance, foreign aid and foreign direct investment) on the real exchange rate (Rabbi, 2011). Lopez, 2007 (Cited in Rabbi, 2011) noted that capital inflow can potentially affect the real exchange rate through three main channels: i.e., through growth; through the external and internal equilibrium of the economy[6].

2.1.5.1 The impact of capital inflow on RER through growth

Capital inflow has a significant role for developing countries, it is used to increase accumulation and rate of investment to create conditions for accelerated economic growth and a higher capital inflow is associated with lower poverty indicators as well higher growth rates (Acosta et.al, 2007) Acosta, et.al (2008) mention that capital inflow affect the real exchange rate and that they do so through their effect on growth. On the one hand, acceleration in the growth rate will lower the ratio of net foreign assets to GDP and, this would lower the real exchange rate. On the other hand, the net foreign asset position of the country is negative Vis a Vis the rest of the world, this could lead to an appreciation of real exchange rate through lower liabilities to GDP ratio. On the internal front, faster growth would be associated with a real exchange appreciation, which may lead to higher internal demand and the mechanism of traditional Balassa-Samuelson argument, and may require internal adjustment; therefore on the whole the impact of growth acceleration on real exchange rate is uncertain (Lopez, Molina and Bussolo, 2007).

2.1.5.2 The impact of capital inflow on RER through internal equilibrium

Lopez, Molina and Bussolo, (2007) noted that capital inflows affect the internal equilibrium of the economy through the condition where domestic capital and labor are efficiently and effectively utilized. Capital inflow lead to an acceleration in the demand for services, inflation will tend to be higher in this sector (i.e., the non-tradable sector) and this furtherly leads to a real exchange rate appreciation (Balassa-Samuelson effect).

The diverse behavior of relative prices of different sectors between countries determines the growth of the real exchange rate. Again, the prices of diverse sectors are related to the evolution of productivity of different sectors. This productivity frame work can be explained with the help

[6] An external equilibrium refers to a balance of payment equilibrium of an open economy, note that when an open economy achieves an external equilibrium, output is not necessarily at the full employment level. While internal equilibrium is achieved at the full employment and stable price.

of a simple model consisting of two factors of production, i.e., labor (L) and capital (K), which are fully employed in the production of tradables and non-tradables. The model assume Cobb-Douglas production technology determines the output in each sector (Alberola, 1999):

$$Y_t^T = A^T(L_t^T)^{\Theta}K_t^T)^{1-\Theta}$$

$$Y_t^N = A^N(L_t^N)^{\Theta}K_t^N)^{1-\Theta} - - - - - - - - - - - - - - - - - (2.1)$$

Where, Θ represent the labour intensity of production in each sector. It is assumed that labour is perfectly mobile both in tradable and non-tradable sector, indicating that there is equalization of nominal wage.

$$W_T = W_N = W - (2.2)$$

Furthermore, labour is paid the value of its marginal product, hence:

$$\frac{\partial w^j}{\partial l^j} = \frac{w^j}{P^j} - (2.3)$$

Under Cobb-Douglas technology the ratio of marginal productivities is proportional to the ratio of average productivities:

$$\frac{\frac{\partial Y^T}{\partial L^T}}{\frac{\partial Y^N}{\partial L^N}} = \frac{\frac{\Theta Y^T}{L^T}}{\frac{\delta Y^N}{L^N}} - (2.4)$$

The above equation follows that the price differential of different sectors is equal to the level of productivity differentials among sectors, plus a drift capturing the comparative intensity of labor. We can express the result in logarithm, where lower case is the natural logarithm of labor productivity of different sectors, and we get;

$$P_t^N - P_t^T = \log\left(\frac{\Theta}{\delta}\right) + Y_t^T - Y_t^N - - - - - - - - - - - - - (2.5)$$

This equation shows that, higher productivity levels in the tradable sectors result in higher relative prices for non-tradable sectors. In other way round, by ignoring the constant term and representing;

$n = [(Y_t^T - Y_T^N) - (Y_t^{*T} - Y_t^{*N})]$, and the internal equilibrium exchange rate:

$$q^* = n^* - (2.6)$$

Normally, there may have different sources for productivity differential, Balassa and Samuelson (1964) initially put forward the argument that economic growth is associated with an increase in the relative price of non-tradables, nevertheless productivity gains in the domestic tradable sector relative to the domestic non-tradable sector would result in a real exchange rate appreciation.

The main concern of this study is to connect the capital inflow (specifically, remittance, foreign aid and FDI) into this process. Hence, if the capital recipient country uses some parts of the capital inflow on the non-traded goods, this will increase demand and this leads to withdraw labor out of the export sector (the tradable one). In equation 2.6, $\frac{\partial Y}{\partial L} < 0$, it follows that the productivity of the non-tradable sector (Y_t^N)will decline and the productivity of the tradable sector will increase. Therefore,

$$Y_t^T - Y_t^N = \Lambda r - (2.7)$$

Where, $\Lambda > 0$, therefore, capital inflow will also lead to an appreciation in the internal real exchange rate.

2.1.5.3 The impact of capital inflow on RER through External equilibrium

Capital inflow may affect the external equilibrium of the economy by improving the net foreign asset position of the country. Alberola and Lopez (2001) and Alberola et al. (1999) noted that the external equilibrium of the economy will be reached when any current account imbalance is compensated by a sustainable flow of international capital. In other words, the rate of sustainable capital flows will be a function of the stock of foreign assets and liabilities of the economy, therefore, a change in the net foreign asset position of the country will lead to changes in the real equilibrium exchange rate.

The portfolio model of RER determination (Lopez et al cited in Rabbi, 2011) focuses on asset equilibrium, as identified by the realization of economic agent's desired foreign asset stock. Eventually, the growth of net foreign assets (F) is given by the current account balance (CA). If we

consider foreign capital inflow in the home country (include remittance, aid and foreign direct investment) are the major international net transfer (T):

Then we can write as:

$$\Delta F = CA = TB + i^{*}F + T \quad \text{---------- (2.8)}$$

Where TB; is the trade balance and $i^{*}F$; is the world interest rate (assumed given). Then, it could be more appropriate to focus on the path of the foreign asset stock relative to GNP:

$$\Delta f = ca = tb + (i^{*} - g)f + t \quad \text{----------(2.9)}$$

Where, g is the GDP growth rate$f$, tb and$t$denote the ratios to GDP of the respective uppercase variables.

Conversely, if the Marshall-Lerner condition holds, then an increase in the relative price of domestic tradables shifts consumption toward foreign tradables and worsens the trade balance. Given the trade balance (tb) as a percentage of GDP:

$$tb = -\Upsilon q_x \ , \qquad \Upsilon > 0 \quad \text{---------- (2.10)}$$

The capital account deficit assumed to be depend on the divergence between the current level of assets as a percentage of GNP *(f)* and the desired equilibrium level (*f*)*itself. It shows the desired rate of growth of net foreign assets by the home country and it also determined by exogenous factors such as saving preferences and demographics. But, the model does not show these factors. Thus,

$$\Delta f = ca = a(f^{*} - f) \qquad , a > 0 \quad \text{---------- (2.11)}$$

The equation shows that, agents will accumulate assets to reach the target, when the actual net foreign asset position is below its desired level. While, if$f$ is greater thanf^{*}agents will reduce their asset holdings until they attain (f^{*}).And now, equating (2.11) and (2.9) after using (2.10) and solving for q_x we get;

$$q_x = \frac{a}{\Upsilon}(f - f^{*)} + \frac{(i^{*} - g)}{\Upsilon} f + \frac{1}{\Upsilon} t \quad \text{---------- (2.12)}$$

Finally, this equation indicates that the external Real exchange rate depends on:

- The divergence between current and equilibrium asset holdings;
- The ratio of international transfer to GDP(i.e. remittance, aid and FDI) and;
- The current stock of net foreign assets

Lastly, defining the equilibrium external real exchange rate as q_x^* that steady with $f = f^*$, it follows that:

$$q_x^* = \frac{i^* - g}{\Upsilon} f^* + \frac{1}{\Upsilon} t \quad \text{---------- (2.13)}$$

From the above equation (2.13), we can conclude that:

- Increases in the international transfer (i.e. remittance, aid and FDI) to GDP ratio (*t*) would be associated with a real exchange rate appreciation;
- Improvements in international interest rate (i^*) would lead to an appreciation Real exchange rate.
- Increases in f^*would also lead to a real exchange rate appreciation, only it $i^* > g$ and
- A higher growth rate would be linked with a lower equilibrium real exchange rate

To conclude that, capital inflow (international transfer) can affect the real exchange rate through growth and both the internal and external equilibrium of an economy. Furthermore, higher capital inflow would be associated with a real exchange rate appreciation.

2.1.6 Theoretical Determinants of the Real exchange rate

The behavior of the real exchange rate relative to its equilibrium value has substantial effects for domestic resource allocation between tradable and non-tradable goods and international competitiveness as well. Williamson 1994 (cited in Takaendesa, 2006) noted that "the motivation behind the preoccupation with issues of the real exchange rate by economists has been the desire to an appropriate concept of equilibrium exchange rate and estimating its value."

There are several methods of modelling exchange rate, however some do not refer to the real exchange rate: including balance of payments models, monetary models, portfolio balance models and generally the so called "fundamentals'' model (Takaendesa, 2006). Kempa (2005) noted that hence, it is very challenging to compile theoretical literature on exchange rate determination, since there is no universally accepted exchange rate model one could help to.

Mundell (cited in Takaendesa, 2006) using a macroeconomic model of a monetary economy, provides an early proper analysis of the determination of the equilibrium real exchange rate. The model is based on a small and open monetary economy with given prices and Mundell defines the equilibrium real exchange rate as the relative price of international to domestic goods that equilibrates the money market. The limitation of Mundell's model as well as other real exchange models with the exclusion of "fundamentals" models is, it does not permit a difference to be drawn between the effects of temporary and permanent changes in the determinants of the Real exchange rate. Essentially, fundamentals models are relatively new models of the determination of real exchange rate and which syntheses the former or the present literatures on the determinants of the equilibrium real exchange rate. Even though, there are a number of variants of the fundamentals models, Edwards (1989) and Montiel (2003) are two most important for analytical frameworks in empirical studies.

2.1.6.1 Edward's Theoretical Framework of Real exchange rate

Edwards (1989) perhaps, a pioneered in the fundamentals models of the real exchange rate determination for a small open developing economy (Rabbi, 2011).This model allows for both real and nominal factors to play a role in the short run. However, only real factors (the fundamentals) determine the long run equilibrium RER. (See diagram 2.3)

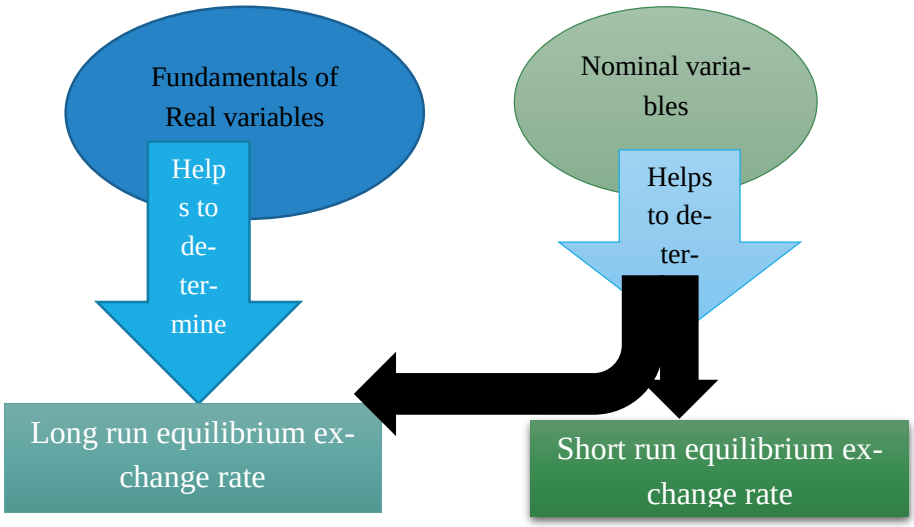

FIGURE 2. 3 FEATURES OF EDWARD'S RER MODEL

Source: Rabbi, 2011

The model attempts to capture the macroeconomic features of developing economies, including the existence of exchange controls, trade barriers and a market-determined parallel exchange rate for financial transactions.

The model considers a three goods; exportables, importables, and non-tradables, it assume a small and open economy. Moreover, it also assumes no price rigidities and no inter-temporal credit rationing.

The Edward model (1989) assume that a country produces the exportable (X) and non-tradable goods (N) and consumes the importable (M) and the non-tradable (N), Nationals of this country hold both domestic money (M) and foreign money (F). Initially it is assumed that there are effective capital controls, so that there is no international capital mobility. The private sector has inherited a given stock of foreign money. The government consumes importable and non-tradable goods and uses both non-distortionary taxes and domestic credit creation to finance its expenditure. Initially, it is assumed that there is no capital mobility between nations, nonetheless this is later relaxed. It is also assumed that the government has not subject to capital controls, therefore there are some capital flows across the borders. Moreover, the model assumes the dual nominal exchange rate system, is characterized by a fixed rate for commercial transactions (E) and a market determined rate for financial transactions (δ).The freely floating financial rate adjusts in order to achieve

asset market equilibrium. It is also assumed that the nation levies a tariff on imports (τ) and that its proceeds are handed back to the public in anon-distortionary way. The price of exportable in terms of foreign currency is fixed (since the nominal exchange rate for commercial transactions is fixed) and equal to unity. Lastly, the model assumes that economic agents have perfect foresight.

Edwards's model starts from the portfolio decisions and divides the economy into four major divisions: the demand side, supply side, government and external sector:

Portfolio Decision

$$A = M + \delta F \quad ---------(2.14)$$

$$a = m + \rho F \quad ---------(2.15)$$

Where, $m = \frac{M}{E}$, $\rho = \frac{\delta}{E}$

$$m = \delta(\frac{\delta \cdot}{E})\, \rho F, \ \delta' \sim 0 \quad ----------(2.16)$$

$$F \cdot = 0 \quad ----------(2.17)$$

Where, A; total asset, M; domestic money, F; foreign money, δ; market determined nominal exchange rate, E;commmercia rate, ρ;the spread between the market determined nominal exchange rate and commercial rate.

In equation (2.14), total assets (A)are defined in domestic currency as the sum of domestic money (M) and foreign money (F) multiplied by the market determined nominal exchange rate (δ). Equation (2.15) real assets, defines in terms of exportable goods, where$E$is the commercial rate and$\rho = \frac{\delta}{E}$ is the spread between the free$\delta$and E . Equation (2.16) shows the portfolio composition and proposes that the desired ratio of real domestic money to real foreign money is a negative function of the expected rate of depreciation of the market determined rate δ. Due to perfect foresight assumption, in equation (2.16), the actual rate of depreciation can possibly replace expected depreciation.

Finally, equation (2.17) shows that there is no mobility of capital and that no commercial transactions are subject to the rate δ. It is also assumed that the economy has inherited a positive stock of foreign money ($F0 > 0$).

Demand Side:

$$P_M = EP_M^* + \iota , e_x = \frac{E}{P_N} , e_M = \frac{P_M}{P_N} , eM^* = \frac{P_M^* E}{P_N} ------------ (2.18)$$

$$C_M = C_M(e_M, a); \frac{\partial C_M}{\partial e_M} < 0; \frac{\partial C_M}{\partial a} > 0 ------------------- (2.19)$$

$$C_N = C_N(e_M, a); \frac{\partial C_N}{\partial e_M} < 0; \frac{\partial C_N}{\partial a} > 0 ------------------- (2.20)$$

Supply Side:

$$Q_X = Q_X(e_X); \frac{\partial Q_X}{\partial e_X} > 0 -------------- (2.21)$$

$$Q_N = Q_N(e_X); \frac{\partial Q_N}{\partial e_X} < 0 ------------------- (2.22)$$

From equations (2.5) to (2.22), variablese_M ande_X are thedomestic relative prices of importables and exportables respectively with respect to non-tradables. Variable e_M includes a tariff on imports, on the other hand,eM^* is the domestic relative price of importables excluding a tariff. The demand for non-tradableand importable goods depends on the relative price of importables as well as on the level of real assets, while supply functions depend on the price of exportables relative to non-tradables.

Government Sector:

$$G = P_N G_N + EP_M^* G_M ----------------------------- (2.23)$$

$$g = g_M + g_N$$

$$\frac{EP_M^* \ G_M}{G} = \Lambda ------------------------------ (2.24)$$

$$G = t + \dot{D} ------------------------------ -(2.25)$$

The government sector is represented by equation (2.23) and (2.24), where $G_M$and $G_N$are government consumption of$\text{importable} \text{and} \text{non tradable respectively}$. The equation,$g = g_M + g_N$ is simply an expression of real government consumption in terms of exportables, where $g = \frac{g}{E}$ and$g_N = \frac{G_N P_N}{E}$, Equation (2.24) explains the ratio of government consumption on importable goods asΛ, while,Equation (2.25) the budget constraint of the government is defined as government consumption has to be funded via non-distortionary taxes$t$and domestic credit creation$\dot{D}$. Yet, under fixed nominal commercial rates a positive rate of growth of domestic credit ($\dot{D} > 0$) is not sustainable. In this situation, stationary equilibrium will be achieved when $\dot{D} = t$ and $\dot{D} = 0$.

<u>External Sector:</u>

$$CA = Q_X(e_X) - P_M^* \; C_M\left(e_{M,}a\right) - P_M^* G_M \text{------------------------} (2.26)$$

$$\dot{R} = CA \text{--------------------------------} (2.27)$$

$$\dot{M} = \dot{D} + E\dot{R} \text{------------------------------} (2.28)$$

$$e = ae_M^* + (1-a)e_X = \frac{E(P_M^* + (1-a)P_X^*}{P_N} \text{------------------} (2.29)$$

Where, $a$is the real wealth, $\dot{R}$ is the balance of payment, $\dot{D}$is the domestic credit creation Equations (2.26) represents the current account(CA) in foreign currency, which is the difference between output of exportables and private as well as public sector consumptionof importables. Due to the assumption of no capital mobility and a freely determined financial transactions nominal exchange rate, Equation (2.27) shows the equality of the balance of payment ($\dot{R}$) and the current account (CA). Equation (2.28) presents the link between changes in international reserves, changes in domestic credit and changes in the domestic stock of money.

Finally, the model is closed using equation (2.29), which is the definition of the Real exchange rate as the relative price of tradables to non-tradables, but not including tariffs on imports.

The long-run sustainable equilibrium, which is the steady-state is attained when the non-tradable goods market and the external sector are in equilibrium. Due to the assumption of tight exchange controls, if the current account remains always in equilibrium, means that long-run sustainable

equilibrium in the external sector. However, in the short run, there can be departure from this condition resulting in accumulation or de-accumulation of international reserves. Thus, the long-run sustainable equilibrium (the steady state) is attained under the following four conditions

- The demand and supply for non-tradables are equal;
- There is external equilibrium ;($\dot{R} = 0 = CA = \dot{M}$)
- Fiscal policy is sustainable; and
- Portfolio equilibrium holds.

The non-tradable goods market will be in equilibrium when:

$$C_N(e_{M,}a) + e_X g_N = Q_N(e_X) \quad (2.30)$$

From the above equation (2.17), it is possible to express equilibrium price of non-tradable as follows;

$$P_N = \varphi(a, g_N, P_M^*, \iota); \frac{\partial \varphi}{\partial a} > 0, \frac{\partial \varphi}{\partial g_N} > 0, \frac{\partial \varphi}{P_M^*} > 0, \frac{\partial \varphi}{\partial \iota} > 0 \quad (2.31)$$

Conversely, before solving for $P_N$there is an investigation into how changes ing_N, P_M^* and ι influence real wealth, since the real value of total asset (a) is an endogenous variable.

By reexamining equation (2.18) and substituting the rate of change of the spread $(\frac{\dot{P}}{P})$for $(\frac{\dot{\delta}}{\delta})$, because the nominal exchange rate for commercial transactions is fixed, we can re-write:

$\frac{M}{P_F} = \delta(\frac{\dot{P}}{P})$, by inverting equation (2.18) and solving for$\dot{P}$, the following equation is obtained;

$$\dot{P} = PL\,(\frac{M}{P_F}),\ L'(.) < 0 \quad (2.32)$$

The equilibrium real balances and the parallel market premium are represented by the following figure 2.4:

In fig 2.4, the $\dot{P} = 0$ schedule has a positive slope, because the public in order for to hold more of m as ρ increases. The higher the spread, the lower the expectations of further increases in the free market rate and thus the higher the amount of domestic money the public is willing to hold

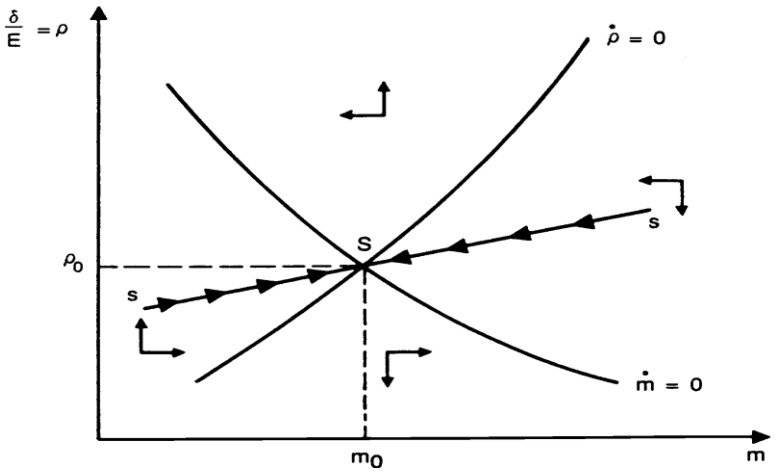

FIGURE 2. 4 EQUILIBRIUM REAL BALANCES AND PARALLEL MARKET PREMI UM:

SOURCE: EDWARD (1989)

By combining equations (2.23), (2.25), (2.26), (2.27) and (2.28), the following expression for $\dot{M}$ can be constructed:

$$\dot{M} = Q_X(e_X) - C_M\left(e_{M,}a\right) + g_N - \frac{t}{E} \text{ ---------- (2.33)}$$

In the above figure 2.4, equilibrium of the external sector requires that$\left(\dot{M}\right) = 0$. If the steady state assumption remains binding that the government expenditures are fully financed with taxes, then the$(\dot{R} = 0)$ schedule will match the $(\dot{M} = 0)$ schedule. Whereas the $(\dot{M} = 0)$ schedule is negatively sloped, because an increase in$m$ results in both a higher$a$ and acurrent account deficit; in order to re-again equilibrium, real assets a should go down through a fall in$P$.

Figure 2.4 also shows that the steady state level of real balance $(m_{0)}$ andthe steady-state parallel market premium (p_0) schedules intersect with each other. Thus, this system is characterized by saddle path equilibrium and (ss), is the saddle path with arrows represent the dynamic forces at work in the system.

Finally, the steady state values of p and m are identified, equation (2.31) can be used to find the long-run equilibrium price of non-tradables given the corresponding values of g_N , P_M^* and ι. Equation (2.29) can be used to find the long-run equilibrium real exchange rate.

$$RER = v(\, m_0 + \, p_0\, F_0, g_{N0,\, \iota 0,} P_{M0}^*) - (2.34)$$

The long run equilibrium real exchange rate is a function of real variables only, the so called the fundamentals, include: international terms of trade, international transfers (containing foreign aid, foreign direct investment and worker's remittance). Therefore, equation (2.34) represents, the long-run equilibrium Real exchange rate. Hence, a changes in some real variables (fundamentals) in this equation results in changes in the equilibrium real exchange.

However, changes in nominal variables, such as domestic credit expansion, and changes in the values of the nominal exchange rate will affect the path of the actual Real exchange rate in the short run.

2.1.6.2 Montiel's Theoretical Model for Long-run Equilibrium RER

Montiel's (2003) model is a basic theoretical models of exchange rate determination. The model is based on the notion that real exchange rate is an endogenous variable, and it attempts to synthesis the relevant 'fundamentals' that have been identified by economists (Montiel, 1999).In this model, the economy endogenous variable (RER) determined by three types of variables:

- Predetermined variables;
- Exogenous policy variables; and
- Other exogenous variables

Predetermined variables are endogenous variables that change slowly over time, such as the economy's capital stock, technology, net international creditor position and nominal wage. Exogenous policy variables consist of fiscal and monetary policies, trade policies and other variables under the control of the domestic authorities. Other exogenous variables can be classified into three categories: 1. Observable variables, such as the terms of trade, world interest rates etc. 2.Unobservable variables can be treated as random shocks and, 3. Bubble variables, are variables those that influence the economy only through their pressure on expectations. Meanwhile, the (Montiel,

2003) model expresses it as determined by the reduced form of relationship, the real exchange rate (RER) is an endogenous variable;

$$RER(t) = F[X_1(t), X_2(t), X_3(t), B\ (t)] - (2.35)$$

Where, X_1 = the current values of a set of predetermined variables;

X_2 = Current and expected future values of a set of real policy variables;

X_{13} = Current and expected future values of a set of observable and unobservable variables;

B =Bubble variables.

The long run equilibrium Real exchange rate depend only the sustainable values of the exogenous and policy variables that affect the real exchange rate directly or indirectly (long-run fundamentals). Hence,

$$LRER = F(X_2^*, X_3^*) - (2.36)$$

Where, $LRER =$ Long-run equilibrium Real exchange rate; X_2^* and X_3^* Long-run fundamentals

Thus, primarily the fundamentals must be identified before the estimation of the long run equilibrium real exchange rate. For this, specific model is needed, which to investigate the factors influencing the long-run equilibrium value of the real exchange rate. This model incorporates the three-good production framework with various assumptions:

- The exportable goods are not consumed in the domestic economy;
- The capital is fixed and not mobile across sectors;
- Labour is mobile inter-sectorally;
- The capital stock is fixed, and does not allow for investment outlay;
- The economy is assumed to be financially open; and
- The residents pay a premium for external borrowing
- Consumption decisions are assumed to be made by infinitely lived representative agents

- Assumptions of perfect foresight agent

The model can be summarized in the form of two equations, representing the internal and external balances[7]. Accordingly, the internal balance condition for simultaneous equilibrium in the market for non-tradable goods and labour can be expressed as follows:

$$Y_{NT}(q, \emptyset) = (1 - \Theta)q_c + g_{NT} \quad \text{---------- (2.37)}$$

Where, Y_N =Level of output of non-tradable goods in the economy;

q =Price of importable goods in term of non-tradable goods;

$\emptyset$ =Terms of trade;

Θ = Share of importable in private absorption;

c = Private absorption, measured in terms of importable goods; and

g_N = Government consumption of non-tradable goods.

The left hand side of equation (2.36) is the supply of non-tradable goods, whereas the right-hand side represents the demand for such goods.

The external balance condition sets the current account deficit equal to the sustainable level of capital inflows. It is given by:

$$\Pi^* f^* = \emptyset Y_X(q, \emptyset) + Y_z(q, \emptyset) + (r^* + \Pi^*)f^* + t - (\iota(\Pi^* + \Theta)c - g_z \quad \text{-------- (2.38)}$$

Where, Π^* =World rate of inflation;

f^* =The economy's steady-state net international creditor position;

---

[7] According to montiel (2003) model, the equilibrium RER is defined as the value of the RER that is simultaneously consistent with internal and external balances, conditioned on sustainable values of exogenous and policy variables i.e. internal balance defined as a situation in which the markets for non-traded goods and labor are both in equilibrium, whereas External balance refers to a situation in which the current account deficit is equal to the value of the sustainable capital inflow.

Y_X, Y_z =The level of output of exportable and importable goods, respectively;

r^* =The world real interest rate;

$t =$ The value of international transfers received by this economy

$\iota =$ The cost, per unit of consumption of making consumption transactions; and

g_z =The government's consumption of importable goods.

To explain why people demand money, Montiel's (2003) model includes transaction cost(ι.). People hold money to reduce the cost of making transactions, and this cost is lower, per unit of consumption when more money is held. Since the demand for money inversely depends on the domestic rate of inflation, transaction costs per unit of consumption increase in Π^* .In the above equation, domestic output of tradable goods is the sum of the production of exportables and importables($\emptyset Y_X + Y_z$), and domestic spending on tradable goods is the sum of private spending as well as government spending($\iota + \Theta)c + g_z$. The domestic excess supply of tradable goods, which is the difference between the supply of and demand for tradable goods, is equal to the trade balance surplus. Adding net interest receipts from abroad$(r^* + \Pi^*)f^*$ and the receipt of net international transfers (t) to the trade balance yields the current account of the balance of payments. To hold the external balance, the current account must be equal to the sustainable capital inflow, which is the amount of new borrowing required to offset the inflationary erosion of the country's net international creditor position in the presence of world inflation.

Graphically, the long-run equilibrium real exchange rate can be determined by plotting the internal balance condition and the external balance condition in a diagram with real private consumption(c) on the horizontal axis and the real exchange rate (e) on the vertical axis.

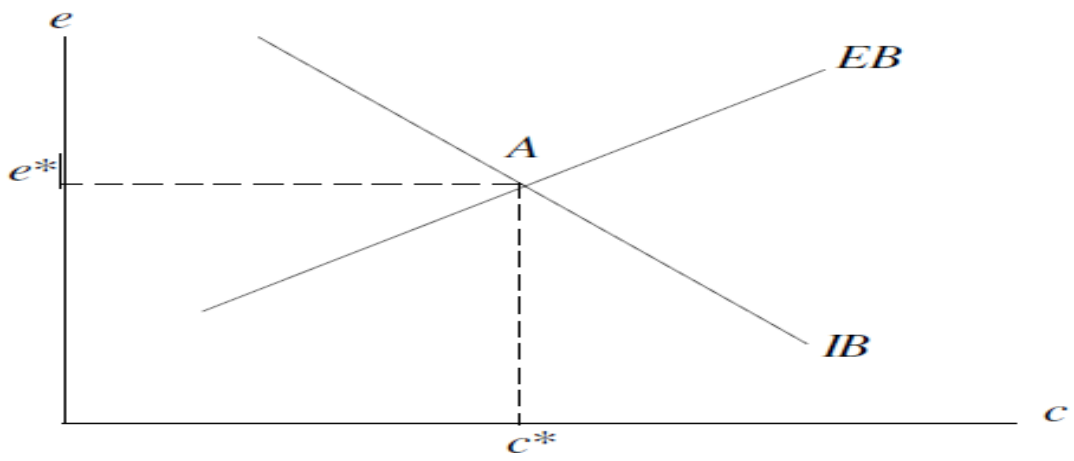

FIGURE 2. 5 DETERMINATION OF THE LONG RUN EQUILIBRIUM REAL EXCHANGE RATE :

(SOURCE MONTIEL, 2003)

From the above figure 2.5, internal balance (IB) curve have a negative slope, because to maintain equilibrium in the market for non-traded good, the increase in the demand for non-traded goods, should offset by an increase in their relative price (a reduction in *e*). On the other hand, that the external balance curve (EB) has a positive slope, because an increase in the consumption of non-tradable goods due to an increase in consumption increases the trade deficit. This situation involves a Real exchange rate depreciation to transfer resources into the production of traded goods and to the keep external balance. Hence, it is clear that long-run equilibrium Real exchange rate will be attained at (e^*) where the internal and external balance intersect each other. Several definitions of the real exchange rate were provided earlier in this study. Whichever definition is used, the equilibrium real exchange rate is one that is consistent with both the external and internal balance of the economy (Williamson, 1994: 178).

Montiel's (2003) proposes that long-run equilibrium RER will be affected by factors that cause changes in the positions of the internal balance and external balance curves. By merging Edwards's (1989) model, Montiel's (1999), and Montiel's (2003) model, the variables that affect the Real exchange rate include:

- Change in government spending,
- The demand for non-traded good

- Terms of trade
- Changes in fiscal policy
- Changes in the value of international transfers
- Changes in international financial conditions,
- differential productivity growth in the tradable goods sector (The Balassa-Samuelson effect),
- Changes in monetary policy,
- Changes in commercial policy,
- Change in nominal exchange rate policy, and
- Changes in foreign exchange reserves.

All of these factors together represent the relevant set of long-run fundamentals, and permanent changes in any of them will change the long-run equilibrium real exchange. Finally, we take the variables from here for the empirical estimation of our study, but before that the empirical literature is essential because that may offer more light on variables that have been empirically found to affect the Real exchange rate.

2.2 Empirical Literature

There are several cross country and country specific studies that have been conducted and established the link between capital inflow and the Dutch disease and have different result with different methodology. And now, in this section were viewed the existing empirical evidence that focused on developing countries and finally we also presented the existing empirical evidence on Ethiopia. And the review is categorized based on the type of capital inflows i.e., remittances-induced Dutch disease, aid induced Dutch disease, foreign direct investment induced Dutch disease and finally capital inflow induced Dutch disease).

2.2.1 Remittances and Dutch Disease

Acosta et al. (2009) carried out a study about the Dutch Disease impacts of remittances in El Salvador using Bayesian estimation. The study developed and estimated a two-sector dynamic stochastic general equilibrium (DSGE) model to investigate the effects of remittances in El Salvador. By using a BVAR analysis, remittance inflows are found to have Dutch Disease effect under two different condition, when remittance flows are exogenously determined, remittances are counter cyclical**.** The author found an increase in remittance flows leads to a decline in labor supply and an increase in consumption demand that is inclined toward non-tradables. The study also found reallocation of labor from the tradable sector to the non-tradable sector (the higher the price in this sector serve as incentive for an expansion of the sector).

Chowdhury and Rabbi (2013) examined impact of worker's remittance on real exchange rate in Bangladesh. The study made use of the annual data from 1971 to the end of 2011 with real exchange rate being dependent variable. Using Johansen co-integration and Vector Error Correction models, the study has found that the flow of remittances is appreciating the RER and decreasing the external trade competitiveness, thus, the process is slowly bringing about deterioration in the economy of Bangladesh.

Mughal and Makhlouf (2013)using IV Bayesian estimation, found the Dutch Disease effects of remittances in Pakistan, evidence from both the spending and resource movement effects. The study found that remittance inflow leads to appreciation of the real effective exchange rate (REER) and shift in resource allocation through consumption of non-tradable goods and services. Hence, the study concluded that, the Pakistani economy exhibits symptoms of Dutch disease as a result of migrant remittance inflows.

Korir (2013) examined whether Diaspora remittances cause Dutch disease effects in Kenya. This study used secondary time series monthly data, spanning the period January 2004 to December 2011 for monthly analysis. The study also carried out vector error correction (VECM) approach to investigate the relationship between Diaspora remittances and real effective exchange rate. And the study found that an increase in Diaspora remittances causes a decrease in real effective exchange rate.

The finding among cross countries on the link between remittance and Dutch disease effect also had mixed in results. Lopez et al. (2007**)** investigate the spending effect of remittance for the period 1990 to 2003 in Latin America. The study conclude that remittances appear to lead to a significant real exchange rate appreciation. From fixed effect estimation, doubling of workers remittance brought about a 5% appreciation of the real exchange rate in recipient economy. the study also furtherly, explored whether the estimated appreciation would be consistent with the natural appreciation that one would expect in the real equilibrium exchange rate following a positive shock, or instead whether the observed changes are more likely to be driven by changes in the misalignment component. Amuedo-Dorantes and Pozo (2004) using IV fixed effect model, found the Dutch Disease symptom that remittances appreciate real exchange rate in 13 Latin American and Caribbean countries. The author concludes that remittance appreciate the real exchange rate in all the countries of the study.

In addition to the spending effect of remittance, its effect on resource movement was obtained by Lartey et al., (2012): using disaggregating sectorial data, the author examined the relationship between remittance, exchange rate regime and the Dutch disease in 109 developing and transition economies for the period from 1990 to 2003.The empirical result shows that, an increase remittance inflow have spending effect that leads to RER appreciation. In addition, they found that the resource movement effect that favors the non-tradable sector at the expense of tradable goods. Furthermore, the study also shows the Dutch disease effects operate stronger in fixed exchange rate regimes.

Kemeguet al., (2011)examined the effect of remittance inflows on the real exchange rate conducted on 34 sub-Saharan-African remittance receiving countries using annual data from 1980 to 2008.For the analysis of the study they used feasible generalized least squares and generalized method of moments by Arellano and Bover (1995).The result shows that, when cross sectional dependence and individual effects are controlled for remittance inflows on average appreciate the underlying exchange rate of the recipient economy. Nonetheless this appreciating effect of remittance inflows on the real exchange rate is mitigated by monetary policy, overdependence on imports and direction of fiscal expenditure .hence, there was no Dutch disease effect of losing export competitiveness in recipient countries.

2.2.2 Foreign Aid and Dutch Disease

As developing countries experience shortage of capital and simultaneously face many other macroeconomic problems, so, they require foreign aid from the host country. Nonetheless, to reap the benefits of aid presence of some good policies is very much important. Burnside and Dollar (2000) found that foreign aid is very much effective in improving the growth of GDP in developing countries with good policy measures. If aid is not channeled into investment appropriately rather it directed to consumption, it causes rise of the price of non tradables, thereby appreciating real exchange rate and it is commonly referred to as Dutch disease. Following a significant inflow of aid to developing countries, like other capitals its effect in creating Dutch disease on recipient countries becomes an important area of study. Studies such as Kelfala M. (2014), Nyoni (1998), Sackey (2001) and Opoku-Afari et al (2004) are among the recent works that have tried to address the empirical question in country specific study.

Kelfala M. (2014) investigated the long-run relationship between foreign aid, the real exchange rate, the trade balance, and economic growth using annual data from 1974 to 2005 in Sierra Leone. And the study found that, even if the country is heavily foreign-aid dependent country, the Dutch Disease hypothesis does not hold for Sierra Leone. Rather, the study concludes, foreign aid can simultaneously achieve economic growth and poverty reduction in Sierra Leone. Hence, In the case of Sierra Leone, the answer "Can Foreign Aid Buy Growth?" (Easterly, 2003) is affirmative.

Nyoni (1998) investigated the impact of aid on real exchange rate using annual data from 1967-1993 in Tanzania. The study employ OLS unrestricted error correction model (UECM), the study found that, foreign aid flows are associated with Real exchange rate depreciation, rather than appreciation. Through applying similar approach like Nyoni (1997), Sackey (2001) examine the relationship between aid and real exchange rate for Ghanaian economy and the author argue that in addition to depreciating effect, aid has a positive correlation with export performance for in the economy of Ghana.

Opoku-Afari et al (2004) studied on the relationship between capital inflow and real exchange rate for Ghanaian economy. Using OLS Engle-Granger two step approach, they found that, the inflow of aid leads to real exchange rate appreciation. Moreover, the study goes beyond the estimation of a single-equation and uses a system-based methodology. They use three alternative measures of

capital flows, inflows that require repayment like aid, permanent flows include remittance, and FDI. Similarly, Ahmed (2009) found relative to equilibrium exchange rate, aid has a significant appreciation effect on real exchange rate for Pakistani economy for the period 1972 to 2007. On the other hand, Addison and Baliamoune-Lutz (2013) using unrestricted VAR founds a mixed result on Dutch disease from aid inflow in Morocco but not in Tunisia for the period of 1980 to 2009. In the Moroccan economy, an appreciation of RER and declining of the growth of the manufacturing industry because of aid inflow found significant in the long-run.

Similar to specific country studies, the finding among cross countries on the link between aid and the Dutch disease effect also had mixed findings. Fielding and Gibson (2012) found the impact of aid inflow on real exchange rate and output level in sub-Saharan African countries. The study targeting 26 aid receiving Sub-Saharan African countries with annual data from 1970 to 2009. After capturing of countries heterogeneity, they employed a VAR specification and found that, an aid inflow causes a real exchange rate appreciation in most countries. But the size of the effect varies substantially. And argue that even if aid is associated with appreciation of exchange rate its impact depends on the type of exchange rate regime. Hence, the study also found aid inflows cause a much larger real exchange rate appreciation in countries with a hard fixed exchange rate peg i.e., 12 hard peg countries (out of 13) than in countries with a more flexible exchange rate regime. Similarly, Lamens (2015) investigate the existence of the Dutch Disease in Sub-Saharan African countries using annual data over the period of 1960 to 2013.Usingfixed effect panel regression model to determine both the spending and resource movement effect. And finally the study concludes that the Dutch Disease did not occur in aid recipient sub Saharan African countries, notwithstanding the symptoms being present as they are offset in the long run.

Bazoumana Ouattara and Eric Strobl (2001) examined the relationship between foreign aid inflows and the real exchange rate in CFA Franc countries using annual data from1980 to 2000.Using the dynamic panel analysis, the study test the hypothesis that foreign aid inflows cause a real exchange rate appreciation in the recipient country. And they found that, this hypothesis is rejected in the case of the CFA countries. Put differently, the finding shows foreign aid inflow is not a cause for Dutch disease effects in CFA Franc countries.

Additionally, Ni Lar et.al (2016), Examined the impacts of foreign aid by focusing on the economies of Cambodia, Lao PDR, Myanmar and Vietnam from the perspective on whether the foreign aid has caused the Dutch-Disease. The study investigated Granger causalities among foreign aid, the ratio of tradable to non-tradable output and real GDP, and also assessed the impulse responses of real GDP to foreign aid shock under a VAR model approach. Through the empirics, the study found that the Granger causality from foreign aid not to the ratio of tradable to non-tradable output but to real GDP, and also identified the significantly positive impulse response of real GDP to foreign aid shock. This empirical outcomes implied that the CLMV economies have not suffered from the Dutch Disease phenomenon and rather have enjoyed a positive production effect by receiving foreign aid.

2.2.3. FDI and Dutch Disease

In contrast to remittance and aid, the empirical evidence on the relationship between foreign direct investment and Dutch disease are very scarce. Studies like that of parvin (2013), Biswas and Dasgupta (2012) are among the studies conducted studies on the link between FDI and Dutch disease in specific country empirical frame.

Parvin (2013), tried to investigate the relationship between foreign direct investment and real exchange rates (RER) empirically by using annual data over the period 1960 and 2012 for the Turkish economy based on Neo-classical theory, Heckscher-Ohlin model and OLI framework. The study employed unit root test procedures and Johansen methodology for Co integration in order to investigate long run relationship between FDI and real exchange rate in the study area. The study employed two long run models have been recommended and estimated in this study: In the first regression, FDI is a dependent variable, and the study concludes that an increase in FDI inflow will lead to the appreciation of Turkish currency While, in second long run model, real exchange rate is the dependent variable and Parvin (2013) found that, an increase interest rate causes depreciation of currency and thus affect (fall or rise) FDI inflow in the long run.

Biswas and Dasgupta (2012), on the work of Real Exchange Rate Response to Inward Foreign Direct Investment in Liberalized India. By using a quarterly data for the period 1994-95Q1 to 2009-10Q4, Biswas and Dasgupta (2012) examined the impact of foreign capital inflows in India on the real exchange rate. The Johansen multivariate co-integration test is used to establish a link

between the real exchange rate and relevant macroeconomic variables. They found that Foreign Direct Investment (FDI) affect real exchange rate positively in India, and they conclude that FDI have an appreciation effect both on short-run and long-run in Indian economy.

Like comparison studies, the impact of FDI on spending effect of Dutch disease in cross country studies is mixed in finding; Athukorala and Rajapatirana (2003) examined the nexus of real exchange rate (RER) and capital inflows through a comparative study of Asian and Latin America using pooled data over the period from 1985 to 2000.The study identify that the degree of appreciation in Real exchange rate associated with capital inflow is equivalently much higher in Latin American countries compared to their Asian countries, notwithstanding the fact that the latter experienced far larger foreign capital inflows relative to the size of the economy. While Real exchange rate appreciation is a phenomenon, typically associated with other non-FDI forms of capital inflows in the study area. Finally, the author concludes, in all of fourteen (14) samples countries, FDI was found to have a depreciation effect on real effective exchange rate. This was due to the biased effect of FDI to invest in tradable than non-tradable as a case in most developing countries.

Lartey (2008), using a dynamic panel method, investigate a Dutch disease effect of FDI in developing countries from the period of 1980 to 2000.The study found that both spending and resource movement effect of FDI in developing countries. He further reveals that the existence of a tradeoff between resource movement effects and exchange rate appreciation. If the resources move towards non-tradables is lower, the appreciation of the real exchange rate will be higher via the higher relative price of non-tradable sectors.

Contrary to Lartey's (2008) conclusion, from comparative studies of each type of capital inflow, but in line with Athukorala and Rajapatirana (2003),Naceur et al., (2012), found a depreciation effect of FDI on the REER in a sample of 57 developing countries for the period 1980 to 2007. The impact of FDI on Dutch disease was cancelled over time as domestic productivity increase following FDI inflow. Further, since most of the FDI was used to import machinery that induced production, it leads to a downward pressure on price and REER.

2.2.4 Capital inflow and the traded sector[8] growth

In most of the Dutch Disease studies, focus is given to real exchange rate appreciation and loss in external competitiveness. There are some studies, which directly investigate the effect of external capital inflows on the contraction of traded manufacturing and agricultural sector. In the literature, likewise with the earlier studies above, evidence of contraction of the tradable sector is mixed as well. Rajan and Subramanian (2009) investigated the link between aid, Dutch disease and manufacturing growth conducted in thirty two (32) aid receiving developing countries. The study shows using cross country panel data, a one percentage point increase in the ratio of aid-to-GDP is associated with 0.2 to 0.3 percentage point's reduction in the share of manufacturing sector to total the total GDP. Hence, they conclude that aid inflows into an economy have systematic adverse effects on the developing economy's competitiveness as indicated by the decreasing growth of the export industries, which is in line with the core Dutch Disease model.

Nsor-Ambala (2015) also studied on foreign transfers, manufacturing sector growth and the Dutch disease, with the aim of investigating the impact of external inflow on the growth rate of manufacturing sector in 42 low income countries. The study employed different estimation method i.e. OLS, GMM, Fixed effect. The study did not found, the Dutch effect on the relative growth of manufacturing sector. Even aid flows stimulate manufacturing sector.

Dzansi (2015) to examine the effect of remittance inflow on manufacturing growth, the study used a sample of 40 remittance dependent economies over the period from 1991 to 2004. The study found, positive and robust effect of remittance inflow on manufacturing growth. This indicates that, remittance inflow could improve the standard of living in poor countries is through the effect on manufacturing growth.

2.2.5 Empirical studies on Capital Inflow and Dutch Disease in Ethiopia

In cross country, there is an extensive study on the link between capital inflows and the Dutch disease in developing countries, while little attention has been paid to specific country studies, particularly in Ethiopia.

[8] The traded sector includes both the agricultural and the manufacturing sector growth

Tefri (2007) investigated the "Dutch Disease" effect of foreign aid on the Ethiopian Economy over the period of 1970 to 2003. The study employed three stage-least square methods to examine the link between external aid inflow and export performance in Ethiopia. The study found that an appreciation impact of aid on the real exchange rate. Hence, a massive aid inflows lead to real exchange rate appreciations. Moreover, the study also shows that, the appreciation impact of aid on the real exchange rate can be described by the fact that aid inflows is likely to be invested in the non-tradable service sectors (such as social development, public administration and defense and transport and construction) instead of being directly invested in the tradable sectors like(agriculture and manufacturing). Finally Tefri (2007) conclude that external aid inflows to Ethiopia result in appreciation of exchange rate and hence loss of export competitiveness, and thus, the existence of Dutch disease problem of aid in Ethiopia. Yet, the study has the following limitations. The study employs real exchange rate instead of REER, which shows bilateral export competitiveness rather than multilateral competitiveness and 3SLS might not capture the general dynamic movement of real exchange rate, due to the fact that its persistent nature exchange rate should be specified in dynamic model.

Martin (2009) also studied on the determinants of the real exchange rate in Ethiopia, with the aim of investigating whether a huge capital inflows (mainly, foreign aid and remittances) hinder competitiveness over the period 1995 to 2008.The study employed three co-integration approaches i.e. Unrestricted Error Correction model, Dynamic OLS approach and Fully-Modified OLS approach. The study did not find evidence of a Dutch disease due to capital inflow particularly aid and remittance, both in the short run and in the long run. Rather, the study finds two main long-run determinants of the real exchange rate in Ethiopia: trade openness has a negative impact on the long run value of real exchange rate, whereas terms of trade shock have a positive impact on the real exchange rate. Nonetheless, the study does not reflect the dynamic response of real effective exchange rate to its determinants.

Notwithstanding their immense importance, the previous studies have not made explicit analysis on the link between capital inflow and the real effective exchange rate and resource movement (sectorial decomposition) effect. Moreover, they did not examine the effects real effective exchange rate on net export. Henceforth, this paper attempts to fill this research gap in the Ethiopian literature using the Bayesian VAR model.

CHAPTER THREE

Macroeconomic conditions and capital inflow in Ethiopian economy

3.1 General overview of Ethiopian economy

Ethiopia faced one of the worst droughts in 30 years caused by the El Niño climate conditions, leading to failed harvest and shortage of livestock forage (ADB, 2016).however, according to NBE report (2017),the Ethiopian economy has recovered from this El Niño induced drought and re-gained its growth trajectory in 2016/17. This was made possible as a result the growth in industrial, service and agricultural sector output. According to World Bank report (2016), Ethiopia's location gives it strategic dominance as a jumping off point in the horn of Africa, close to Middle East and its markets. Next to Nigeria, Ethiopia is the second most populous nation in Africa, and its population is about 102 million in 2016. Over the last ten years, the country has achieved double-digit economic growth in real terms, averaging 10.6% per year, which is also the second fastest growing economy in Africa following to Angola. This impressive growth was mainly attributed to service sector (10.3 percent), agricultural sector (6.7 percent) and industrial sector (18.7**)** percent (WB, 2016). Ethiopia is also making remarkable economic and social development gains. Per capita income has more than doubled in real terms since 2004/05. At the same time, poverty has fallen to 29.6 percent in 2010, and likely even more since then, while inequality has remained low with a Gini coefficient of 30% in 2010. (IMF, 2016).

3.2 Ethiopia GDP-Composition by sector

According to World Bank group report (2016), Ethiopia's output tripled in real terms over the past 14 years-driven primarily by service and agriculture. Real gross value added increased from 184 billion birr in 1999 to 571 billion birr in 2013 (WB, 2016). Service contributed to half of output growth in this period, while agriculture contributed by one third. Industry which apart from manufacturing also contributed about 15 percent to growth. The contribution of manufacturing was just 4 percentage points. The structure of output shifted from agriculture towards service. The output share of agriculture declined from 57 percent in 1999 to 42 percent in 2013 (IMF, 2016). Meanwhile, the IMF report also shows that service output increased from 33 to 45 percent, while industry increased from 10 to 13 percent. Hence, the service sector was one of the driving forces

behind Ethiopia's growth acceleration, and the second biggest employer in Ethiopia, accounting for 15 percent of total employment (WB, 2016). This shows that recently, Ethiopia is getting an economic structure which is shifting from the traditional agriculture sector to the modern service sector. Since, the service sector accounts for the lion's share in terms of the structure of GDP (46.6%) in 2014/15 taking the lead from the agriculture sector (NBE, 2015). Agriculture has been the dominant sector accounting over 50% of GDP share and 85% of employment for decades as the manufacturing sector contribution to GDP and employment stagnates at lower levels. The Ethiopian development policies during the last two decades targeted industrialization by giving a leading role for the agriculture sector (NPC, 2017). But, the recent Growth and Transformation Plans (GTP) of Ethiopia aspires to make the country a manufacturing hub by providing infrastructure access and huge industrial parks. The national planning commission report, (2017) adds that the manufacturing sector is expected to make a significant contribution to growth and structural change during the period of GTP II (2014/15-2019/20). Its GDP is projected to grow at annual average rate 23.9% and the GDP share is expected to increase from 4.6% (2014) to 8% (2019/20). On the other hand, the service sector GDP is projected to increase at an annual average rate of 10.1%, lower than its previous period average growth. It is also anticipated to show a modest decline in its share of GDP from 43.4% (2014) to 41.6% by the end of 2019/20 (NPC, 2017).

According to the development strategies of the country, the growth and the dominance of the service sector is planned to be contained as it is considered as a threat and unwanted. The government targets attracting investment in the manufacturing sector by pulling resources out of the service sector. Even though the manufacturing sector growth has huge growth effects, the experiences of low- income countries suggest that it is not the only sector to lead economic growth. Recently, services are considered to be dynamic that can drive economic growth and employment. According to Ghani and Connell (2014), services contribute more than manufacturing sector to output and employment growth in low income countries. Therefore, with the objective of transforming its economy and joining the middle-income country group, Ethiopia is striving to industrialize its economy. However, with a higher share of GDP contributed by the service sector and low level of manufacturing sector growth; industrializing the economy is a daunting task.

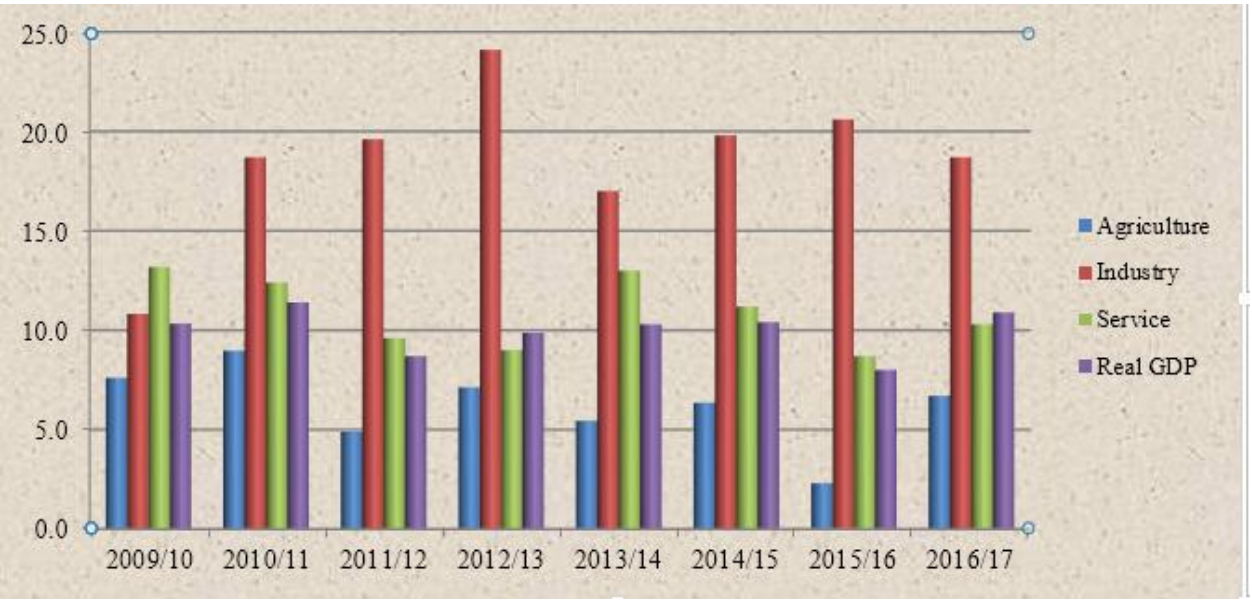

FIGURE 3. 1 REAL GDP GROWTH BY MAJOR SECTORS

SOURCE: NPC, 2017

In 2016/17, the agricultural sector exhibited 6.7 percent growth rate which showed recovery from previous year which merely saw 0.3 percent expansion. Yet, the industrial sector showed 18.7 percent growth rate in 2016/17, which was recorded 21 percent in 2015/16.The agricultural sector is the primary and dominant economic sector in the contribution of GDP growth until 2010/11.but on wards 2010, service sector is the leading role in the contribution of GDP growth. On the other hand, the industrial sector contribution is the least compared to the service sector and agricultural sector. The following figure shows, sector contribution to GDP growth from 2007/08 to 2015/16.

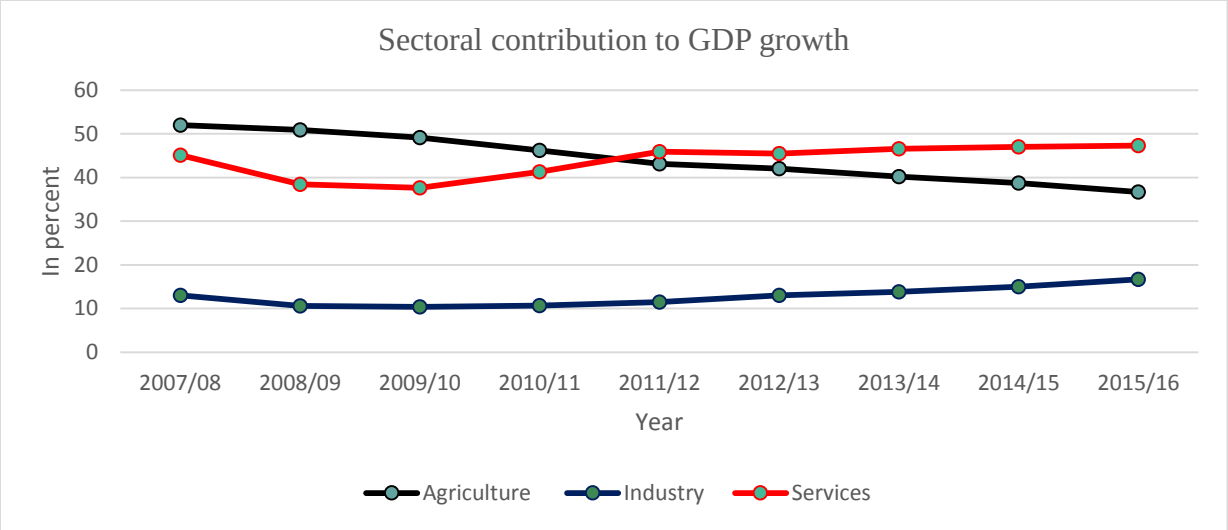

FIGURE 3. 2 SECTORAL CONTRIBUTION TO GDP GROWTH

Ethiopian economic growth is expected to continue at a rapid pace although forecasts suggest that it will moderate to just over 7% over the next five years. In addition to favorable weather conditions for the agriculture during the last couple of years, Conducive Government Policies, Heavy investment to address infrastructure bottlenecks, Expansion of Exports and remittances and increased public expenditure to enhance pro-poor growth are the main drivers for the recent growth of Ethiopian economy (NBE, 2017).

i. Conducive Government Policies:

In recent years, the government has adopted a robust growth and poverty reduction strategy, focusing on infrastructure development, commercialization of agriculture, improvements in access to basic services, as well as on private sector development, including the creation of appropriate regulatory and institutional frameworks to help the private business (NBE, 2017).The licensing procedures and business registration requirements have been modernized, Improvements in policies along with major public investments in infrastructure have reinforced Ethiopia's recent growth in output and services, moreover, the growth and diversification of its exports. Incentives provided to new economic activities have started to yield results. For example, in terms of flower industry, exports of flower have expanded from less than USD 10 million in 2004/05 to close to USD 170 million in 2009/10 and USD 271 million in 2016/17 (NPC,2017). Hence, the success story of the flower industry could be replicable in other economic activities with export potential.

ii. Heavy investment to address infrastructure bottlenecks:

Ethiopia is currently undertaking several huge infrastructure projects aiming to become a favorable investment destination. Since, the development of infrastructure push has been a particularly important factor in driving growth (NBE, 2017). Over the past five years, the Government and public enterprises have invested about USD 89 million on developing new infrastructure. (AFDB, 2017).Afterwards, the heavy public investment in infrastructure and social services has created a major expansion in domestic demand, hence raising overall growth.

iii. Expansion of Exports and remittances:

The introduction of the EPRDF reform measures in 1992 seemed to have a positive impact on export performance. Export earnings showed continuous revival in the years following the reform, reaching a level of USD 453.6 million in 1994/95 and nowadays the country's exports have also been growing strongly, averaged USD 631.41 million from 2006 until 2017. While Coffee is the major export item, contributing, on average, above 35% to the overall foreign exchange earnings of the country. Similarly, remittances and foreign direct investment have also been growing significantly. Remittances by Ethiopian diaspora living abroad to families and invest in Ethiopia have also played a substantial role in the flow of private transfer. (NBE, 2017)

iv. Increased public expenditure to enhance pro-poor growth:

Public expenditure has been growing by about 19 percent per annum since 2003/04. The share devoted to pro-poor sectors in the total increased from about 26 percent in 1999/00 to about 43.3 percent in 2002/03 and 64 percent in 2008/09, up by 26.7 percent per annum since 2003. The public expenditure is concentrated in infrastructure and human capital development. In particular, there has been a major expansion in social services through the construction of new primary schools and health facilities (NBE, 2017).

3.3 Capital inflow and real effective exchange rate movement in the context of Ethiopia

3.3.1 Trends of capital inflow

It is a known fact that most developing countries operate in an economy with scarce resources, and crucial components of these resources are capital-related (Tassew, 2011). The capital needed to boost economic growth and warrant welfare, however, is not adequate domestically hence; there is need for external capital (Murshed, 2017). Like all other developing nations, Ethiopia is historically dependent on inflow of foreign capital to finance investments necessary for the nation's development. In this study, capital inflow consists of remittance, foreign aid and FDI. These external capital inflow in the Ethiopia have been very substantial. According to world Investment Report (2017), Ethiopia as one of the largest recipients of FDI in the continent. Its inflow was increased from 51.9 million USD in 2000/01 to over 3.2 billion USD in 2016/17. In 2016/17 the country recording a 46% growth and became the second largest LDC host economy, up from the fifth position in 2015.Notwithstanding, the UNCTAD data reports that, the inflow of foreign direct investment (FDI) to Africa continued to decline in 2016, Ethiopia attracting more inflows than ever before. Moreover, the report added that "*Even though China was one of the major sources of FDI, foreign investors from other economies such as Turkey have started investing more in Ethiopia's agro-processing, hotels and resorts, as well as in its manufacturing activities.*"

Remittances also one of the main important sources of incomes in Ethiopian economy. Since, the country's law provides for freedom of movement within the country, abroad, emigration, and deportation. The government is also working with UNHCR, the UNDP, the IOM, different charitable organizations and NGO's on migration policy and development to support migrants and returning citizens (Tassew, 2016). Nowadays there is a huge upward movement in remittances payments intended for developing countries in general and Ethiopia in particular, it may be associated with i.e. Immigration between developing and developed countries has increased dramatically in the past and decline in transaction costs as technological improvements have allowed for faster, lower cost mechanisms for the international transfer of payments between individuals (Guiliano and Ruiz Arranz, 2006).The impact of remittance is more profound in Ethiopia, because its inflow was in-

creased from USD 12.5 million in 1980 to USD 460,348 million in 2000; this figure again increased to USD over 5 billion in 2017, (NBE, 2017*)*.Unlike other external capital inflow (such as foreign direct investment and foreign aid), Remittance is stable in nature (Kapur, 2004).An increasing trend in remittance was mainly due to the rising of the Ethiopian migrants in the rest of the world particularly during 1970 to 1990. Foreign aid is also another important source of international capital inflow in Ethiopia. Ethiopia has a long history of receiving foreign aid, dating back to the early 1950s (Alemayhu and kibrom, 2011). The amount of aid inflow was very low until the 1980's, however, afterwards 1980's the importance of foreign flows in Ethiopia grew in importance due to recurrent droughts, fast population growth, huge and growing balance of payments deficits (Alemayhu and kibrom). Nowadays, most of the time, we hear donations made by one country or other multilateral institutions. The question is how much is Ethiopia really getting in foreign aid? While there is no documented data for all forms of aid the country received over the past several years, data is available about development aid Ethiopia received from member countries of OECD. Data from (NBE, 2016) indicates that foreign aid has been increasing in and increasing order ever since 2000, its inflow increased from 399,546.75 million USD in 2000/01 to 1,376,262.9 billion USD in 2015/16 fiscal year. The below figure also indicates the quarterly upward trend in remittance, foreign aid and foreign direct investment.

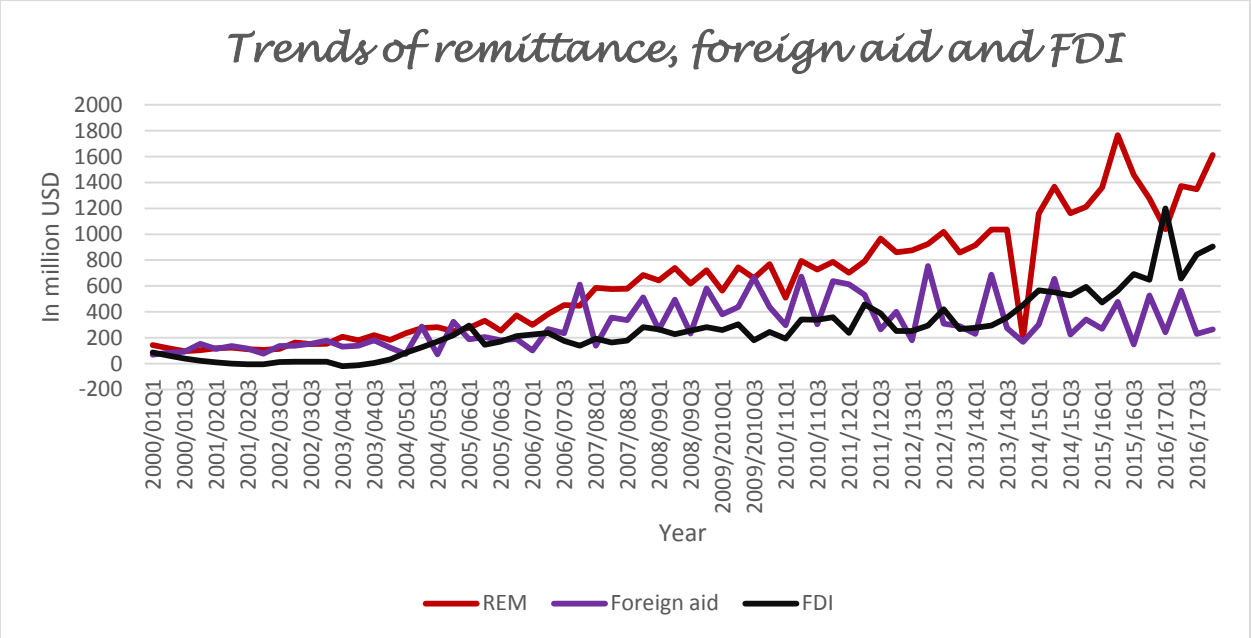

FIGURE 3. 3 TRENDS OF REMITTANCE, FOREIGN AID AND FDI

The above figure 3.3 indicates that, the inflow of capital (remittance, FDI and foreign aid) to Ethiopian economy shows an increasing trend from 2000/01 quarter 1 to 2016/17 quarter 4.

3.3.2 Movement in real effective exchange rate

Ethiopia has operated a managed floating exchange rate regime since 1992.The international monetary fund (IMF) and world bank, have both frequently advised Ethiopia to devaluing its currency to balancing the impact of imported inflation and maintaining export competitiveness as they are mostly unprocessed products and need to stay competitive on price (IMF, 2017). Nevertheless, real effective exchange rate movement was not always in line with the objectives of national bank of Ethiopia. Meanwhile, the real effective exchange rate (REER) of the Birr has been appreciating since 2010/11 due to higher domestic inflation relative to that of its major trading partners (NBE, 2016/17).In 2016/17, the REER appreciation was 7.9 percent compared to 1.1 percent a year earlier owing to strengthening of Birr against trading partner's currency and rising domestic inflation. Conversely, the nominal effective exchange rate (NEER) of the Birr appreciated by 1.6 percent compared to 2.7 percent depreciation in 2015/16 fiscal year.

In the following table 3.1 an increase REERI and NEERI indicates that an appreciation, and the reverse is true for a decrease in REERI and NEERI.

TABLE 3 1 REAL AND NOMINAL EFFECTIVE EXCHANGE RATE

			Percentage Change	
Fiscal Year	REERI	NEERI	REERI	NEERI
2008/09	140.7	67.5	-6.54	-8.7
2009/10	121.2	56.1	-13.84	-17.0
2010/11	122.8	42.9	1.33	-23.5
2011/12	139.4	43.2	13.49	0.7
2012/13	140.2	42.0	0.59	-2.7
2013/14	140.8	40.7	0.44	-3.3
2014/15	157.6	42.3	11.93	4.0
2015/16	159.3	41.2	1.1	-2.7
2016/17	171.9	41.8	7.9	1.6

Source: National bank of Ethiopia, 2017

Where, REERI: Real effective exchange rate index,

NEERI: Nominal effective exchange rate index

The real exchange rate in Ethiopia has been appreciating steadily over the same period time as shown in figure 3.4.

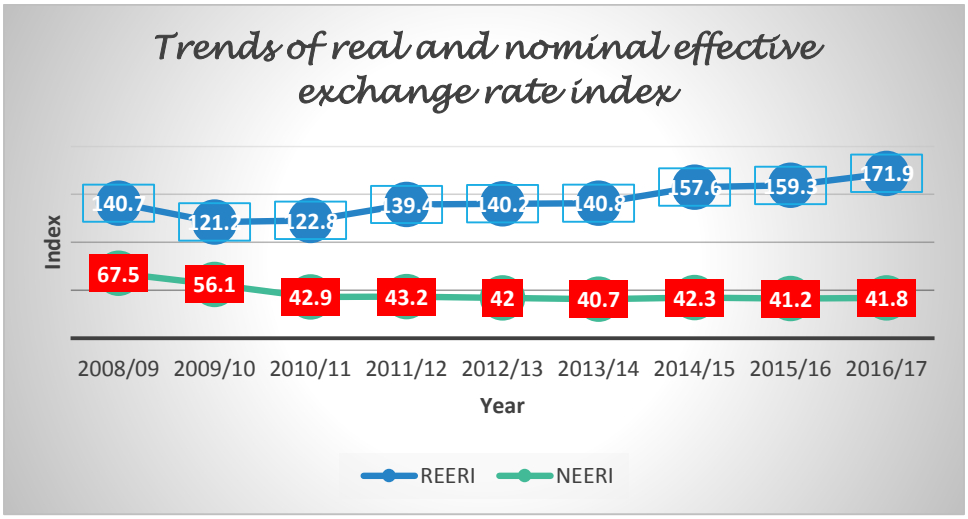

FIGURE 3. 4 TRENDS OF REAL AND NOMINAL EFFECTIVE EXCHANGE RATE INDEX

SOURCE: OWN COMPUTATION FROM NBE.2017

Figure 3.4 shows, real effective exchange rate steadily increase overtime. Moreover, in recent time, the Ethiopian Birr continued to lose ground against the USD and during 2016/17 both the nominal and real effective exchange rate appreciated by 1.6 percent and 7.9 percent respectively. This was mainly due to the higher domestic inflation compared to Ethiopian's major trading partners (NBE, 2017).

3.4 Implication of real effective exchange rate on Ethiopian net export

For instance, consistent with the theory, the appreciation of the REERI for 2008/09, 2013/14, 2015/16 and 2016/172 could hinder the improvement of the competitiveness of Ethiopia's exports in the international market. Yet, for most of the period under consideration, export did not deteriorate following an appreciation of REER, showing the decisive relationship between changes in exchange rate and export value and therefore net export. It is also observed that import also increased over time following on the appreciation of REER.

3.4.1 Trends of export, import and net export

Ethiopia is one of the few African countries which do not have oil and mineral resource. Ethiopia trade is highly dependent on the export of agricultural productivity. Coffee is the prime export product for Ethiopia. Nevertheless, recurring drought and political instability has hampered coffee production. Coffee export accounts for approximately 65% of the foreign exchange for the country (www.economywatch.com>export-import). Apart from coffee, livestock is another major export sector for Ethiopia. A major portion of livestock production is exported to neighboring countries. Other major items of export are gold, leather product, chat and oil seeds. According to economy watch report (2010),Ethiopia imports, food, machinery, transport equipment, fuel, cereals, vehicles and textile, and china is the largest import partner for Ethiopia.it accounts for over 16% of the total import volume. Saudi Arabia, India, Italy and japan also have significant share in Ethiopian import.

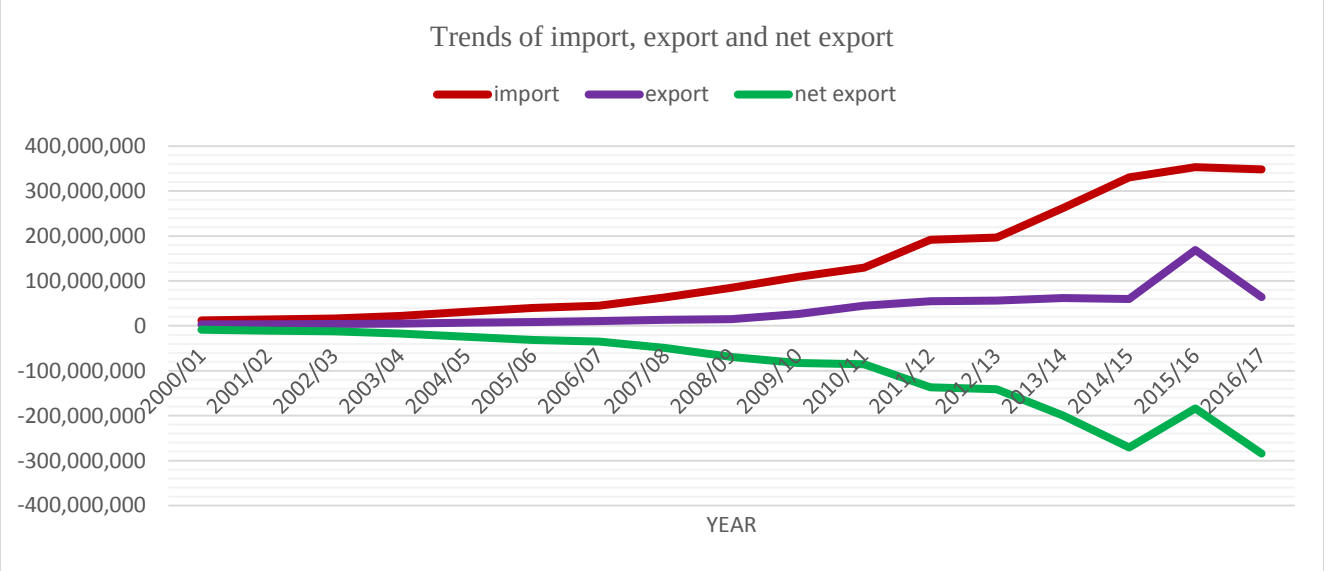

FIGURE 3. 5 TRENDS OF EXPORT, IMPORT AND NET EXPORT

Source: Own computation from NBE data

Figure (3.5) indicates the steady growth of both export and import from 2000/01 to 2016/17.however, the growth rate of import was relatively higher rate while export grew slowly. Hence forth, even if both export and import grew, the net export deficit has been widening because the base for import growth is relatively larger than the export growth.

CHAPTER FOUR

Methodology of the study

This study will attempt to examine the relationship between external capital inflows (remittances, foreign aid and foreign direct investment) and REER. Impacts of the external inflows on changes in the composition of traded and non-traded sectors will also be investigated. This chapter looks at the methods that are adopted to achieve the objective of this study. It mainly focuses on the issues such as model specification, data sources, econometric model, and definitions of variables and different econometric tests that will be used to checks validity of the results.

4.1 Theoretical framework and Model specification

Many Economic theories provide an established theoretical framework for analyzing the impact of surge capital inflow on real exchange rate. This study builds the model based on the neoclassical growth model (Solow, 1956 and Swan, 1958 (cited in Hibbs, 2004)).Solow used the following production function;

$$Y = F(A, K, L) \quad (1)$$

Sy and Tabarraei (2010), construct a model on the relationship between capital flows[9] and the real exchange rate, labelled two countries as home and foreign. The firms in the each country produce tradable and non-tradable sectors.

Economic theory emphasizes that movements of factors of production, from where they are cheap to where they are scarce benefits both the origin and the destination countries. (Pilbeam, 2006). Hence, assume that, the home country is a developing country and therefore its per capita income level is relatively low. In this country, capital (oil revenues, aid, remittance and foreign direct investment) and labor are used to produce non-tradable goods (service sector), hence they generate revenue from the service sector. However, only labor is used in the tradable sector (agricultural and manufacturing sector). The foreign country assumed that was an advanced (developed) coun-

[9] Although the model is best appropriate for an oil exporting economy, is used to for all three types of capital inflow.

try, thus capital and labor are used in the tradable sector, and they generate revenue from the industrial sector, therefore the per capita income and its technical progress are relatively high. While only labor is used in producing non-tradable goods (services).Based on the work of Sy and Tabarraei (2010), categorized countries as;

Home country: The production function for the home country has a Cobb-Douglas form in the non-tradable sector.

$$Y_{NT} = A_{NT} L_{NT}^{\beta} K_{NT}^{1-\beta} \quad ---------- (2)$$

Where $A_{NT}$the productivity in the non-tradable sector, L_{NT} labor in the non-tradable sector and K_{NT} the capital used in the production process.

Let the factor prices be denoted P^O can be interpreted as the price of one unit of capital or capital inflow, s is the government subsidy to domestic firms and W is the wage rate. Therefore, the

Profit of a representative active firm in this sector is defined as revenue minus cost:

$$\Pi_{NT} = P_{NT} Y_{NT} - W L_{NT} - (1 - S) K_{NT} P^{O} \quad ----------(3)$$

Both production inputs are variable inputs. Taking the factor prices as given from the factor markets, the firm's problem is to choose (K, L), where K≥0 and L≥0, so as to maximize profit. An

Interior solution will satisfy the first order condition. The first order condition for maximum

Profit could be given by:

$$\beta P_{NT} A_{NT} \left(\frac{K_{NT}}{L_{NT}}\right).^{1-\beta} = W \quad ---------- (4)$$

$$1 - \beta P_{NT} A_{NT} \left(\frac{L_{NT}}{K_{NT}}\right).^{\beta} = (1 - S) P^{O} \quad ---------- (5)$$

In the tradable sector, the production function is a linear function of the labor force: it describes a linear relationship between the input (labor) and output. The form can be represented as;

$$Y_T = A_T L_T \quad (6)$$

In a small open economy[10]assumption, integrated with the rest of the world in both capital and goods market. However, we initially assume that, there are two goods both tradable and non-tradable. Consumers derive utility from consuming both goods. As earlier, we consider a representative agent economy. The household receives an endowment Y^T of tradable good and Y^{NT} of non-tradable good. Such models of international trade often assume the law of one price[11] i.e. the price which prevails at all markets (representative price). The international price of tradable good is assumed to be constant and normalized to unity. Thus, the profit is given by:

$$\Pi_T = A_T L_T - W L_T \quad (7)$$

The first order condition to maximize this profit function with respect to labor is:

$$A_T = W \quad (8)$$

The assumption, labor market is homogenous across the sector of production is common in open economy macro model and vital for the Balassa-Samuelson hypothesis[12] .Then, wages are equal in the tradable sector and non-tradable sector, hence the right hand side of equations (4) and (8) are equal. Combining this result with equation (5), and yields;

$$P_{NT} = \left(\frac{A^T}{\beta A_{NT}}\right)^{\beta} \left(\frac{1-SP^O}{1-\beta A_{NT}}\right)^{1-\beta} \quad (9)$$

[10] A small open economy (SOE) is an economy that participates in international trade, but is small enough compared to its trading partner that its policies do not alter world prices.(http://en.m.wikipedia.org>wiki>small open economy)

[11] The law of one price states that the price of the same commodity in two different countries must be equal when expressed in the same currency (the absolute version).

[12] The Balassa-samuelson (BS) hypothesis: based on the assumption that productivity varies more by country in the traded goods sector than in other sector, it implies that countries with rapidly expanding economies should tend to have more rapidly appreciating exchange rate.

Foreign country: the tradable sector in the foreign country uses labor and the imported resources (imported oil) from the domestic country.

The production function for the foreign country has a Cobb-Douglas form in the tradable Sector.

$$Y_T^* = A_T^*(L_T^*).^{\gamma}\,(K^*).^{1-\gamma} - (10)$$

Where $A_T$the productivity is in the tradable sector, L_T is labor in the non-tradable sector and $K_T$is the capital used in the production process and the asterisk (*) indicates the value in the foreign country and γ is the parameter.

The profit can be written as:

$$\Pi_T^* = P_T^* Y_T^* - W^* L_T^* - eP^O Q^* - (11)$$

Then, the partial differentiation of profit function with respect to their respective factor prices (price of labor and price of capital).hence, the first order condition is:

$$\gamma P_T^* A_T^* (\frac{Q^*}{L_T^*}).^{1-\gamma} = W^* - (12)$$

$$(1-\gamma) P_T^* A_T^* \left(\frac{L_T^*}{Q^*}\right).^{\gamma} = eP^0 - (13)$$

Under the assumption that the law of one price holds for the tradable i.e. $P_T^* = eP_{T.} = e$. That means, there are no frictions whatsoever that will put a wedge between the two pricesand then normalized the price of tradables in the home country.

Equation (13) therefore, can be simplified to:

$$(1-\gamma) A_T^* \left(\frac{L_T^*}{Q^*}\right).^{\gamma} = P^0, \quad 0 < \gamma < 1 - (14)$$

The non-tradable sector in foreign country uses only labor as a production factor: hence the profit and production function can be,

$$\Pi_{NT}^* = P_{NT}^* Y_{NT}^* - W^* L_{NT}^* - (15)$$

$$Y_{NT}^* = A_{NT}^* L_{NT}^* - (16)$$

The first order condition imposes, $P_{NT}^{*}A_{NT}^{*} = W^{*}$,as in the home country, wages should be equal in the two sectors. Combining these conditions yields:

$$P_{NT}^{*} = \gamma e\frac{A_T^{*}}{A_{NT}^{*}}\left(\frac{(1-\gamma)A_T}{P^O}\right).^{\frac{1-\gamma}{\gamma}} ----------------------------(17)$$

If we suppose that the price index is a geometric average of the prices of the tradables and non-tradables then the real exchange rate can be written as $RER = \frac{eP}{P^*}$,where,

$$P = P_{NT}^{\Theta}P_T^{1-\Theta}, \qquad P^* = P_{NT}^{*\Theta}P_T^{*1-\Theta} ---------------------------(18)$$

By replacing equations (9) and (17) in the above equation, we get

$$RER = \left[\frac{\left(\frac{A_T}{\beta A_{NT}}\right).^{\beta}\left(\frac{(1-S)P^O}{(1-\beta)A_{NT}}\right).^{1-\beta}}{\frac{\gamma A_T^*}{A_{NT}^*}\left(\frac{(1-\gamma)A_T}{P^O}\right).^{\frac{1-\gamma}{\gamma}}}\right]^{\Theta} -------------------------(19)$$

P^O is the price of a unit of capital. Yet, since when the price of tradable is normalized to 1, it is the terms of trade as well. Log-linearization[13] of the above equation. Then, it yields,

$$r\tilde{e}r = \Theta\left[\left(\beta\,\tilde{a}T - \frac{1}{Y}\,\acute{a}T\right) - (\tilde{a}NT - \acute{a}NT) + P^{\tilde{O}}\left(\frac{1}{Y} - \beta\right)\right] -------------- (20)$$

This equation states that a positive change in the terms of trade, i.e. the price of capital affects the real exchange rate positively (since$\frac{1}{Y} - \beta \geq 0$). In addition, the home country will experience a Real exchange rate appreciation if its productivity growth advantage in tradable goods is larger

[13] Log-linearization is the first order Taylor expansion, expressed in percentage terms than in level differences. Since in economics, we prefer to think in terms of percentage deviation from reference values, because things are not always consistent or well defined.

than its productivity growth advantage in the non-tradables. Whereas, the home country will experience a real exchange rate depreciation if its productivity growth advantage in tradable goods is lower than its productivity growth advantage in the non-tradables. This represents the Balassa-Samuelson effect. The terms of trade and the Balassa-Samuelson effect, therefore, are the main driving forces of exchange rate movements in the long run.

The above equation (20), contains other determinants of exchange rate other than capital inflow. These other determinants of exchange rate are the main deriving forces of real exchange rate in developing countries (Edward (1989). Recent empirical studies on the impact of capital inflow on real exchange rate in developing countries (See Martins (2009), Naceur *et al.,* (2012), Rabbi *et al.,* (2013) and Uddin **(**2015**))** founds that the impacts of capital inflow on real exchange rate vary with the types of capital inflows. To fill the gaps of the previous studies, this study identifies different types of capital inflow (Aid, FDI and Remittance).From this analysis, it is noticeable that international capital inflows may increase domestic expenditure on both traded and non-traded sector goods and services. If this expenditure falls disproportionately on non-traded sector, then prices of non-traded sector goods and services may rise and leads to REER appreciation. To investigate this relationship we specified REER as the dependent variable in a spending effect equation. For this study to capture the impact of capital inflow on the real effective exchange rate of Ethiopia through the spending effect model, following, Edward (1989), Alemayehu (2002), Martins (2009), Rabii*et al.,* (2013) and Uddin **(**2015**)**is used.

$$log\ (reer_t) = \beta_0 + \beta_1 \log(tot_t) + \beta_2 \log(techp_t) + \beta_3 \log(govc_t) + \beta_4 \log(top_t) + \beta_5 \log(domcre_t) + \beta_6 \log(rem_t) + \beta_7 \log(aid_t) + \beta_8(fdi_t) + \varepsilon_t \quad ----------(\mathbf{21})$$

Where, $\boldsymbol{reer}$= Real effective exchange rate,$\boldsymbol{techp}$= technological progress$\boldsymbol{govc}$= Government consumption of non-tradable goods and service, $\boldsymbol{tot}$= Terms of trade, top= trade openness$\boldsymbol{aid}$= Foreign aid, $\boldsymbol{fdi}$= Foreign direct investment, $\boldsymbol{rem}$= Remittance,$domcre$ = Domestic credit$\boldsymbol{\varepsilon}$= error term and = $\boldsymbol{\beta_0 - \beta_8}$are coefficients to be estimated. All variables are expressed in log.

4.2 Capital inflow and Sectorial Output Decomposition

After, investigating the relationship between capital inflow and the real effective exchange rate, we then explore the impact of capital inflow on the tradable to non-tradable output ratio (agriculture, manufacturing and service sectors in Ethiopia). As prices of non-traded goods and services increase following a surge in external inflows, resource moves to non-traded sector from tradable sector. Consequently, the traded sector could shrinks, while others gain importance in the productive structure of the economy.

To capture this resource movement effect, we employ traded to non-traded ratio (TNT) as the dependent variable in the resource movement effect equation. To capture the impact of these resource movement effect, the following tradable to non-tradable (TNT) ratio model can be used following Lartey et.al (2008) and Murshedet.al (2015) is used.

$$log\ (TNT_t) = \beta_0 + \beta_1 \log(tot_t) + \beta_2 \log(techp_t) + \beta_3 \log(govc_t) + \beta_4 \log(top_t) + \beta_5 \log(domcre_t) + \beta_6 \log(rem_t) + \beta_7 \log(aid_t) + \beta_8(fdi_t) + \varepsilon_t \quad ----------(\mathbf{22})$$

Where, TNT=Traded to non-traded sector ratio, $\boldsymbol{reer}$= Real effective exchange rate,$\boldsymbol{techp}$= technological[14] progress $\boldsymbol{govc}$= Government consumption of non-tradable goods and service, $\boldsymbol{tot}$= Terms of trade, top= trade openess $\boldsymbol{aid}$= Foreign aid, $\boldsymbol{fdi}$= Foreign direct investment, $\boldsymbol{rem}$= Remittance,$domcre$ = domestic credit $\boldsymbol{\varepsilon}$= error term and = $\boldsymbol{\beta_0 - \beta_8}$ are coefficients to be estimated.

4.3 The impact of real effective exchange rate appreciation on net export

In this study, the modeling of net export follows similar equation to that of Gomez and Alvarez-Ude (2006), which emphasized the effect of exchange rate on trade balance is used. The model begins from equilibrium goods market in an open economy that can be described by the following equations**:**

[14] Edward (1989), the data for this variable is not available for most developing countries including Ethiopia. As a result, this variable is not included in empirical estimation.

$$Y = C(Y - T) + I(Y, r) + G + X(Y^*, \varepsilon) - M(Y, \varepsilon) - - - - - - - - - - (23)$$

Where, Y represents total domestic income, C represents consumer spending, and T represents income tax, I represents investment, r is interest rate, G represents government spending, $\boldsymbol{\varepsilon}$represents real exchange rate, M represents import, X represents export, and Y* represents foreign income. The real exchange rate is given by:

$$\varepsilon = \frac{EP^*}{P} - (24)$$

Where, E ; nominal exchange rate

P^*&P; Foreign and domestic price level respectively.

As the objective is to examine the relationship between net export (NX) and exchange rate, other variables are assumed to be constant.

The net export is:

$$NX = X - M - (25)$$

By substituting the export and import equations given in equation (24) into(25), we can define the net export as;

$$NX = X(Y^*, \varepsilon) - M(Y, \boldsymbol{\varepsilon}) - (26)$$

After that, substitute equation *(24)* into equation *(26),* the NX can be given by*:*

$$NX = X\left(Y^*, \frac{EP^*}{P}\right) - M\left(Y, \frac{EP^*}{P}\right) - (27)$$

Assume$\frac{EP^*}{P}$ is stationary, we can rewrite the equation *(26)* as;

$$NX = NX(Y, Y^*, \varepsilon) - (28)$$

Therefore, equation (28) expresses the net export as a function of the levels of domestic and foreign income and the real exchange rate.

$$lnNX_t = \Theta_0 + \Theta_1(lnY_t) + \Theta_2(lnY_t^*) + \Theta_3(lnREER_t) + \Theta_4(lnrem) + \Theta_5(lnaid) + \Theta_6(lnfdi)$$

$$- (29)$$

Where ln represents natural logarithm, $u_t$is assumed to be a white-noise process, and net export,NX_t represents net export in Ethiopia and $Y_t$is real gross domestic product a proxy for real domestic national income, REER is the real effective exchange rate and Y_t^* represent the average real gross domestic product of Ethiopia's trading partner national income a proxy for foreign income.

4.4 Definition of variable and source of data

All the data are obtained from secondary sources. The study employed quarterly data over the period of 2000/01Q1 up to 2016/17Q4, which gives a total of 68 observations. The variables used in the model are in Annex 1.

4.5 Methods of data Analysis

An econometric method of data analysis will be used. Precisely, this section clearly provides a brief overview of the relevant econometric method for the study like, econometric models, stationary and non-stationarity and model diagnostic test will covered and the econometric methodology part will be analyzed using E-view version 10 statistical software package.

4.5.1Auto regressive distributed lag model (ARDL)

Most econometric literature provides different methodological procedures to empirically examine the long-run relationship and dynamic interactions between two or more time-series variables. The most commonly used methods include the two-step residual based procedure for testing the null hypothesis of no co-integration which is attributed to Engle and Granger (1987) and the full information maximum likelihood-based approach of Johansen (1988) approach, all this methods of co-integration required that the variables should be integrated of the same order i.e., order one I(1) (Pesaran et al., 1999). As a result, these methods of Co-integration test cannot apply when there is a mixture of I(0) and I(1) variables in our model. Pesaran and Shin (1999)present a newly developed approach to co-integration, is the Autoregressive Distributed Lag ($ARDL$) co-integration

technique or bound co-integration technique and further extended by Pesaran et al. (2001) is adopted for this study. Furthermore, the reason using ARDL model are as follows:

- it does not require all variables to be integrated of the same order I(1) as the Engle granger and Johnson co-integration approach and it is still applicable irrespective of whether the underlying regressor's are purely I(0), I(1) or mutually co-integrated.
- It is simple, allowing co-integration relationship once the lag order of the model is identified.
- It does not consider the problems arising from the different order of integration of the variables.
- The test is relatively more efficient in small samples or finite sample data sizes

The ARDL approach requires three steps. The first step is to check the existence of long run relationship among the variables of interest that is determined by F- test. The second step requires the estimation of long run relationship and to determine their values, thereafter the short run elasticity of the variables with error correction representation of the ARDL model. This application of error correction version of the ARDL model is mainly to determine the speed of adjustment to the equilibrium. Meaning that the ECM estimates the speed at which our dependent variable returns to the equilibrium given the change in the independent variable. The study proceeds to estimate the short run and long run relationship by following the Unrestricted Error Correction Model (UECM) which is unrestricted intercepts and no trends based on the assumption made by Pesaran et.al (2001).

The ARDL error correction model used for the testing the long-run relationship of the model is given as:

$$\Delta y_t = -\sum_{i=1}^{p-1} \Upsilon_i \Delta y_{t-1} + \sum_{j=1}^{k} \sum_{i=1}^{qj-1} \Delta x_{j,t-j}{}' B_j\,, i - \phi \left(\sum_{j}^{y_{t-}\alpha -} = 1, x_{j,}\, t' \Theta_j \right) + \varepsilon_t - -$$

$$- (1)$$

Where,Δ is first difference operator, shows the speed of adjustment, and shows the long-run coefficients. Using this cointegration equation Pesaran et al (2001) develop a method to assess the existence of long-run association between variables called bound test approach. And the bound test can be representing from equation (1) as:

$$\Delta y_t = -\sum_{i=1}^{p-1} \Upsilon_i \Delta y_{t-1} + \sum_{j=1}^{k} \sum_{i=1}^{qj-1} \Delta x_{j,t-j}{}' B_j\, , i - \rho y_{t-1} - \alpha - \sum_{j=1}^{k} x_{j,t-1}\, \psi_j + \varepsilon_t - - ----------------------------(2)$$

For the above equation, Peasaran et al., (2001) develop a test between the null of no long- run relation: null and alternative hypotheses for co integration are as follows:

The null of no co integration, i.e.

$H0$=$\psi_1 = \psi_2 ----= \psi_k = 0$ (No long run relationship)

Against the alternative hypothesis

$H1$=$\psi_1 \neq \psi_2 ----\neq \psi_k \neq 0$ (A long run relationship exist)

The long run relationship of the underlying variables is detected through the F-statistic (Wald test). In this approach, long run relationship of the series is said to be established when the F-statistic exceeds the critical value. The test for co-integration when the independent variables are I(d) (where $0 \leq d \leq 1$): a lower value assuming the regressor's are I(0) and an upper value assuming purely I(1) regressor's. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected irrespective of the orders of integration for the time series.

4.5.2 Bayesian VAR model

The study also uses a Bayesian VAR framework to examine the impact of real effective exchange rate on net export. Bayesian vector autoregressive (BVAR) is constructed upon the VAR model by using Bayesian methods to estimate a vector autoregressive (VAR) model.

The reason for using Bayesian VAR model in this study as follows: Initially, in my study, the two model specifications may be subject to simultaneous bias. Hence, estimation and inference from

those models might be complicated by the fact that endogenous variables may appear on both side of the equation. The alternative approach to handle such kinds of specification that overcome the limitations of simultaneous equation model was Vector Autoregressive (VAR) model. But, a common feature of VAR like all other popular multivariate time series models is that, as researchers include more variables, the number of parameters quickly grows large (Over-parameterization). The problem of over parametrization is severe, when dealing with models that have many variables and as well when the time dimension of the data is short. This is the case in Ethiopia for which the available time series data are very short. Hence, the most popular way to tackle the issue of the large number of parameters is to use Bayesian inference, which, allows researchers to avoid over fitting the observed sample via its use of priors. I.e. based on the idea of shrinkage which is restricting some of the elements of the coefficient matrix of the VAR model and the associated variance-covariance matrix to zero. (Essentially, focus on the prior distributions that they themselves depend on a substantially smaller number of parameters (hyper parameter). Sims (1980).

The functional principle of Bayesian VAR follows perfectly the Bayes rule, by forming a (subjective) prior probability for the object of interest and updating the prior with the (objective) information coming from the data sample, thus forming the posterior distribution.(Geweke and Whiteman, 2006). Bayesian inference uses the prior probability distribution of an uncertain parameter (Sivia and skilling, 2006). This prior probability distribution expresses uncertainty about the parameter before taking into account the data to be used. (Statisticat, 2016). The Bayesian approach provides a formal framework to facilitate the inclusion of extraneous economic information about the VAR model parameters that would be difficult to incorporate in frequentist[15] analysis.it is also incorporating such prior superfluous information in the estimation and inference. (Dorfman, 1997)

Based on Nalban (2015), the general model equation of the Bayesian Vector Autoregressive Model (BVAR) in this study will take the form:

$$Y = b_0 + \sum_{i=1}^{k} b_i(X_i) + \epsilon - - - - - - - - - - - - - - - - (4.3)$$

From equation 4.1, we can re-write a general VAR (P) model equation as:

$$Y_t = c + B_1 Y_{t-1} + B_2 Y_{t-2} \pm - - - \pm B_p Y_{t-p} + \epsilon_t - - - - (4.4)$$

A standard VAR model with *n* endogenous variables and *p* lags written in a compact form is represented as:

$$Y_t = X_t b + \boldsymbol{\varepsilon_t}, t = 1,\text{----------}, \text{T} - (4.3)$$

Where$Y_t$is the *n*x1 vector of endogenous variables, $X_t = I_n \Theta\left(1, Y_{t-1,} - -, Y_{t-p}\right)$ ′of dimensions $n\ x\ nk$ $(k\ =\ np + 1\ )$holds the constant and lagged terms,$b\ =\ vec(B), B\ =\ (B0, B1, \ldots, Bp\ )$' is $nkx1$ vector of parameters, while εt is a $nx1$ vector ofresiduals which are independent and identically distributed$N(0, \varepsilon)$. The parameters of interest are VAR coefficients(b) and Σ (residuals variance-covariance matrix).

Using the Bayes' rule, the posterior distribution of the parameters $p(b, \Sigma\ |Y)$ is equal to:

$$P(b, \Sigma\ |Y) = \frac{P(Y \mid b, \Sigma)P(b, \Sigma)}{P(Y)} \propto P(Y \mid b, \Sigma)P(b, \Sigma) - - - - - - - - - - - - - - (4.5)$$

Where $P(Y\ |b, \Sigma)$ is the model likelihood, $P(b, \Sigma)$ is the joint prior distribution and $p(Y)$ is the marginal likelihood. The proportionality in (4.2) follows from the fact that the marginal likelihood does not depend on the parameters to be estimated, yielding the posterior as being proportional to the likelihood function times the prior. (Korobilis, 2011). The selection of appropriate prior distribution is the most important stage in Bayesian modeling. When setting the prior of the covariance matrix of the parameters, there is a wide variety to choose from: Minnesota prior, Normal-Wishart prior, Normal-Diffuse prior, etc. In Bayesian analysis an important issue is the specification of the prior for the parameters of interest. Often a prior is specified that simplifies the posterior analysis. In particular, it is convenient to specify the prior such that the posterior is from a known family of distributions.

To sum up, the supremacy of Bayesian VAR model over other macro-economic model in explaining the dynamic relationship among macro-economic variables;

- ✓ Incorporate additional information on parameters through priors. This "makes sense".
- ✓ It have a better estimation performance than alternative methods in small samples (Rabanal & Rubio-Ramirez, 2005).
- ✓ To overcome the over fitting problem by appending the sample information with the prior probabilities for the parameter i.e. shrinking the parameters via prior distributions.
- ✓ In the BVAR model, the priors act as restrictions on coefficients, shrinking and sharpening the estimates, and generating more accurate forecasts or forecasting accuracy For example, in this study, remittance shock, and foreign aid shock. The Bayesian VARs model in this study employs the Minnesota prior to estimate.

4.5.2.1 The Minnesota prior estimation

The Minnesota prior as suggested by (Litterman,1980), is the most prevalent method used for prior distribution is the prior .This prior, transforms the VAR model into random walk process for each variable (Luetkepohl, 2011).And also Minnesota (Litterman) prior represents a very flexible way of forming a priori distribution, which can be straightforwardly reproduced. Only a reduced number of hyper parameters are required in order to construct the Minnesota prior for a model of any size. Moreover, the hyper parameters enclose some important statistical evidences specifically for economic time series: unit roots, past values of a variable contain more information than past values of the other variables in the system, observations from the recent past are more important for current values than the ones in the more distant past, etc. (Nalban,2015). The prior distributions of the parameters considered here in this study are the Minnesota priors. This kind of priors is the most common among empirical work related to Bayesian VAR models, mainly because they reflect the typical trending behavior of macroeconomic time series (Litterman, 1986). Likewise, (Bobasu, 2016) imposing Minnesota priors is the simplest way of dealing with the variance covariance matrix of the VAR coefficients.

Yet, unlike other VAR methods where restrictions are imposed with certainty, in other words, the coefficients of the variables deemed less important by a researcher are assigned a value of zero and hence the variables are excluded from the model with certainty. In addition, the Minnesota

prior expresses the degrees of uncertainty the specification of prior variance for each coefficient of the variables in the model (Litterman, 1986) and (Ciccarelli and Rebucci, 2003).

4.5.2.2 Choosing the Value of appropriate Hyper-parameters

In Bayesian statistics, a hyper parameter is a parameter of a prior distribution.in Bayesian VAR model for different values of three hyper-parameters: namely the overall, other, and decay hyper-parameters that relate to the Minnesota prior covariance matrix (Sims, 1984). The Minnesota prior approach the coefficient of the first-own lag is set equal to one and all the other coefficients, including all the other own-lag coefficients and the coefficients for the other variables in the Bayesian VAR system, are set equal to zero (Litterman,1980). The value of hyper parameter L1 (over all tightness of the parameter is in between 0 and 1, L2 (relative cross variable weight hyper parameter is also in between 0 and 1, while L3 (lag decay hyper parameter) is greater than zero, i.e.between1 and 2 (http:linkedin.com>pulse>var).Based on Utlaut and Roye (1986), this study used the standard values of hyper-parameters and set the prior value of the autoregressive (AR) coefficients on its own first lag for each variable to one. Hence, the value of Lamda1 1=1(overall tightness), Lamda2=0.5(cross-equation tightness) and Lamda3=0.1(harmonic lag decay). To sum up, the key importance of Bayesian vector autoregressive (BVAR) model is that it avoids the problems of collinearity and over-parameterization that often occur with the use of VAR models since BVAR incorporates a natural and principled way of combining prior information with data. This means that in our data analysis, we can incorporate past information about a parameter and form a prior distribution for current and future analysis and prediction (Wasserman. 2004).

4.6 Pre and post diagnostic test of the model

4.6.1 Stationarity and Unit root Test

When dealing with time series data, it is necessary to consider whether the series is stationary or not. A series that is not stationary is referred to as non-stationary, and a series is said to be integrated and is denoted as $I(d)$ where(d) is the order of integration [16](Alemayhu, 2012). Most of

[16] The order of integration refers to the number of unit roots in the series, or the number of differencing operations it takes to make a variable stationary.

macro-economic variables typically follow a non-stationary path, nonetheless, in a classical regression model we normally deal with the relationship between stationary variables (Alemayhu, 2012). If the dependent variable is a function of a non-stationary process, the regression will produce spurious results (Gujarati et al., 2009). In other words, the dependent variable will follow the trend of its explanatory variables and the result will be meaningless. In such a case, it may possible to get significant t-ratios and a very high R^2 even though the trending variables are completely unrelated (Gujarati et al., 2009). Hence we need to perform unit root or stationarity tests before proceeding estimation of parameters.

There are several ways to test the stationarity of the series. Some of these are: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS), GLS detrended Dickey-Fuller, Elliott, Rothenberg, and Stock Point Optimal (ERS), and Ng and Perron (NP) unit root tests. The Dickey-Fuller (augmented Dickey-Fuller) test will be considered in this study.

Dickey-Fuller and the Augmented Dickey-Fuller Tests

The stationarity of a time series can be tested directly with a unit root test. In the literature we see both the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) most frequently adopted as the procedure of testing unit root. The dickey-fuller test is starting with to estimate the following Autoregressive order one (AR (1) model (Wooldridge, 2016 p, 598).

$$\boldsymbol{y_t = \Theta y_{t-1} + u_t} \qquad \boldsymbol{, u_t \sim IID(0, \delta^2)}$$

In difference form, the above random walk equation can be re write as;

$y_t - y_{t-1} = \Theta y_{t-1} - y_{t-1} + u_t$(Subtract$yt - 1$ from both side)

$$\Delta y_t = y_{t-1}(\Theta - 1) + u_t$$

To simplify the above equation, let $\delta = (\Theta - 1)$, the above equation becomes;

$$\Delta y_t = \boldsymbol{\delta y_{t-1} + u_t}$$

In addition to the above random walk model (RW), the Dickey Fuller test is estimated in the following different forms (Guajarati (2004)**.**

$\boldsymbol{y_t}$is random walk with drift :$\Delta y_t = c_1 + \boldsymbol{\delta y_{t-1}} + \boldsymbol{u_t}$(H0: δ=0 and H1: δ <0)

y_t is random walk with drift and trend: $\Delta y_t = c_1 + c_2 t + \boldsymbol{\delta y_{t-1}} + \boldsymbol{u_t}$(H0: δ=0 and H1: δ <0**)**

In the above equation, y_t is the relevant time series and Δ is a first difference operator,c_1 is the constant and $c_{2t}$is trend term, t is a linear trend and u_t is the error term.u_tShould satisfy three things: Uncorrelated error terms, the assumptions of normality and constant error variance. The results of a DF test can be biased if the error terms are not white noise or serially correlated. (Harris and Sollis, 2003).

The Dicky fuller type of test are sensitive to structural break in the data. Such test confuse structural break with non-stationarity (Alemayhu et.al, 2012). Essentially, stationary variable with some structural break may be labelled to be non- stationary. Fortunately, there are some tests that take structural break into consideration in testing for unit root. Andrew and zivot, 1992 (cited in Alemayhu et.al, 2012) provided the test for unit root of one structural break while Reyes, 1998 introduced the test for unit root in the case of two breaks and they distinguished between additive outliers and innovational outliers (cited in Alemayhu et.al, 2012).

In the above equation, the test for unit root using ADF is when null hypothesis is that there exists a unit root in the time series (non-stationary time series), which is, $H0$: $\delta = 0$against the alternative hypothesis that the time series is stationary (no unit root) which is, $H1$: $\delta < 0$.In both tests, ifthe calculated statistic (t-statistic) is less in absolute terms than the MacKinnon (1996) values (t-critical), the null hypothesis is accepted. It means there is a unit root (not stationary) in the series. The opposite is true when the calculated statistic (t-statistic) is greater than the MacKinnon critical value[17].

[17] To reject or accept the null hypothesis at convectional significance level (1%, 5% and 10%) is based on the DF distribution of:

$DF_\tau = \frac{\hat{\theta}-1}{SE(\hat{\theta})}$ Where,$D_{F\tau}$, is critical value of tau (τ) statistics,$\hat{\theta}$is the estimated coefficient ofy_{t-1} and $SE(\hat{\theta})$ is standard error of $\hat{\theta}$. If so, if the calculated statistics is greater than the critical DF statistics we reject the null hypothesis and we can conclude that the series is stationary (no unit root) and the reverse is true.

4.6.2 Lag Length Selection Criteria

Initially, before estimating of the VAR type of model, we should decide how many lags of the variables included in the specification, to choose the order of the model that yields good model. The order of the VAR model refers to the optimal number of lags that should be included in the model. Lütkepohl (2005) shows that inappropriate lag length affected the power of estimation and forecasting. I.e. choosing a higher order lag length over the true lag length generates an increase in the mean square forecast errors of the model and a lower order lag length than the true lag length often causes auto correlated error. Ciccarelli (2003) identifies, the problems of unstructured VAR includes high degree of multi collinearity and many degrees of freedom used for large lag operator.

There are several criterion for choosing the optimal lag length in a time series:the Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQ),root mean square error(RMSE), Mean absolute error (MAE),Bias proportion (BP), Log likelihood (LIK).Above all, the widely applicable and a well-known information criterion approach to lag length selection are Akaike's Information Criterion (AIC)(Akaike,1973). In the current context it is given by:

$$AIC = \log \hat{\sigma}^2 + 2\frac{p + q + 1}{T}$$

Where, $\hat{\sigma}^2$ is the estimated variance of εt. An alternative is Schwarz's Bayesian Information Criterion (*SC*, *BIC* or *SBC*), proposed by Schwarz (1978), which is given by:

$$BIC = \log \hat{\sigma}^2 + \frac{p + q + 1}{T}\log T$$

Both criteria are likelihood-based and represent a different trade-off between 'fit', as measured by the log likelihood value, and 'parsimony', as measured by the number of free parameters, p + q + 1 (assuming that a constant is included in the model). Usually, the model with the smallest AIC or BIC value is preferred.

4.7 Impulse Response Function and Variance Decomposition

Both impulse response and variance decomposition are useful in assessing how shocks or innovations to economic variables reverberate through a system. These two approaches are useful for characterizing the dynamic behavior of the VAR model (Sims, 1980).

4.7.1 Impulse Response Function

In practical work, it is often of interest to know the response of one variable to an impulse in another variable in a system that involves a number of further variables as well. Impulse response is very important in tracing the impact of any variables on others in the system. It is essential tool in policy effectiveness and empirical causal analysis (Utlaut and Roye, 2010). Impulse response function (IRFs) shows the effect of shocks on the adjustment path of the variable.An impulse response function traces the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables (Utlaut and Roye, 2010).A shock to the j^{th} variable directly affects the j^{th} variable and is transmitted to all the endogenous variables through dynamic structure of the VAR (Stock and Watson, 2001).

Impulse response functions represent the mechanisms through which shock spread over time. Let us consider a representation of a covariance stationary VAR (p).

$$Y_t = C(L)_{\varepsilon t}$$

$$\sum_{i=0}^{\infty} C_i \, \varepsilon_t$$

The matrix $c_j$has the interpretation $\frac{\partial Y_J}{\partial \varepsilon_{\cdot t}{}'} c_j$

$\frac{\partial Y_t - j}{\partial \varepsilon_{\cdot t}{}'} c_j$That is,

The row$i$, column$k$element ofCjidentifies the consequences of a unit increase in the$k$th variable's innovation at date$t$for the value of the$i$th variableat time$t + j$,holding all other innovation at all dates constant.

4.7.2 Variance Decomposition

The forecast error variance decomposition provides complementary information for each variable contributes to the other variables in the vector auto regressive (VAR) model). Variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR, whereas impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, Therefore variance decomposition provides information about relative importance of each random innovation in affecting all the variables in the VAR. Variance decomposition technique also breaks down the variance of the forecast error for each variance following a shock to a particular variable (Utlaut and Roye,2010) and in this way, it identifies which variables are strongly affected.

CHAPTER FIVE

Result and Discussion

5.1 Stationarity test

Observations from a non-stationary time series shows trends, seasonal effects and other structure that depend on the time index, which means, the mean, variance and other summery statistics do change overtime (Alemayehu et.al, 2012).and such non-stationary series gives spurious(non-sense) result (Alemayehu et.al,2012). Hence, before any empirical estimation making a non-stationary time series data stationary by identifying and removing trends and seasonal effects. Time series are stationary, if they do not have trends and seasonal effects and as well it is easier to model. In account of this, we have tested the presence of a unit root in a series of all the variables using the ADF statistical test. We assume the series contain both trend and intercept. The result of unit root test is summarized in table 5.1.The result from Augmented Dicky-Fuller (ADF) test result in Table 5.1 indicates that, in the spending and resource movement effect model, variables like government consumption on non-tradable (lngovc) and domestic credit (lndomcre) become stationary at level. While, the ratio of tradable and non -tradable sector (tnt),foreign aid(lnaid),terms of trade(lntot) and trade opness(open) are stationary at first difference. Correspondingly, in net export model, net export (lnnx), domestic income (lny), remittance(lnrem), foreign direct investment (lnfdi), real effective exchange rate (lnreer) and foreign income (lny*) becomes stationary at first difference. (See annex: 2)

5.2. Estimation result and discussion for REER (spending effect) model

5.2.1 Bounds Test for Co-integration

The preliminary task in the ARDL approach to Co-integration is to test whether or not the presence of Co-integration or long run relationship among the variables .As indicated in the ADF test, the variables those included in both spending and resource movement effect specification are making their stationary both at the level (I (0) and at the first difference (I (1). If the variables are a mixture of I (0) and I(1), we can use the bound test approach for co-integration of variables under ARDL specification as proposed by Pesaran et al., (2001).The Bound test for co-integration is run to check the joint significant of the coefficients in the specified conditional ARDL model. The bound test of all variables under this study, with the null hypothesis of no co-integration against the alternative

of co-integration. And the decision to accept the null hypothesis (no co-integration), if the calculated F-statistics is found to be less or lower than the bound test critical value. Conversely, we reject the null hypothesis, if the F-statistics is greater than the upper bound and lower bound critical value, and we can conclude that there is co-integration (long run relationship) among the variables.

The result of bound test for spending effect model is summarized in the following table.

TABLE 5. 1: BOUND TEST FOR CO-INTEGRATION: BOUND TEST FOR CO-INTEGRATION

ARDL Bounds Test

Date: 01/17/10 Time: 14:28

Sample: 6 68

Included observations: 63

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.195082	7

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	1.92	2.89
5%	2.17	3.21
2.5%	2.43	3.51
1%	2.73	3.9

Source: own computation from Eviews 10

Hence, the result in the above table indicates that the F-statistics (4.195082) is above both the lower (I0 bound) and the upper (I1 bound) critical value at 1 %, 2.5%, 5% and 10% significance level. Hence, we can reject the null hypothesis of no long run relationship among the variables and accept the alternative hypothesis at all levels of significance.

5.2.2 Long run estimation of real effective exchange rate model

As indicating in the above table 5.1, there is long run relationship among the variables at all level of significance, the next step will be estimating the long-run and short-run model. The lag length to include in estimation is selected based on Schwarz Information Criterion (SIC)[18] and views automatically select the maximum lag to be included. Accordingly, subject to the sample size for the dynamic model, SIC select (2, 1, 5, 0, 2, 0, 1, and 0) for foreign aid, remittance, FDI, domestic credit, government consumption on non tradables, terms of trade and trade liberalization respectively is the efficient lag length for both dependent and independent variables. The result of long-run estimated model is summarized in the following table.

TABLE 5. 2: LONG RUN COEFFICIENTS OF REAL EFFECTIVE EXCHANGE RATE MODEL

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNAID	0.449439	0.091168	4.929770	0.0000
LNREM	-0.115571	0.068802	-1.679759	0.1001
LNFDI	0.024498	0.012453	1.967282	0.0555
LNDOMCRE	0.426377	0.065866	6.473386	0.0000
LNGOVC	-0.040768	0.031169	-1.307981	0.1977
LNTOT	-1.476611	0.307316	-4.804868	0.0000
OPEN	-0.244948	0.442662	-0.553352	0.5828
C	6.571816	0.974114	6.746452	0.0000

Source: own computation from Eviews 10.0

Given the above table 5.2, the log-run spending effect model indicates that, for the study period, except government consumption expenditure (LNGOVC), trade liberalization (OPEN) and remittance (LNREM), all estimated coefficients are found statistically significance at 1%, 5% and 10%

[18] Automatic lag selection for ARDL using SIC, is select the optimal lag to minimize residual sum of square.

level of significance. Domestic credit (LNDOMCRE), foreign direct investment (LNDOMCRE) and foreign aid (LNAID) have a positive and significant impact on the real effective exchange rate in the long-run. On the other hand, Terms of trade (LNTOT) have a significant negative impact on the long-run value of the real effective exchange rate. Hence, all this variables found to affect the real effective exchange rate in Ethiopia significantly. On the other hand, government consumption expenditure on non-tradable, trade liberalization and remittance inflow have no significant impact on real effective exchange rate of Ethiopia.

There is a significant positive relationship between foreign aid and real effective exchange rate, since foreign aid is directly received and managed by the government. How the inflow aid is spent depends on Government's policy as a result, this inflow of aid is efficiently used then it can increase physical and human capital stock and enhance performances of tradable sector than appreciating the real effective exchange rate. Like other developing countries, the existence of idle resources (mainly labor) and dependency on imported materials the inflow of foreign aid brings a depreciation effect on REER. So, foreign aid inflow to Ethiopia does not have a harmful impact on the country's exchange rate. This is not surprising given the fact that foreign aid is often directed at infrastructure development and provision of public service projects with high social and economic returns in developing countries like Ethiopia, adding to the economy's productive capacity. Then, foreign aid is properly channeled into investment rather than consumption, real effective exchange rate depreciate and no Dutch disease effect. This result is consistent with a modified Dutch disease model of Nkusu (2004).Moreover, the result is consistent with the findings of Sackey (2001), Issa and Outtara (2008), Addison (2013) and Makhlouf and Mughal (2013).while, this result is contradicting with other findings like, Rajan and Subramanian (2011) and Fielding and Gibson (2012). The empirical result in the above table indicates that a one percentage point increase in foreign aid ,the real effective exchange rate depreciated by 0.45 percent. For this reason, foreign aid impact on REER becomes inoffensive effect.

FDI also have positive significant effect, is smaller in magnitude compared to foreign aid coefficient. The empirical result in the above table shows that, a one percentage point increase in foreign direct investment (LNFDI) significantly depreciate the real effective exchange rate by 0.02percent.Due to the fact that, investments may foster higher productivity and increased competitiveness

in the long run. Investments made in export and import-competing sectors lead to improved physical and human capital, technology and technical knowledge spillovers and higher productivity, which should ultimately lead to a more competitive economy. Therefore, FDI well cause the REER to depreciate. This result is also confirmed for other findings such as, Athukorala and Rajapatirana (2003), Martins (2007), and Naceur (2012).Despite this, there are other studies whose findings are contradicted with our findings in developing countries such as Lartey (2007) and (2008), Tabarrei (2010).Similarly, there is a significant positive relationship between domestic credit and real effective exchange rate, this may happen the contractionary fiscal and monetary policy cuts the upward scenarios in real effective exchange rate in Ethiopia

There is a significant negative relationship between terms of trade and real effective exchange rate, hence terms of trade has an appreciation effect on real effective exchange rate in the long-run. This can be an indication of the income effects of terms of trade surpass the substitution effect in Ethiopia. That means improved terms of trade means higher domestic income, which leads to increased spending. Spending on tradables does not cause a change in their prices (small economy hypothesis), but higher demand of non-tradables causes their prices to increase, leading to appreciation in the REER.

$$LNREER = 6.57 + 0.44LNAID - 0.11LNREM + 0.02LNFDI + 0.42LNDOMCRE - 0.04LNGOVC - 1.47LNTOT - 0.24OPEN - - - - - - - - - (5.1)$$

5.2.3 Short-run Dynamics of real effective exchange rate model

The variables of our model are co-integrated in the long run, so there exists an error correction mechanism which brings together the long-run relationship with its short-run dynamic adjustments. A crucial parameter to note in the estimation of Vector Error Correction models (VECM) is the coefficient of adjustment, which in this study, measures the speed of adjustment in the REER following a shock in the system. It can also be seen as a measure of the degree of adjustment of the actual REER with regard to its equilibrium level. As shown below in Table 5.3, these are -0.39, and this ECM coefficient shows how quickly variables coverage to equilibrium and it should have a statistical significant coefficient with a negative sign. According to Bannerjee et.al (1998,) the highly significant error correction term further confirms the existence of a stable long run relationship. In the table below 5.3, the quarterly result for REER shows that the expected negative sign

of error correction is highly significant. This confirm the existence of long run relationship among the variables with their various significant lags. The coefficient of $eq(-1) = -0.39$ indicates, the speed of conversion is 39%, implies that 39 % deviation of the actual value of REER would be corrected within one quarter. As a result, full adjustment towards an equilibrium value achieved approximately within 2.56 quarter[19].Similarly, the coefficients of the error correction term in the above table 5.5 shows that REER has the significant coefficient at 1% level, with a t-value of -4.63, and has a correct negative sign. This suggests that the REER equation constitutes the true co-integrating relationship. The estimation of dynamic error correction model for REER is presented as on the following table.

TABLE 5. 3: SHORT RUN DYNAMICS OF REAL EFFECTIVE EXCHANGE RATE MODEL

Co-integrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNREER(-1))	0.341832	0.103553	3.301031	0.0019
D(LNAID)	0.020002	0.011069	1.807038	0.0776
D(LNAID(-1))	-0.033089	0.011674	-2.834378	0.0069
D(LNAID(-2))	-0.009263	0.011684	-0.792756	0.4322
D(LNAID(-3))	-0.037393	0.011685	-3.200091	0.0026
D(LNAID(-4))	-0.024090	0.010488	-2.296985	0.0264
D(LNREM)	0.013360	0.016314	0.818937	0.4172
D(LNFDI)	0.009591	0.004346	2.207047	0.0326
D(LNDOMCRE)	0.263275	0.070806	3.718237	0.0006
D(LNDOMCRE(-1))	0.282562	0.071669	3.942618	0.0003
D(LNGOVC)	-0.015961	0.011644	-1.370705	0.1774
D(LNTOT)	-1.769287	0.463787	-3.814872	0.0004
D(OPEN)	-0.095899	0.169864	-0.564562	0.5752
CointEq(-1)	-0.391508	0.084476	-4.634542	0.0000

[19] Since the data is quarterly.

Source: own computation from Eviews 10

Short run dynamic results reveal that the real effective exchange rate is affected by the lagged value of itself and it is statistically significant. In line with the long run estimation of the model, foreign aid, foreign direct investment and domestic credit affect the real effective exchange rate positively and statistically significant at 10%, 5% and 1% level respectively. While, terms of trade affect the real effective exchange rate negatively and statically significant at 1 percent level to determine the position of real effective exchange rate in the short run. In addition, Lagged foreign aid also affect the real effective exchange rate negatively and significant at 1 percent however lagged domestic credit affect the real effective exchange rate positively and as well it is significant at 1 percent level. The short-run dynamics also supports that remittance inflow, government consumption on non tradables and trade liberalization are statistically insignificant in this study period.

In contrast with the Dutch disease hypothesis, the inflow of foreign aid has a depreciating impact on real effective exchange rate in the short-run, likewise to its long-run effect. As foreign aid inflows to the Ethiopian economy increase by one percent, the impact on real effective exchange rate depreciate by 0.02 percent significantly. This short-run depreciating effect is due to, foreign aid can put in to use in the economy, where there exist a resource gap. The presence of resource gap[20]forces the country to look out ward for foreign capital in order to fill either of the gaps which are perceived to be the binding constraint for economic growth than appreciating the real effective exchange rate in the short run. The allocation of additional income from foreign aid towards to infrastructure development, agriculture technology improvement and provision of public service projects. So, foreign aid inflows increase productivity and growth through the depreciating effect of REER than brings the Dutch disease effect both in short run and long run.

Even though, the magnitude of the short run coefficient of FDI which is 0.009 is less than its long-run coefficient, the depreciation effect have the same both in short run and long run similar to foreign aid inflow. This is due to FDI supplements national saving, supports local businesses and

[20] Saving-investment, fiscal and foreign exchange gap

develops infrastructure. Hence forth, FDI is not bring Dutch disease effect, rather, FDI have a depreciating effect in this study period.

In line with the long run estimation, Terms of trade is negatively associated with the real effective exchange rate and statistically highly significant in the short run. It indicates that improvement in terms of trade may cause a positive trade balance, which may in turn exert pressure on nominal exchange rate appreciation. Due to this appreciation, the country devalue their own currencies occasionally. This nominal exchange rate devaluation might have been one of the reasons for negative association between terms of trade and real effective exchange rate in this study period. However remittance inflow, one of the main crucial variable in this study is not statistically significant in the determination of real effective exchange rate both in the short run and long run. Mean that, there is no robust evidence that remittance affects real effective exchange rate. Of course, this does not imply that remittance is necessarily in effective.

5.2.3 Long run residual diagnostic and stability for REER Model

5.2.3.1 Residual diagnostic model for REER

After estimation of a model, conducting various diagnostic tests is an important step in time series modeling. Since diagnostic testing on data series thus provides information regarding how these data might be modeled and in order to test the standard property of the model.. In this study, diagnostic tests that will provide explanation for the existence of serial correlation (Brush and Godfray LM test), functional misspecification test (Ramsey's RESET test), test for normality (Jaque-Bera test) and heterosckedasticity test are conduct. The summary of diagnostic test is summarized in the following table.

A. Serial correlation test: is used to test whether the residual is serially correlated or not. If the residual is not serially correlated our model is best model. Unlike the Durbin-Watson statistic for AR(1) errors, the serial correlation LM test may be used to test for higher order ARMA errors and is applicable whether there are lagged dependent variables or not. Therefore, we recommend its use (in preference to the DW statistic) whenever you are concerned with the possibility that your errors exhibit autocorrelation. A generalization of this procedure that supports testing for higher-order autoregressive disturbance is the LM test of Breusch pagan and Godfrey test (Godfrey 1988). In this test the regression is augmented with p lagged residual series. The null hypothesis of the

test is that there is no serial correlation in residuals up to the specified order against the alternative hypothesis and the decision rule is that accept the null hypothesis if F-calculated is less than F-tabulated however reject the null hypothesis if F-calculated higher than F-critical values.Table5.5 result show that the p-value is more than 5 percent, we can't reject the null hypothesis. Our null hypothesis is, there is no serial correlation. Hence, the test accept the hypothesis of no serial correlation up to order two, with a p value 0.29. Where p is a pre-specified integer or no serial correlation between residuals based on the probability F statistic.

B. Heterosckedasticity test: There are number of heterosckedasticity tests in order to check the problem of heteroscedasticity. For this study, we employ the brush pagan Godfrey test of heteroscedasticity. This set of tests allows whether the residual is heterosckedasticity or not, that means to be a best model the residual must be homoscedasticity. In the following table 5.6 result show that the P-value is 0.14which is more than 5 percent, meaning that we can't reject the null hypothesis. Our null hypothesis is that residual is not heterosckedasticity which is desirable.

C. **Jaque-Berra normality test**: is used to test whether the residuals are normally distributed or not. Fig5.1 result shows that the P-value is 0.18 (18 percent) which is more than 5 percent, meaning that we can't reject null hypothesis. Our null hypothesis is that the residuals are normally distributed. Hence, From the Jarque -Bera test, we fail to reject the null hypothesis of normally distribute error terms. This means that the error terms are normally distribute with mean zero and constant variance and the relationship between the variables is confirmable.

5.2.2.2 **Stability Test for REER model**

A. Ramsey RESET Test for functional form: it indicates that whether the models are well constructed or not. The result in the following table show that the P-value is 0.82 (56 percent) which is more than 5 percent. Hence, we failed to reject the null hypothesis of Ramsey RESET test. Result proves that the model did not have omitted variable bias and the models are well constructed. Again, with these value, the test result of F statistics reveals that fail to reject the null hypothesis. These stated that the error terms are normally and independently distributed with zero mean and constant variance and the researcher concluded that the model is stable (table 5.4)

B. **Cumulative sum and cumulative sum of squares recursive residuals**

To test a structural stability of the model, there are also different tests based on recursive residual. The two most important are the recursive residuals (CUMSUM) and cumulative sum of squares recursive residuals (CUMSUMSQ) which are recommended by (Pesaran and Shin, 1999, 2001). The CUMSUM test is based on a plot of the sum of the recursive residual. If this sum goes outside the critical bound, one concludes that there was a structural break at the point at which the sum began its movement towards the bound. Hence, for the stability test the graph plots both the cumulative sum of residual with 5% critical lines. And, if the cumulative sum remains inside between the two critical lines or bounds back after it is out of the boundary lines, the null hypothesis of correct specification of the model cannot be rejected. But, if the cumulative sum goes outside between the two critical bounds there exists series parameter instability problem**.** (See annex A5)**.**The straight lines represent critical bounds at 5% level of significance. As depicted in the figure above, the plot of cumulative sum of recursive residuals graphical test of stability revealed by oscillation of the calculated statistics between the critical bounds at 5% level of significance and it is the indication of stable parameters under study. This is re-enforced by the same pattern of the plot of cumulative sum of the squares of recursive residuals shown in the figure below.

The CUMSUM of squares test is similar to the CUMSUM test, but plots the cumulative sum of squared recursive residuals, expressed as a fraction of these squared residuals summed over all observation.**(**See, annex A6).The straight lines represent critical bounds at 5% significance level

Thus, the plots of CUMSUM and CUMSUMSQ stay within the lines, and, consequently, this confirms the equation is correctly specified and the model is stable. Furthermore, the result shows that there is no structural instability in the model during the sample period. Henceforth, we can precisely conclude that long and short run estimates are quite stable and as well there is no any structural break showing the Results of the estimated model are efficient and reliable.

The summary of diagnostic test is summarized in the following table (or, see annex A1-A6).

TABLE 5. 4: DIAGNOSTIC TEST RESULT FOR REER MODEL

No.	Test	Chi-Square	p-value
1	Serial Correlation LM Test	0.1671	0.2929
2	Hetroskedasticity (Bruch-Pagan)	0.1597	0.1407
3	Normality (Jarque-Berra)	Not applicable	0.188
4	Ramsey RESET	Not applicable	0.8239

Source: own computation from Eviews 10.0

5.3 Estimation result and discussion of TNT (resource movement effect) model

The second objective of this study is to establish the impact of capital inflow on resource movement effect model (traded to non- traded sector ratio).Likely with the spending effect model, this objective also achieved by using Auto regressive distributed lag (ARDL) estimation where the long run and short run relationship generated are analyzed.

Likely, the real effective exchange rate model, at the first stage of the long run relationship between the variables under investigation in resource movement effect model is tested by computing the bound F-statistic (bound test for co-integration) in order to establish a long run relationship among the variables. Hence, based on the result in table 5.5**,** the calculated F statistics is (11.62) which is higher than both lower and upper bound critical value at all levels of significance. Accordingly, it is possible to reject the null hypothesis of no co-integration (long run relationship). In other words, the result implies the variables are co-integrated in the long run.

TABLE 5. 5: BOUND TEST FOR CO-INTEGRATION

ARDL Bounds Test

Date: 01/06/10 Time: 18:15
Sample: 5 68
Included observations: 64
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	11.625550	7

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.03	3.13
5%	2.32	3.5
2.5%	2.6	3.84
1%	2.96	4.26

Source: own computation from Eviews 10.

5.3.1 Long run estimation of traded to non- traded sector ratio (TNT) model

As explained in the REER model, if the variables found to have co-integration then we can estimate long-run equilibrium relationships among the variables. Since, the objective of the study is to address the impact of capital inflow on traded to non- traded sector ratio.

Results of ARDL estimation of TNT for different specifications are presented in table (5.8).foreign aid (LNAID), foreign direct investment(LNFDI),domestic credit(LNDOMCRE) and terms of trade(LNTOT) have statistically significant at 1 percent level of significance and openness also significant at 10 percent level. Contrariwise, remittance inflow (LNREM) and government consumption on non- tradable (LNGOVC) is not significant on traded to non-traded sector ratio (resource movement effect) model.

TABLE 5. 6: LONG RUN COEFFICIENT OF TRADED TO NON-TRADED OUTPUT RATIO (TNT) MODEL

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNREM	0.022682	0.029286	0.774521	0.4445
LNAID	-0.097055	0.032368	-2.998477	0.0053
LNFDI	0.043461	0.007037	6.176173	0.0000
LNGOVC	0.011139	0.045257	0.246124	0.8072
LNDOMCRE	-0.172744	0.036211	-4.770512	0.0000
LNTOT	-0.967485	0.119626	-8.087613	0.0000
OPEN	-0.490050	0.254810	-1.923195	0.0637
C	8.087386	0.520139	15.548503	0.0000

Source: own computation from Eviews 10.

These findings reflect that, likewise, the real effective exchange rate model, government consumption on non tradables and remittance inflow has no statistically significant in traded to non-traded sector ratio. The magnitude of Foreign aid, terms of trade and domestic credit affect the composition of traded to non-traded sector ratio negatively and statistically significant. A one percent increase in foreign aid inflow leads to 0.097 percentage point fall in TNT ratio. This finding indicates that, most of the foreign aid in Ethiopia is heavily invested in non-traded sector particularly in social development to improve productivity in the non-tradable sector, than used the aid to increase physical and human capital stock to enhance performances of tradable sector. For this reason foreign aid shrinks the TNT ratio in the long run. While, terms of trade appears statistically highly significant in the resource movement effect model. It indicates that terms of trade does have a pressure on resources to move from tradable to non-tradable sectors. In resource movement effect

model, foreign direct investment appears positive and statistically significant. A one percent increase in foreign direct investment inflow (FDI) leads a 0.0434 Percentage point rise in TNT sector ratio. These results show that, the FDI flow to Ethiopia are mainly diversified into the manufacturing industrial sector. The distribution of FDI to manufacturing sector and service sector for about 41% and 32% of the total FDI inflow to Ethiopia from 1992 to 2011, while the primary sector accounted 25%.(EEI,2011). So, the degree of the manufacturing for FDI is increase than the other two. As a result, FDI therefore, clearly exhibits no the resource movement effects of the Dutch disease.

The estimated long run equation can be presented as follows:

$$TNT = 0.02LNREM - 0.09LNAID + 0.04LNFDI + 0.01LNGOVC - 0.17LNDOMCRE - 0.96LNTOT - 0.49OPEN - - - - - - - - - - - - - - - - - (5.2)$$

5.3.2 Short run dynamics of traded to non -traded sector ratio

Short-run relationships between the traded to non- traded sector ratio and their regressor's are examined with the Error Correction Model (ECM) based on the ARDL approach. It indicates the speed of adjustment to restore equilibrium in the dynamic model and the coefficient of the ECM which has to be negative and statistically significant shows how quickly the dependent variables converge to the long run equilibrium. Results of the error correction model based on the ARDL model are presented in Table 5.7.

TABLE 5. 7: SHORT RUN DYNAMICS OF TNT MODEL

Co-integrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TNT(-1))	0.305183	0.102624	2.973794	0.0057
D(TNT(-2))	0.298337	0.106265	2.807495	0.0086
D(TNT(-3))	0.528621	0.120899	4.372405	0.0001
D(LNREM)	0.000301	0.007348	0.040914	0.9676
D(LNREM(-1))	-0.013180	0.009060	-1.454690	0.1558

D(LNAID)	-0.007546	0.005498	-1.372374	0.1798
D(LNAID(-1))	0.014663	0.005858	2.503129	0.0178
D(LNAID(-2))	0.007777	0.004891	1.589885	0.1220
D(LNFDI)	0.011332	0.004040	-2.805006	0.0086
D(LNFDI(-1))	0.002225	0.004807	-0.462860	0.6467
D(LNFDI(-2))	-0.012817	0.004126	-3.106677	0.0040
D(LNDOMCRE)	0.066567	0.033406	1.992660	0.0552
D(LNDOMCRE(-1))	-0.006800	0.042859	-0.158651	0.8750
D(LNDOMCRE(-2))	0.028714	0.044294	0.648262	0.5216
D(LNDOMCRE(-3))	0.079410	0.034212	2.321135	0.0270
D(LNGOVC)	-0.006146	0.006214	-0.989091	0.3303
D(LNGOVC(-1))	0.006028	0.006870	0.877387	0.3870
D(LNGOVC(-2))	-0.009847	0.005593	-1.760793	0.0881
D(LNGOVC(-3))	-0.009908	0.005382	-1.840857	0.0752
D(LNTOT)	-0.366900	0.245813	-1.492601	0.1456
D(LNTOT(-1))	0.552739	0.236116	2.340963	0.0258
D(OPEN)	-0.108055	0.110968	-0.973742	0.3377
D(OPEN(-1))	-0.064973	0.160549	-0.404697	0.6885
D(OPEN(-2))	0.331295	0.152116	2.177911	0.0371
CointEq(-1)	-0.469112	0.064955	-7.222149	0.0000

This short run dynamics of traded to non- traded sector ratio analysis reveal that the traded to non-traded sector ratio is affected by the lagged value of itself and it is statistically significant. Lagged foreign aid, lagged terms of trade, lagged domestic credit and lag openness are statistically significant and affect the traded non-traded sector ratio positively. While government consumption on non-tradable and foreign direct investment also statistically significant and affect the traded to non-traded sector ratio negatively. On the other hand, all variables except foreign direct investment, are not statistically significant in the short run. Foreign direct investment are statistically significant at 1% significance level. An increase in foreign direct investment inflow by one percent, result a fall TNT ratio by 0.0113 percent. Likewise the spending effect model, the error correction coefficient CointEq(-1) has negative sign and statistically significant indicating that there is evidence of co-integration. The estimated short-run coefficient for the error correction term is

−0.46 showing that there is high speed of adjustment to the long run equilibrium after the short run shock has been occurred.The value -0.46 indicates that short term deviation of long term relation is corrected each quarter by an amount of 46 percent.

5.4 Residual diagnostic and stability for TNT model

5.4.1 Residual diagnostic test

Likely with the spending effect, in the traded to non-traded sector ratio (resource movement effect) model, it is compulsory to check whether the underlying assumptions of estimation process are fulfilled or not. To do so, we have performed residual based (autocorrelation, heteroskedasticity and normality, coefficient based, and model misspecification diagnostic tests. The summary of diagnostic test is summarized in the following table.

TABLE 5. 8: DIAGNOSTIC TEST RESULT FOR TNT MODEL

No.	Test	Chi-Square	p-value
1	Serial Correlation LM Test	0.0044	0.0678
2	Hetroskedasticity (Bruch-Pagan)	0.4069	0.4504
3	Normality (Jarque-Berra)	Not applicable	0.848
4	Ramsey RESET	Not applicable	0.2766

Source: own computation from Eviews 10.0.

As the above result indicates the null hypothesis of no serial correlation, homoskedasticity and normality of residuals cannot be rejected at conventional level of significance i.e.5%. Finally, the general test for misspecification indicates the null hypothesis of no functional misspecification is not rejected (see, Annex B1-B6).

5.5 Impacts of REER changes on net exports in Ethiopia (BVAR model)

The third objective of this study was to establish the impacts of real effective exchange rate changes on net exports in Ethiopia. This objective was achieved by using Bayesian VAR estimation where the impulse functions and variance decomposition generated are analyzed.

5.5.1 Bayesian VAR Lag order selection criteria

Impulse response analysis based on Bayesian vector auto regressions (BVARs) plays a central role in modern empirical macroeconomics (Pesaran and Smith, 1998).An important preliminary step in impulse response analysis is the selection of the appropriate VAR lag order. In this study, there are several lag order selection criterion are employed. While Schwarz Information Criteria (SC) and Hannan-Quinn information criterion (HQ) select two lags whereas Likelihood Ratio test (LR) and Final Prediction Error (FPE) select a lag length of four and the Akaike Information Criteria (AIC) picks five lags. Enders, (2004) selecting appropriate lag length is preliminary in VAR analysis, since allowing long lag lengths consumes degrees of freedom while, too small lags make the model to be wrongly specified. As shown in (annex C1) four lag order selection criteria is used in this study because four lags are suggested by the two criterion. And it is long enough to capture the systems of the dynamic response of net export on other macroeconomic determinants (regressor's) given the available size of the sample

5.5.2 Diagnostic test for real effective exchange rate shocks on net export

Diagnostic tests were conducted to test the adequacy of the model. The model satisfies all diagnostic tests[21.] Autocorrelation tests (the LM test for residual autocorrelation) indicates no evidence of autocorrelation at any of the first four lags at five percent significance level. This can also be confirmed by looking at the model's autocorrelation table given in (annex C2).Residual correlogram (Annex C3) also one useful tool for examining the degree of autocorrelation i.e. it examines the correlation between residual at time t and t-1, t-2… (Harris, 2007).Hence, this study conducts residual correlograms for different order BVAR models and the graph shows that no pattern. Meanwhile there is no autocorrelation problem in our model and the results are presented in annex 8.Jarque-Bera test for residual normality indicates that the errors are normally distributed. Since,

[21] Diagnostic test result are given in **appendix**

(seen in annex C4) at five percent significant level, reject the null of multivariate normal residuals implying that the residuals of the model are also normally distributed. Besides, the residuals of the model are homoskedastic as the null of homoskedastic residuals cannot be rejected using White Heteroskedasticy (no cross terms) test and the result as well presented in (annex C5). Furthermore, the study also conducts stability test. Stability test shows that all roots of the characteristic polynomial lie inside the unit circle representing that the model is stable and then the Bayesian VAR satisfies the stability condition. As a result, our model is stable to generate impulse responses that can be used to examine the impact of real effective exchange rate and capital inflow shock on net export (See annex C2-C6).

In the following sub section, impulse responses estimated from the Bayesian VAR model for a period of 10 quarter (2.5 years) is discussed.

5.6 Impulse response function

5.6.1 The response of net export to a positive shock on macroeconomic variables

An impulse response function traces the effect of a residual-one standard deviation shock to one of the innovations on current and future values of the endogenous variables. A shock to the i^{th} variable directly affects the i^{th} variable and transferred to all the regressor's through dynamic structure of VAR (Paul, 2013).The following figure show the effect of a residual-one standard deviation positive shock to each of the endogenous variables on net export over 2.5 years. The variables are ordered as follows: LNREER, LNY, LNY*, LNREM, LNAID and LNFDI. In the figure, the solid line denotes the estimated impulse response. Here we present the responses of net export to a unit shock in net export itself, real effective exchange rate, domestic income, foreign income, remittance inflow, foreign aid and foreign direct investment. We have the response of the endogenous variable to a unit shock and time horizon on the vertical and horizontal axis is respectively. The results of net export response due to a positive shock on its determinants (regressor's) are presented below:

A. The impact of net export shock itself:

The response to a cholesky one standard deviation own shock to net export is around 0.16 percent and then it has cyclical pattern effect. Means that, there is highest positive effect on the first quarter

and lowest negative effect on the third quarter. The almost response of net export shock on itself is positive. This suggests that a shock on net export have a positive impact on itself. Hence, a positive one percentage unit on net export shock is expected to lead to an increase in net export itself by 0.29 percent[22] over 2.5 years. (See fig: 5.1)

B. The impact of real effective exchange rate shock on net export

Fig 5.1 displays that, the response to a cholesky one standard deviation of innovations to real effective exchange rate shock resulted negative till the eighth quarter. Net export is found to have significant and negative response over the four years. Yet, after the eighth quarter, net export respond positively. The nearly response of real effective exchange rate shock on net export is negative over the 10 quarter.

C. The impact of domestic income shock on net export

Initially, the impact of domestic income shock on net export is insignificant on the first and third quarter. After the third quarter, net export increases a hump shaped manner and becomes positive and persistent throughout the whole horizon. The results suggest that net export increases steadily following the shock in domestic income on impact. A one percentage unit on foreign income shock is expected to increase the net export by 0.31 percent over 2.5 years (see Fig 5.1).

D. The impact of foreign income shock on net export

As can be seen in figure 5.1, the response to a cholesky one standard deviation of innovations to foreign income changes on net export, is positive up to the fourth quarter. While, afterwards the fourth quarter, net export found to have negative reaction on a unit shock in foreign income and becomes insignificant.

E. The impact of remittance inflow on net export

The net export is found to have insignificant in the first quarter and a cyclical response following a shock in remittance inflow. Due to a unit shock in remittance, net export respond positively

[22] By summing all the values of the responses of the net export after a unit shock in net export itself.

except on the fifth quarter. Since the almost response of net export for a unit shock in remittance is positive. The finding was also consistent with those of the Fayad (2011) who considered the impact of remittance on export led growth and the result indicates that positive relationship between the variables.

F. The impact of foreign aid on net export

The response of net export is found to have insignificant on the first and seventh quarter. While onwards the remaining period, net export respond positively following to a positive unit shock in foreign aid inflow (see fig 5.1).This implies that a unit standard deviation positive shock to foreign aid causes a positive change in net export. The finding of this study was in line with those of Cali and Velde (2009).

G. The impact of foreign direct investment shock on net export

Net export respond cyclically with a small effect to a cholesky one standard deviation innovations in foreign direct investment. The impact is negative on third quarter but turns the net export respond cyclically to a shock in foreign direct investment. Finally, the impact of foreign direct investment on net export is insignificant after the fifth quarter.

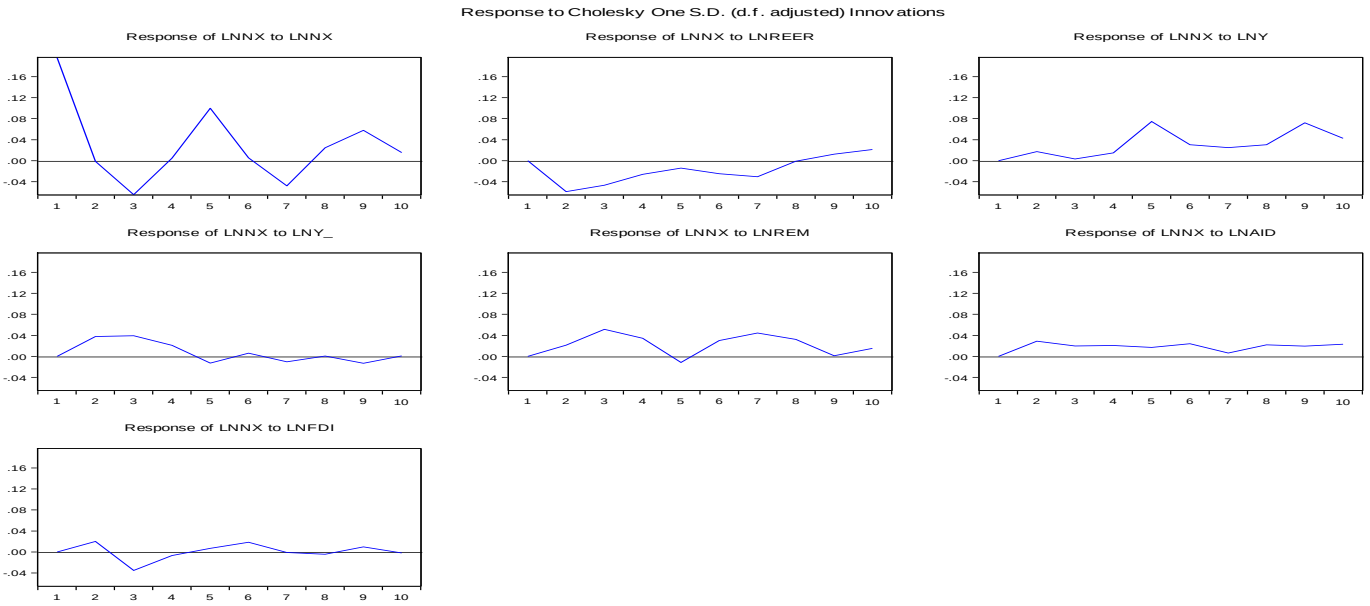

FIGURE 5. 1 THE RESPONSE OF NET EXPORT TO A POSITIVE SHOCK ON ITS DETERMINANTS

5.5.2 Impulse response function: The responses of the real effective exchange rate to a positive shock on macro-economic variables.

Figure 5.2 below shows the response of real effective exchange rate on a positive shock in net export, domestic income, foreign income, remittance, foreign aid, foreign direct investment and real effective exchange rate itself. The response of real effective exchange rate following to its own shock is strong. The Real effective exchange rate responds quickly by about 0.03 percent and again increases in the second quarter to 0.04. However, after the second quarter, it continuously decline following to its own shock. The response of real effective exchange rate to a cholesky one standard deviation innovations to net export positive initially and continue in a hump-shaped manner. Moreover, With respect to a one percent shock in net export, the almost response of real effective exchange rate is positive. The response of REER on a one standard deviation innovation to domestic income initially positive, but after the third quarter it continues decline with small effect. Due to a one percent shock on foreign income, real effective exchange rate respond negatively in the short run i.e., till the third quarter. While, afterwards the third quarter the response of real effective exchange rate is insistently increases and becomes positive. Hence, the almost response of real effective exchange rate is positive and significant, following to a positive shock in foreign income. Due to a one percent shock in foreign aid, the response of real effective exchange rate is insignificant in almost the whole time horizon. Hence, foreign aid found to have no appreciation impact on real effective exchange rate. Likewise in the long run, real effective exchange rate also respond positively for a unit shock in foreign direct investment and this is consistent with ARDL long run estimation of real effective exchange rate model. While, the response of real effective exchange rate to one standard deviation shock in remittance inflow is negative in the short run. However, after the seventh quarter, the response of real effective exchange rate is positive and increasing.

Therefore, the analysis does not find evidence of Dutch Disease through spending effect in Ethiopia, as the real exchange rate does not appear to be appreciated by foreign aid, foreign direct investment and remittance inflow. Furthermore, the result of the dynamic accumulated impulse response for individual and combined graph is presented in annex C7 and annex C8.

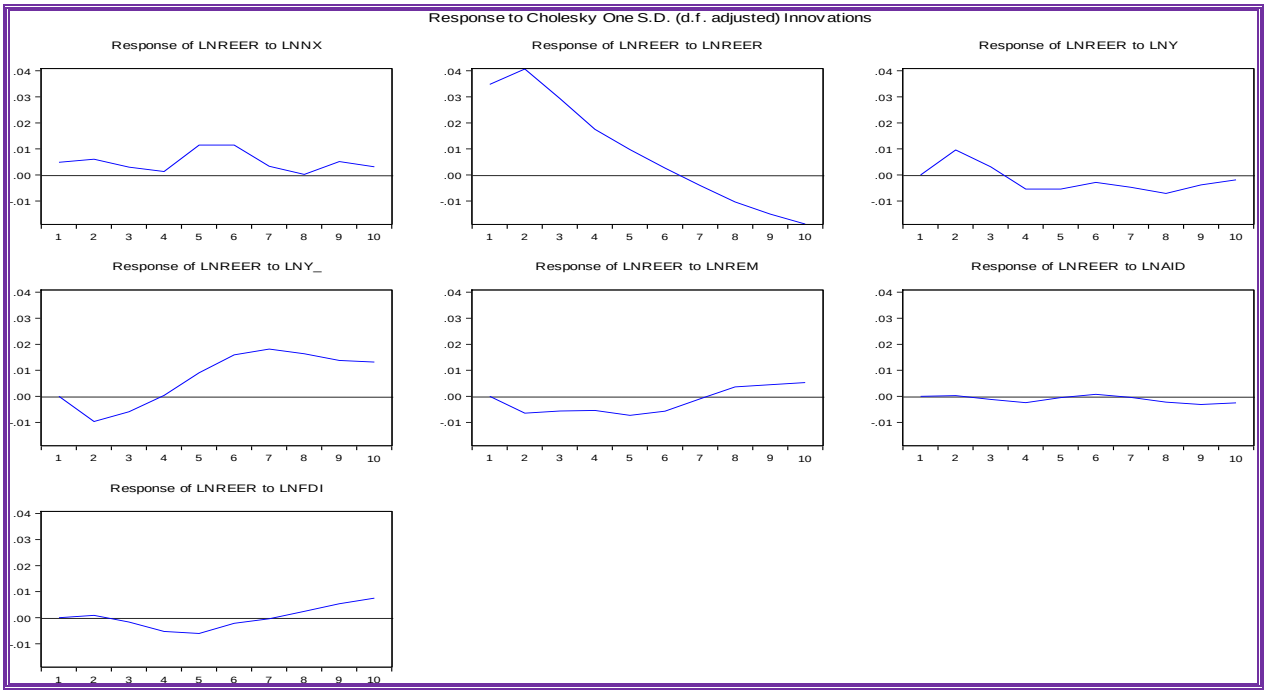

FIGURE 5. 2THE RESPONSE OF REAL EFFECTIVE EXCHANGE RATE TO A POSITIVE SHOCK ON ITS REGRESSER'S

Source: own computation from Eviews 10

5.6 The Relative Importance of Shocks: Variance Decomposition Analysis

Variance decomposition provides a complementary information about the relative importance of each random innovation in affecting all the variables in the model. It also describes the proportion of the movements in a sequence due to a variable's own shock, and other identified shocks (Enders, 2004).unlike impulse response[23], variance decomposition separates the variation in an endogenous variable into the component shocks to the Bayesian VAR. In this study, variance decomposition for Bayesian VAR model is estimated for 2.5 years. The results of variance decompositions analysis is shown in the following tables.

[23] Because, in Bayesian VAR analysis, impulse response function trace the effects of a shock to one endogenous variable on to the other variables.

TABLE 5. 9: VARIANCE DECOMPOSITION OF LNNX ON THE BVAR MODEL

Period	S.E.	LNNX	LNREER	LNY	LNY_	LNREM	LNAID	LNFDI
1	0.194780	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.210005	86.15681	6.303169	0.788084	3.090328	0.519570	2.154387	0.987651
3	0.238671	75.26588	9.232605	0.620254	4.762442	5.308645	2.119650	2.690524
4	0.245323	71.45302	9.918253	0.925532	5.295302	6.875053	2.891813	2.641023
5	0.275551	68.18829	8.107512	8.443717	4.441494	5.811269	2.857672	2.150043
6	0.280920	65.68750	8.292838	9.214477	4.282832	6.727917	3.409011	2.385426
7	0.292232	63.77699	8.849399	9.030542	4.165542	8.774792	3.198330	2.204410
8	0.297503	62.26565	8.556117	9.742499	4.019314	9.613422	3.642132	2.160870
9	0.312876	59.78436	7.946043	13.94217	3.739682	8.697538	3.835449	2.054760
10	0.317881	58.05248	8.176746	15.35467	3.623096	8.603634	4.194670	1.994702

Table 5.10 Variance Decomposition of LNREER on the BVAR Model

Period	S.E.	LNNX	LNREER	LNY	LNY_	LNREM	LNAID	LNFDI
1	0.035273	1.534667	98.46533	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.056417	1.734945	91.21904	2.921497	2.568375	1.508023	0.001426	0.046698
3	0.064436	1.503050	91.11586	2.514894	2.659562	2.084813	0.058124	0.063695
4	0.067502	1.421257	89.88377	2.813627	2.436516	2.721432	0.218259	0.505138
5	0.070646	3.980533	83.89987	2.943264	4.004416	3.959462	0.208143	1.004312
6	0.073846	6.207146	76.93949	2.743542	8.339654	4.589935	0.199626	0.980610
7	0.076203	5.999476	72.50616	2.853197	13.15537	4.369346	0.194487	0.921968
8	0.078868	5.601864	69.40932	3.385507	16.13541	4.248183	0.277607	0.942105
9	0.081910	5.533030	67.77744	3.333657	17.52469	4.206198	0.386099	1.238886
10	0.085523	5.182135	67.00676	3.107292	18.24708	4.247181	0.431369	1.778187

Table 5.11 Variance Decomposition of LNY on the BVAR Model

Period	S.E.	LNNX	LNREER	LNY	LNY_	LNREM	LNAID	LNFDI
1	0.411289	3.305416	0.023100	96.67148	0.000000	0.000000	0.000000	0.000000
2	0.425950	3.082825	0.839196	93.11806	1.875563	0.323910	0.696924	0.063521
3	0.463753	4.215079	1.174111	80.67168	6.790974	0.284659	2.429801	4.433695
4	0.482328	5.608091	1.454397	74.93297	8.946236	0.861587	3.978698	4.218019
5	0.513774	6.292434	1.768148	75.04826	7.929217	0.945411	3.510283	4.506245
6	0.527067	6.424512	2.712605	71.40748	8.809271	1.491075	3.858181	5.296879
7	0.538832	6.344344	2.644631	71.04887	8.886229	1.463466	3.773659	5.838802
8	0.548721	7.577000	2.662657	69.03834	9.360809	1.727892	3.690084	5.943214
9	0.554701	7.675294	2.738377	68.15716	9.350820	1.904426	3.726319	6.447602
10	0.560928	8.786298	2.774381	66.77391	9.701508	1.962552	3.667333	6.334019

Table 5.12 Variance Decomposition of LNY_(foreign income) on the BVAR Model

Period	S.E.	LNNX	LNREER	LNY	LNY_	LNREM	LNAID	LNFDI
1	0.003778	0.580402	0.844742	2.224865	96.34999	0.000000	0.000000	0.000000
2	0.006078	0.267416	0.444755	2.871249	95.97931	0.265058	0.023082	0.149126
3	0.008094	0.554843	1.585614	2.116411	95.00047	0.547787	0.024789	0.170087
4	0.009675	0.959902	4.125042	2.308137	90.58265	1.260110	0.221202	0.542959
5	0.011289	1.581606	10.44208	2.401169	81.62094	2.009105	0.658876	1.286226

6	0.013248	1.822089	19.27483	2.537678	70.58889	2.583274	0.947370	2.245868
7	0.015457	2.621221	27.34544	2.455616	60.68122	2.971251	1.001305	2.923943
8	0.017602	3.817053	33.06821	2.339447	53.31709	3.275828	0.963290	3.219083
9	0.019516	5.456250	36.87489	2.198353	47.62335	3.553712	0.926875	3.366575
10	0.021141	7.205038	39.42360	2.100500	43.14718	3.774694	0.927497	3.421495

Table5.13 Variance Decomposition of LNREM on the BVAR Model

Period	S.E.	LNNX	LNREER	LNY	LNY_	LNREM	LNAID	LNFDI
1	0.285518	0.317498	5.470045	11.07975	4.713414	78.41929	0.000000	0.000000
2	0.293821	1.455775	5.204896	12.23622	5.656267	74.43683	3.09E-07	1.010008
3	0.298523	2.213040	5.347495	11.87881	5.608952	72.40588	0.068828	2.476996
4	0.313566	3.828665	5.978291	14.11976	5.690145	66.25570	0.248747	3.878698
5	0.324164	3.602044	5.811098	17.38624	7.326309	62.00553	0.239357	3.629422
6	0.328176	3.926302	5.673920	17.12342	8.140821	61.15210	0.442165	3.541270
7	0.333439	5.381389	5.623975	17.02895	8.033875	59.24000	0.813660	3.878154
8	0.339294	5.302271	6.141702	16.73633	9.327284	57.26177	0.822664	4.407978
9	0.345675	5.551561	6.871527	16.23037	10.09339	55.39835	1.149277	4.705527
10	0.349799	5.489058	7.309340	15.94085	10.93069	54.25904	1.275790	4.795237

Table 5.14 Variance Decomposition of LNAID on the BVAR Model

Period	S.E.	LNNX	LNREER	LNY	LNY_	LNREM	LNAID	LNFDI
1	0.008127	25.94229	3.047216	1.916608	16.19170	0.105189	52.79700	0.000000
2	0.014332	29.44150	6.279718	1.059830	15.96423	1.501562	45.35086	0.402301
3	0.020583	25.30900	9.047662	1.032805	17.58485	2.362812	43.03788	1.624994
4	0.027197	24.12235	13.12794	0.838064	17.66808	3.719707	37.30626	3.217601
5	0.033061	20.21108	16.03929	0.624893	19.94912	6.854091	32.32891	3.992610
6	0.038572	16.98552	18.73947	0.548597	22.88759	9.174340	28.12795	3.536541
7	0.043766	14.36666	20.60000	0.592834	25.92030	11.30025	24.38011	2.839851
8	0.048657	12.59404	21.80173	0.689420	28.31003	13.05870	21.23815	2.307921
9	0.052918	11.30264	22.78328	1.012373	29.76908	14.26151	18.83368	2.037434
10	0.056758	10.31549	23.55553	1.357920	30.73597	15.17295	16.92602	1.936122

Table 5.15 Variance Decomposition of LNFDI on the BVAR Model

Period	S.E.	LNNX	LNREER	LNY	LNY_	LNREM	LNAID	LNFDI
1	0.617837	1.712254	1.457248	2.687802	0.339191	0.476621	5.039351	88.28753
2	0.723882	4.370949	6.685862	5.017682	0.338673	0.488253	6.948026	76.15055
3	0.802539	4.282405	14.50228	4.217609	1.796145	2.899142	7.887923	64.41449
4	0.887054	6.586403	17.54502	3.471831	2.799080	5.069697	7.311326	57.21665
5	0.955040	5.763731	17.57283	3.015811	7.336278	7.655707	6.325250	52.33039
6	0.995220	5.327013	17.70007	2.822267	11.26875	7.932669	6.342938	48.60629
7	1.039800	5.699207	17.10929	2.590923	14.34808	7.636369	7.396450	45.21968
8	1.082692	5.551657	16.28637	2.389769	14.85565	7.307412	8.874153	44.73498
9	1.115106	5.367395	15.55724	2.304831	14.39650	6.978410	10.07345	45.32217
10	1.135085	5.215643	15.17956	2.242063	13.91418	6.750121	10.83551	45.86293

Cholesky Ordering: LNNX LNREER LNY LNY_ LNREM LNAID LNFDI

Source: Own computation from Eviews 10

As depicted on table 5.9, the variance decomposition for net export indicates that, in the first quarter 100% of the forecast error variance in net export is explained by the shock on itself and after one year, this proportion is declined to about 86 %and eventually further declined to 58 % after

2.5 years (10 quarters).This is seems to be explained by the dependence of net export on other shocks in the economy. Table 5.10 shows that, in the first quarter, 98.46 % of the variance in forecast error of real effective exchange rate seems to be explained by the REER itself and the lingering about 1.5% of real effective exchange rate is explained by net export. Eventually, this percentage is declines to 67% in the tenth quarter. This is due to, foreign income explains around 7 % of the forecast error variance of real effective exchange rate in the first three quarters and again it shows an increasing trend till the tenth quarter. Domestic income, net export, aid and foreign direct investment also vital in explaining the forecast error variance of real effective exchange rate. Hence forth, real effective exchange rate is highly is highly dependence of other macro-economic variables. As we can see from Table 5.11, about 96.67 % of their forecast errors of domestic income seems to be explained by its own shock and the remaining 3.3% is by net export in the first quarter. After one year, 75% of domestic income is explained by itself, and about 20% is explained by foreign income, net export, foreign direct investment and foreign aid. Again, the percentage of domestic income is declined and after the tenth quarter becomes 66.7%. Table 5.12, also shows 96.3% percent of the variance in the forecast error variance of foreign income is explained by itself and about 2.2 % is explained by domestic income. After 2.5 years, the percentage is declined and it becomes 43 %.This is due to the fact that, about 40 percent of forecast error variance of foreign income is explained by real effective exchange rate. Therefore, foreign income is highly dependent on real effective exchange rate. In the first quarter, about 78.4 % of the variance in forecast error of remittance inflow seems to be explained by a shock in itself and 11%, 5.5% and 4.8 percent is explained by domestic income, real effective exchange rate and foreign income respectively. Moreover, after one year, 62 % of the forecast error variance in remittance is explained by shock from itself. This proportion rapidly declines to 54.25% after the tenth quarter (see table 5.13).Remittance is highly dependent on foreign income, since about 10% of the forecast error variance is explained by foreign income. In the table 5.14 shows that, foreign aid shock explain more than 52% of their forecast errors after one quarter. This proportion decreases and after 2.5 years becomes 16.92 %. Foreign income, real effective exchange rate, remittance and net export shocks explain is about 30.75%, 23.55%,15.17% and 10.31 % of the forecast error variance in aid respectively. Similarly, in the first quarter about 88.3% of the variance in forecast error variance of foreign direct investment seems to be explained by its own shock itself. Also 5.03 percent is explained by the domestic income in the same period. Nonetheless, these proportions

not persist but FDI is declined over time and only 45.86 percent is explained by its own shock after two and half years. This reflects that foreign direct investment is highly dependent on other macro-economic variables such that real effective exchange rate, foreign income, foreign aid, remittance and net export explains about 15%, 13.9%,10.8%,6.7% and 5.21% of foreign direct investment forecast error variance respectively (See, table 5.15). To sum up, the variance decomposition tables largely confirm the results obtained in the impulse response analysis.

Moreover, the result of variance decomposition graphically is presented in annex C9 and 10.

CHAPTER SIX

Conclusions and policy implications

6.1 Conclusion

Capital inflow has been indispensable in the accumulation and rate of investment to create conditions for accelerated economic growth in developing countries. Although, this inflows have enormous positive impact on various socio-economic development of capital recipient countries, it is not without problems. Dutch Disease is one such problem.

The main aim of this paper is to find whether recent economic developments in Ethiopia are symptomatic of Dutch Disease. The basic symptoms we tested for include, appreciation of real effective exchange rate, decline in agriculture and manufacturing value added (tradable sector) and growth in the non-tradable sector (faster service sector growth). More specifically, this study sought to provide empirical relationship between capital inflow and Dutch disease in Ethiopia. This was achieved through a three step process each representing an objective.

The first step was to examine the impact of capital inflow (i.e. remittance, foreign aid and foreign direct investment) on spending effect in Ethiopia. The second step is to examine the impact of capital inflow on resource movement effect, and the third step is establish the impacts of real effective exchange rate changes on net exports. The spending effect examines real effective exchange rate appreciation, whereas the resource movement effect examines fall in traded to non-traded sector ratio.

The first objective was to examine the relationship between capital inflow and real effective exchange rate in Ethiopia. This was accomplished through regression analysis using Auto regressive distributed lag (ARDL) model. From bound test statistics, the variables were found to have a long-run relationship hence, we were able to estimate both long-run and short-run coefficients of the real effective exchange rate. In both estimations, foreign aid, foreign direct investment, domestic credit and terms of trade were found to have a significant impact on real effective exchange rate. Further, their signs were also alike both in the long run and short run dynamics of real effective exchange rate. Foreign aid, foreign direct investment and domestic credit were found to have a

depreciation effect of real effective exchange rate, while terms of trade found to have an appreciation effect of real effective exchange rate. Remittance inflow is not significant effect in both the short run and long run coefficients of REER model.

In contrast to the Dutch disease hypothesis, the impact of foreign aid and foreign direct investment inflows did not support real effective exchange rate appreciation in case of Ethiopia. The dynamic (short-run) adjustment process towards the equilibrium relation was also in line with the long run counterpart's impact of foreign aid and foreign direct investment inflow, found to have a significant short-run effect on real effective exchange rate. This finding also shows that there is no Dutch disease effect from foreign aid and foreign direct investment holds both in the short-run and long-run in Ethiopia. Even real effective exchange rate depreciate due to capital inflow.

The second objective is to examine the impact of capital inflow on traded to non- traded sector ratio. The auto regressive distributed lag (ARDL) approach are also employed to determine both the long-run and short-run determinants of traded to non-traded sector ratio. The result reveals that in the long run, all variables except remittance and government consumption on non tradables, found to have significant effect in determining the position of traded to non-traded sector ratio.

Foreign aid, domestic credit, terms of trade and trade liberalization significantly leads to a fall in the traded to non-traded sector ratio as predicted by the theoretical model of TNT**.** While foreign direct investment improve the tradable sector both the short run and long run.

In long run, we have found Dutch Disease impact of foreign aid through resource movement effect, while no such impact has been detected for remittance inflow and foreign direct investment. A coefficient of foreign aid -0.23 is found, a one unit change in foreign aid inflow leads to a fall in traded to non-traded sector ratio by 0.23 percent. This is due to the fact that unlike remittance and foreign direct investment, Foreign aid is directly received by the government. This aid is mostly spent on non -traded goods and services.as a result, foreign aid have a role on redirecting resources to non-traded sector from traded sector. Likewise with the spending effect, in resource movement effect, we have no found Dutch disease impact of foreign direct investment both in the short run and long run. It indicates that foreign direct investment does not exert any pressure on resources to move from tradable to non-tradable sectors.

In short run dynamics of resource movement effect, an improvement in terms of trade leads to a fall in traded to non-traded sector ratio. Whereas trade liberalization, remittance, government consumption for non-tradable and domestic credit found to have insignificant effect in this study period. On the other hand, remittance inflows have been statistically insignificant in both spending effect and resource movement effect regressions irrespective of the short run and long run. This is suggesting that, remittance inflow are not important determinant of real effective exchange rate and have no role on re-allocating resources to non-traded sector at the expense of the tradable sector in Ethiopia in this study period.

The third objective was to establish the impacts of real effective exchange rate shocks on net exports in Ethiopia. This was accomplished through Bayesian VAR estimation of the model. The impulse responses and variance decomposition generated was used to analyze the impacts of real effective exchange rate changes on net exports. From the results of the impulse response functions net export has impact on itself in Ethiopia. Similarly, the near response of net export over the 2.5 years is positive to a unit shock in foreign aid and foreign direct investment inflow. Likewise, real effective exchange rate respond positively to a unit shock in foreign direct investment and remittance inflow. Whereas, the response of net export is insignificant for a unit shock in foreign aid. Therefore, there is no Dutch disease impact of foreign aid, foreign direct investment and remittance inflow, which is confirm the ARDL estimation of real effective exchange rate.

6.2 Policy implication

Based on the empirical findings, the following policy implications are suggested.

- The presence of long-run co-integration between the real effective exchange rate with its determinants and traded to non-traded sector ratios with the included variables in this study implies to be in line with the objective, it will be effective to target one of the variables to influence the behavior of other variables in the long run.
- Foreign direct investment and foreign aid are associated with the depreciation of real effective exchange rate both in the short run and long-run. Henceforth, Ethiopia might continue

To receive capital inflow without fear of its Dutch disease effect through real effective exchange rate appreciation. In fact, the need for foreign direct investment and foreign aid generally arises

with the lack of capital and low saving and investment ratio in the country, hence forth foreign capital (FDI and foreign aid) does provide an important support in our country to finance the supply side of the economy, which again reduces its appreciation impact on REER, and to finance a current account deficit.

- Terms of trade has been a significant variable to affect the position of real effective exchange rate with appreciation and also it leads to fall the traded to non-traded sector ratio. Nonetheless, terms of trade, are beyond the direct control of policy makers. The ability of the government to influence this variable means that to lessen the appreciation of real effective exchange rate or improve the TNT ratio is very limited. The authorities can, however, reduce the impact of such determinants by developing policies to encourage the diversification of tradable goods in the long run.

- Domestic credit also a significant variable to affect the position of real effective exchange rate with depreciation. Hence, the result implies that the government (NBE) can mitigate the potential effect of capital inflow in creating Dutch disease through increasing the domestic credit through tight monetary and loose fiscal policy, its impact on exchange rate can be more effective.

- The researcher also find that foreign aid leads to a fall in traded to non-traded sector ratio in the long run, implies that foreign aid are positively correlated with the country's services sector during the studied period, whereas the tradable sector, comprising manufacturing and agriculture, is negatively associated. Hence, the government could mitigate the possible consequence of Dutch disease through resource movement effect, is allocating of the inflow of foreign aid towards the tradable sector, which enables to reduce the pressure on price by encouraging supply side of the economy and the tradable sector is really determine the total level of national output.

- The flow of foreign direct investment in the study period are leads to a rise in traded to non-traded sector ratio both in short run and long run. Hence forth, the government as well can receive foreign direct investment inflow without fear of its Dutch disease both in spending and resource movement. The inflow foreign direct investment might be used for manufacturing sector like mining, metal and electronic, which again improves the tradable sector.

- A unit real effective exchange rate shock is leads to a fall in net export, implies an increase in real effective exchange rate and decrease international competitiveness. Hence forth, a government should stabilize the real effective exchange rate to increase net export, as domestic goods are more competitive.

- Finally, data availability is noticeable problem in most developing countries, as it is in Ethiopia. Therefore, the researcher could not consider in the empirical model, all the determinants suggested by the original theoretical models, thus the study may suffer from the risk of bias because of having omitted a relevant variable i.e. technological progress. Again, proxies may be found for such variables, there is a risk that they may not correctly represent the impact of the actual variable. Finding appropriate proxy variables, or developing a procedure for their measurement also another road of further research.

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Appendix

ANNEX 1: DEFINITION OF VARIABLE AND SOURCE OF DATA

no	Name of the variable and its symbol	Definition	Data source
1	Real Effective Exchange Rate (REER):	It represents a nominal effective exchange rate index adjusted for relative changes in consumer price indices, a proxy of cost indicators of the home country. Since it is defined as the relative price of domestic to foreign goods. In this study we define exchange rate using price quotation definition. A fall and a rise in REER imply an appreciation and deprecation of exchange rate, respectively.	NBE
2	Traded to non-traded sector ratio (TNT) sector ratio	In the absence of systematic and comparable data on this variable, we approximate that ratio by defining 'tradable sector output' as the sum of agriculture and manufacturing sector value added and 'non-tradable sector output' as service sector value added.	NBE
3	Net export	It refers to the difference in monetary value between total exports and total imports. Depending on whether a country import more goods or export more goods, net export can be a positive or negative value. This was measured in terms of the US dollars.	NBE

4	Government consumption on non-tradable good (GOVC)	It represents the expenditure by the government for the consumption of non-tradable goods and service. Since there is no appropriate and readymade data for non-tradable consumption for Ethiopia, hence, for this study government consumption of non-tradable is obtained from summation of government capital expenditure on social developments (education, health, social welfare, culture and sport) and transport and communication.	NBE
5	Terms of trade (TOT)	It defined as the relative price of export index to import price index. Arise in the prices of export or a fall in prices of imports shows that an improvement in terms of trade	WDI
6	Trade liberalization (TOP)	Trade openness is used as a proxy. This variable is included in the study to capture the impact of liberalization on competitiveness of the domestic economy. $$Openness = \frac{(EXPORT + IMPORT)}{GDP} \times 100$$	NBE
7	Net Domestic credit (DOMCRE)	It is the value for net domestic asset consist claims on government and non-central bank.	NBE
8	Real GDP (Y)	This variable is a proxy for domestic income, the value for real GDP is computed by deflating the nominal GDP. This is the total value of goods and services produced domestically within a period of time. It was measured by the annual real gross domestic product.	WDI

10	World Real GDP (Y*)	It is the proxy variable for foreign income, It refers to the total aggregate value of goods and services produced by trading partners within a given period of time, usually one fiscal year. It was measured the weighted average of major trading partners with Ethiopia. These countries included the Germany, China, U.S.A, United Arab emirates, Saudi Arabia, India and Italia. Since, more than 70% of Ethiopia import is coming from those countries.[24]	WDI
11	Foreign direct investment (FDI)	It is the value of the net flow of foreign direct investment to into production or business in a country via a company in another country, either by expanding operations of an existing business in the domestic economy or by buying a company in the target country This variable is also one of the important ones in this study to investigate the Dutch disease hypothesis.	NBE
12	Remittance (rem)	It is defined as the sum of worker's remittances, compensation of employees, and migrant's transfers. Broader definition of remittances has been taken covering not only worker's remittances but also professional's income and migrant's transfer. This variable	NBE

[24] Ethiopia main trading partner are China is about (21% of total imports), Saudi Arabia (17%), United Arab Emirates (10%), India (8%) Italy (6%), United States (5%), japan (5%) and Germany (3%). (Ethiopian global trade statistics,2017))

		captures the amount of private capital inflow to Ethiopia that is send by Ethiopian citizens, who lived abroad.	
13	Foreign Aid (AID)	The value represents the transfer of capital to the domestic economy from different entities. There are different forms that are given for aid in different sources. In this study foreign aid data are considered as equivalent with public transfers from the rest of the world as explicitly stated in current account balance of the balance of payment.	NBE

Annex 2: ADF Test

Models of spending and resource movement effect									
Lags	variable	With trend				Without trend			
		T-cal	1%	5%	10%	T-cal	1%	5%	10%
0(Level)	lnreer	-1.175	-3.533	-2.906	-2.590	-3.305*	-4.103	-3.479	-3.167
1st D.		-5.833***	-3.534	-2.906	-2.591	-5.811***	-4.105	-3.480	-3.168
0(Level)	tnt	-1.678	-3.533	-2.906	-2.590	-2.419	-4.103	-3.479	-3.167
1st D.		-4.588***	-3.533	-2.906	-2.590	-4.661***	-4.103	-3.479	-3.167
0(Level)	lnrem	-1.316	-3.536	-2.907	-2.591	-5.533***	-4.100	-3.478	-3.166

1st D.		-8.240***	-3.536	-2.907	-2.591	-	-	-	-
0(Level)	lnaid	-1.887	-3.536	-2.907	-2.591	-1.431	-4.107	-3.481	-3.168
1st D.		-9.734***	-3.536	-2.907	-2.591	-9.859***	-4.107	-3.481	-3.168
0(Level)	lnfdi	-1.133	-3.538	-2.908	-2.591	-3.471*	-4.103	-3.479	-3.167
1st D.		-6.079	-3.538	-2.908	-2.591	-	-	-	-
0(Level)	lngovc	-0.520	-3.536	-2.907	-2.591	-9.734***	-3.536	-2.907	-2.591
1st D.		-12.905***	-3.536	-2.907	-2.591	-	-	-	-
0(Level)	open	-1.934	-3.531	-2.905	-2.590	-1.365	-4.100	-3.478	-3.166
1st D.		-8.280***	-3.531	-2.906	-2.590	-8.585***	-4.103	-3.479	-3.167
0(Level)	lntot	-0.848	-3.538	-2.908	-2.591	-2.555	-4.103	-3.479	-3.167
1st D.		-3.880***	-3.533	-2.906	-2.590	-4.338***	-4.110	-3.482	-3.167
0(Level)	lndomc	-0.092	-3.538	-2.908	-2.591	-3.291*	-4.110	-3.482	-3.169
1st D.		-3.048**	-3.544	-2.910	-2.593	-	-	-	
Models of net export									
0(Level)	lnnx	-1.618	-3.540	-2.909	-2.592	-1.923	-4.113	-3.483	-3.170
1st D.		-9.104***	-3.536	-2.907	-2.591	-9.030	-4.107	-3.481	-3.168
0(Level)	lny	0.492	-3.533	-2.906	-2.590	-3.254*	-4.103	-3.479	-3.167
1st D.		3.280**	-3.533	-2.906	-2.590	-	-	-	-
0(Level)	Lny-	-0.021	-3.533	-2.906	-2.590	-3.246*	-4.105	-3.480	-3.168
1st D.		-4.006***	-3.533	-2.906	-2.590	-	-	--	-

Source: Own computation from eviews 10.

Note:, **, *** represent significant at 10%, 5% and 1% level of significance respectively.*

Diagnostic tests for real effective exchange rate (REER) model

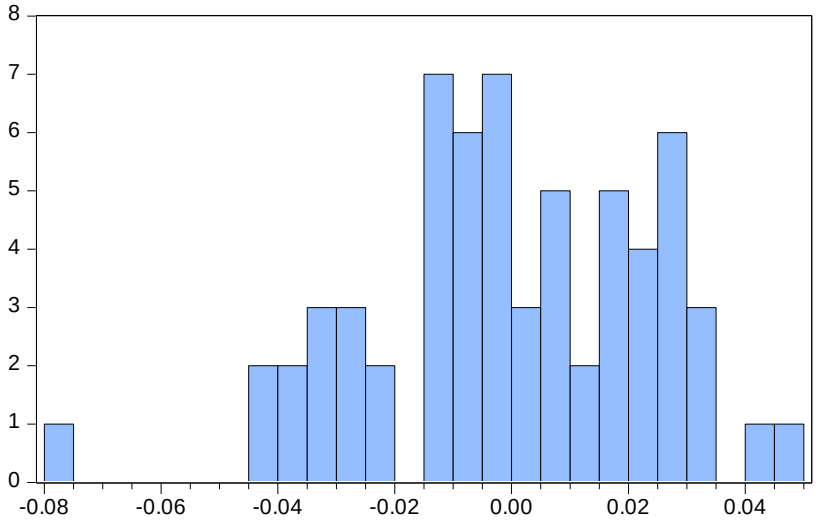
Annex A1: Serial correlation LM test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.264493	Prob. F(2,42)	0.2929
Obs*R-squared	3.578033	Prob. Chi-Square(2)	0.1671

Annex A2: Hetrosckedasticity test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.489912	Prob. F(18,44)	0.1401
Obs*R-squared	23.85764	Prob. Chi-Square(18)	0.1597
Scaled explained SS	14.44857	Prob. Chi-Square(18)	0.6994

Annex A3: Jarque-Bera normality test



Series: Residuals
Sample 6 68
Observations 63

Mean	2.54e-16
Median	-0.000354
Maximum	0.045525
Minimum	-0.079625
Std. Dev.	0.024123
Skewness	-0.509127
Kurtosis	3.483151
Jarque-Bera	3.334472
Probability	0.188768

Annex A4: Ramsey RESET Test for REER model

Ramsey RESET Test

Equation: UNTITLED

Specification: LNREER LNREER(-1) LNREER(-2) LNAID LNAID(-1) LNAID(-2) LNAID(-3) LNAID(-4) LNAID(-5) LNREM LNREM(-1) LNFDI LNDOMCRE LNDOMCRE(-1) LNDOMCRE(-2) LNGOVC LNTOT LNTOT(-1) OPEN C

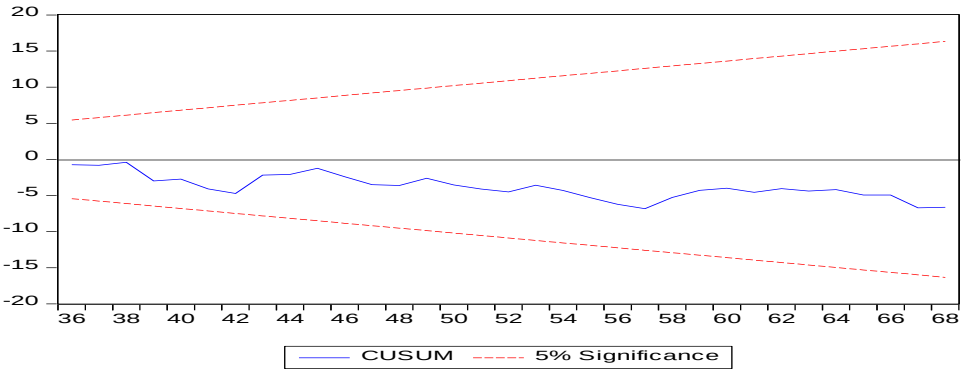
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.223876	43	0.8239
F-statistic	0.050121	(1, 43)	0.8239

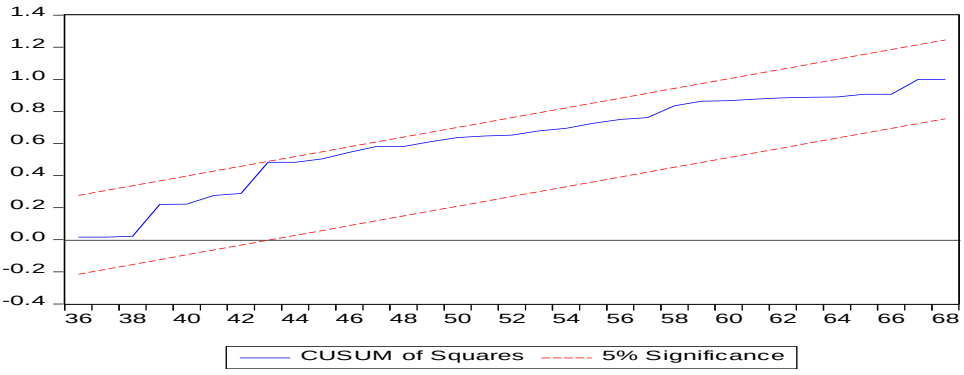
F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	4.20E-05	1	4.20E-05
Restricted SSR	0.036079	44	0.000820
Unrestricted SSR	0.036037	43	0.000838

Annex A5: Graphical Representation of CUMSUM Result



Annex A6: Graphical Representation of CUMSUM Result

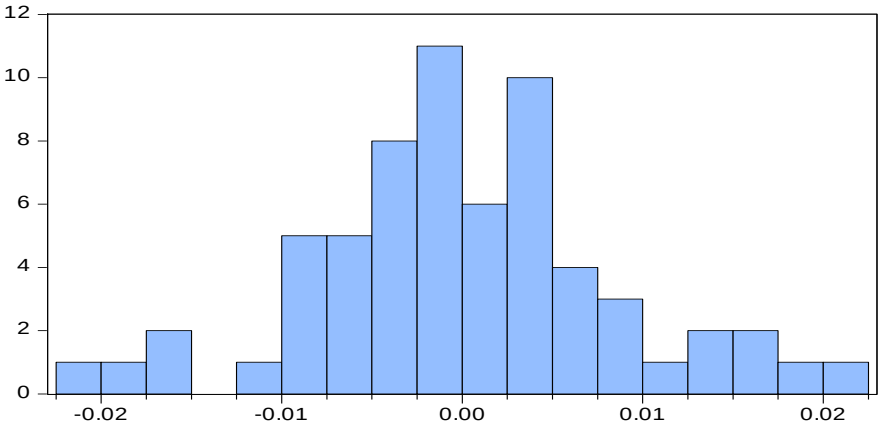


Diagnostic test for traded to non-traded ratio model

AnnexB1: Serial correlation LM test for TNT model

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.957619	Prob. F(2,29)	0.0678
Obs*R-squared	10.84269	Prob. Chi-Square(2)	0.0044

Annex B2: Normality test for TNT model



Series: Residuals	
Sample 5 68	
Observations 64	
Mean	-1.40e-15
Median	-0.000794
Maximum	0.020104
Minimum	-0.020434
Std. Dev.	0.008251
Skewness	0.101897
Kurtosis	3.285300
Jarque-Bera	0.327808
Probability	0.848824

Annex B3: Ramsey RESET Test for TNT model

Ramsey RESET Test

Equation: UNTITLED

Specification: TNT TNT(-1) TNT(-2) TNT(-3) TNT(-4) LNREM LNREM(-1) LNREM(-2) LNAID LNAID(-1) LNAID(-2) LNAID(-3) LNFDI LNFDI(-1) LNFDI(-2) LNFDI(-3) LNDOMCRE LNDOMCRE(-1) LNDOMCRE(-2) LNDOMCRE(-3) LNDOMCRE(-4) LNGOVC LNGOVC(-1) LNGOVC(-2) LNGOVC(-3) LNGOVC(-4) LNTOT LNTOT(-1) LNTOT(-2) OPEN OPEN(-1) OPEN(-2) OPEN(-3) C

Omitted Variables: Squares of fitted values

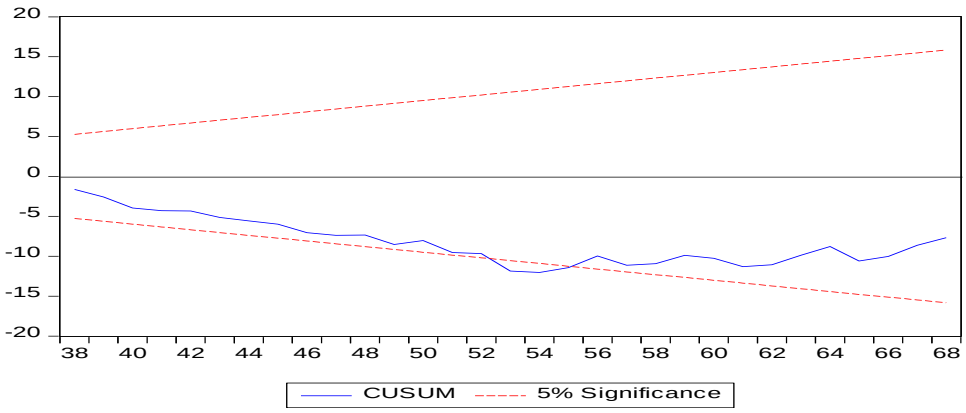
	Value	df	Probability
t-statistic	0.926776	30	0.3614
F-statistic	0.858913	(1, 30)	0.3614

F-test summary:

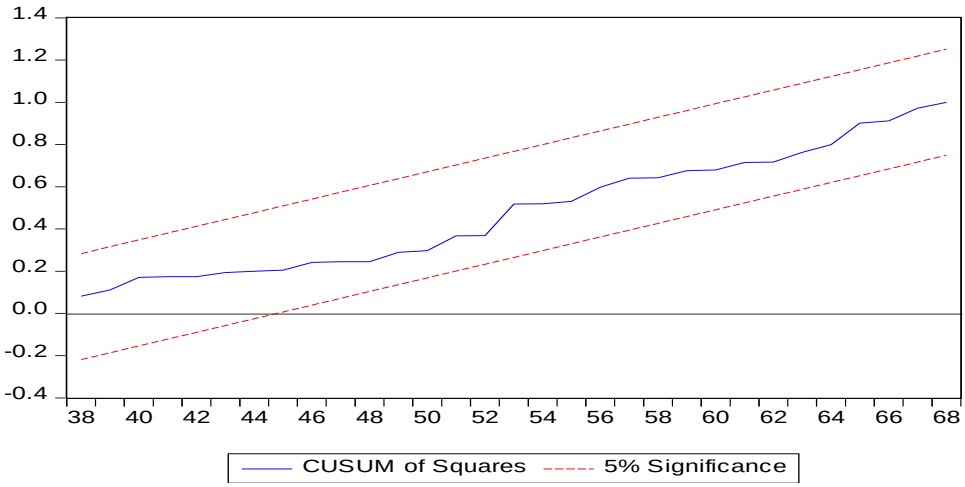
	Sum of Sq.	df	Mean Squares
Test SSR	0.000119	1	0.000119

Restricted SSR	0.004289	31	0.000138	
Unrestricted SSR	0.004170	30	0.000139	

Annex B4: CUMSUM test for TNT model



Annex B5: CUMSUM of square test for TNT model



Annex C1: VAR lag order selection criteria

VAR Lag Order Selection Criteria
Endogenous variables: D(LNNX) D(LNREER) D(LNY) D(LNY_) D(LNREM) D(LNAID) D(LNFDI)
Exogenous variables: C
Date: 01/09/10 Time: 10:08
Sample: 1 68
Included observations: 62

Lag	LogL	LR	FPE	AIC	SC	HQ

0	381.9274	NA	1.32e-14	-12.09443	-11.85427	-12.00014
1	494.8718	196.7419	1.69e-15	-14.15716	-12.23587*	-13.40281*
2	545.5706	76.86591	1.70e-15	-14.21196	-10.60955	-12.79756
3	613.9940	88.28824	1.06e-15	-14.83852	-9.554989	-12.76407
4	683.6326	74.13143*	7.57e-16*	-15.50428	-8.539628	-12.76978
5	736.0690	43.97886	1.24e-15	-15.61513*	-6.969356	-12.22058

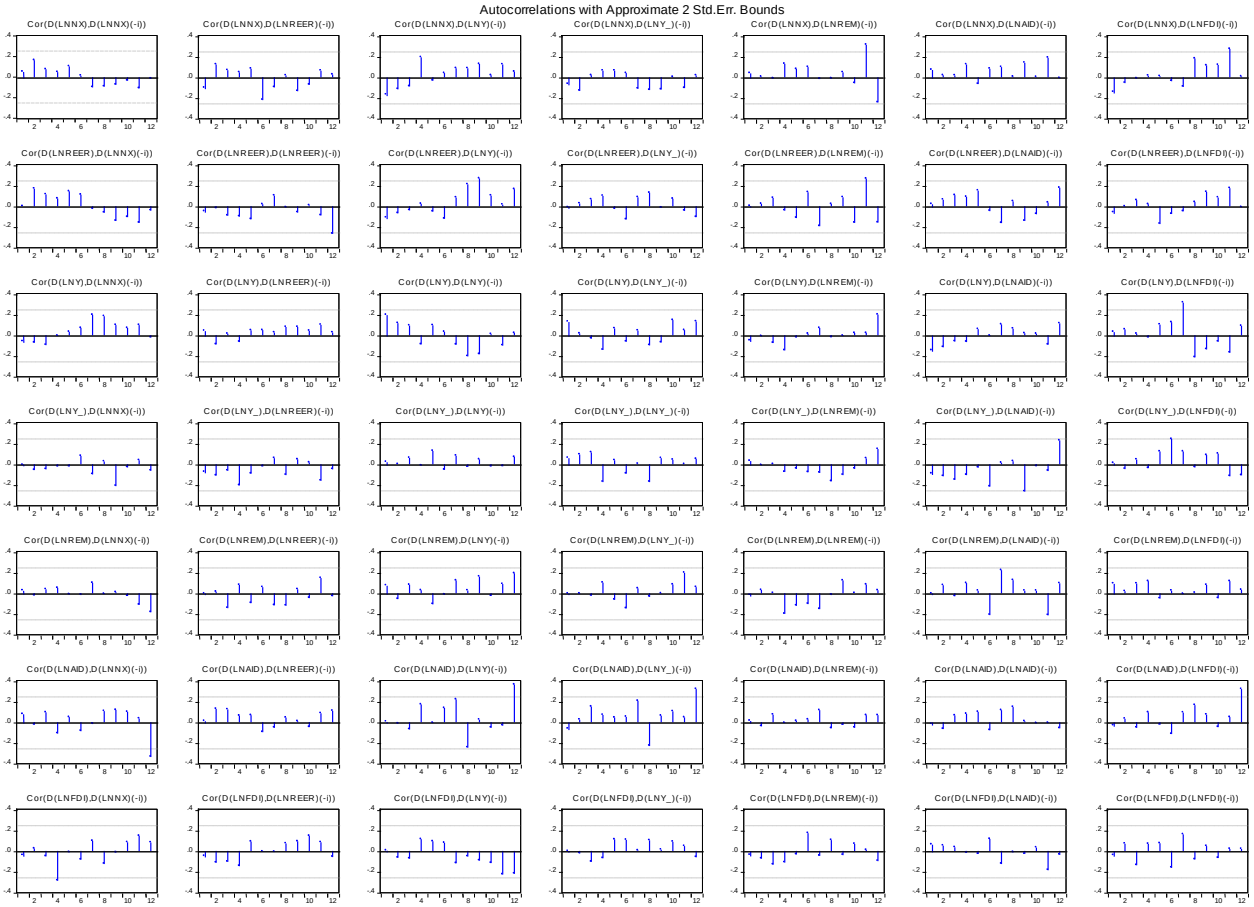
* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

AnnexC2: VAR residual serial correlation LM test

VAR Residual Serial Correlation LM Tests
Date: 01/09/10 Time: 10:1
Sample: 1 68
Included observations: 63
Null hypothesis: no serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	52.87630	49	0.3268	1.091005	(49, 111.0)	0.3478
2	40.92458	49	0.7873	0.805639	(49, 111.0)	0.8006
3	54.37700	49	0.2772	1.128661	(49, 111.0)	0.2972
4	48.57406	49	0.4903	0.985350	(49, 111.0)	0.5116

Annex C3: **Residual correlograms**



Annex C4: VAR residual normality test

VAR Residual Normality Tests				
Orthogonalization: Cholesky (Lutkepohl)				
Null Hypothesis: Residuals are multivariate normal				
Date: 01/09/10 Time: 10:17				
Sample: 1 68				
Included observations: 63				
Component	Skewness	Chi-sq	df	Prob.*
1	0.291456	0.891940	1	0.3450

2	0.000288	8.70E-07	1	0.9993
3	-0.182960	0.351481	1	0.5533
4	-1.293256	17.56136	1	0.0000
5	-2.686626	75.78859	1	0.0000
6	0.054607	0.031310	1	0.8595
7	-1.394522	20.41925	1	0.0000
Joint		115.0439	7	0.0000
Component	Kurtosis	Chi-sq	df	Prob.
1	2.896961	0.027870	1	0.8674
2	3.117308	0.036123	1	0.8493
3	2.886357	0.033901	1	0.8539
4	7.236470	47.11265	1	0.0000
5	16.25297	461.0579	1	0.0000
6	4.156362	3.510082	1	0.0610
7	7.990769	65.38292	1	0.0000
Joint		577.1615	7	0.0000
Component	Jarque-Bera	df	Prob.	
1	0.919809	2	0.6313	
2	0.036124	2	0.9821	
3	0.385382	2	0.8247	
4	64.67401	2	0.0000	
5	536.8465	2	0.0000	
6	3.541392	2	0.1702	
7	85.80217	2	0.0000	

Joint	692.2054	14	0.0000	

Annex C5: Heteroskedasticity Test

VAR Residual Heteroskedasticity Tests (Levels and Squares)

Date: 01/09/10 Time: 15:43

Sample: 1 68

Included observations: 63

Joint test:

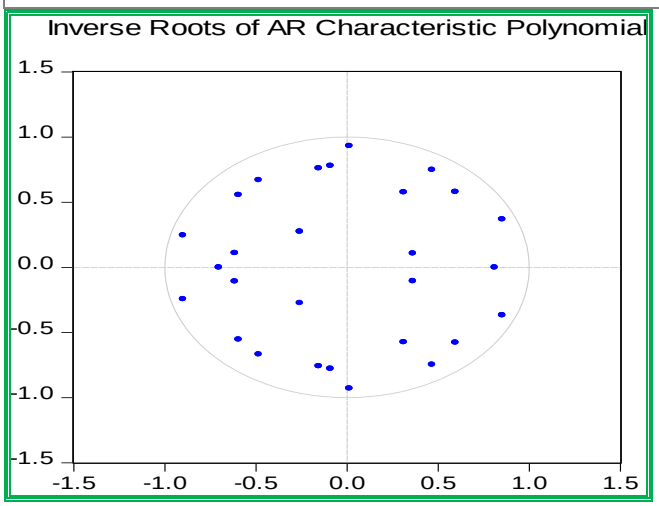
Chi-sq	df	Prob.
1580.480	1568	0.4074

Individual components:

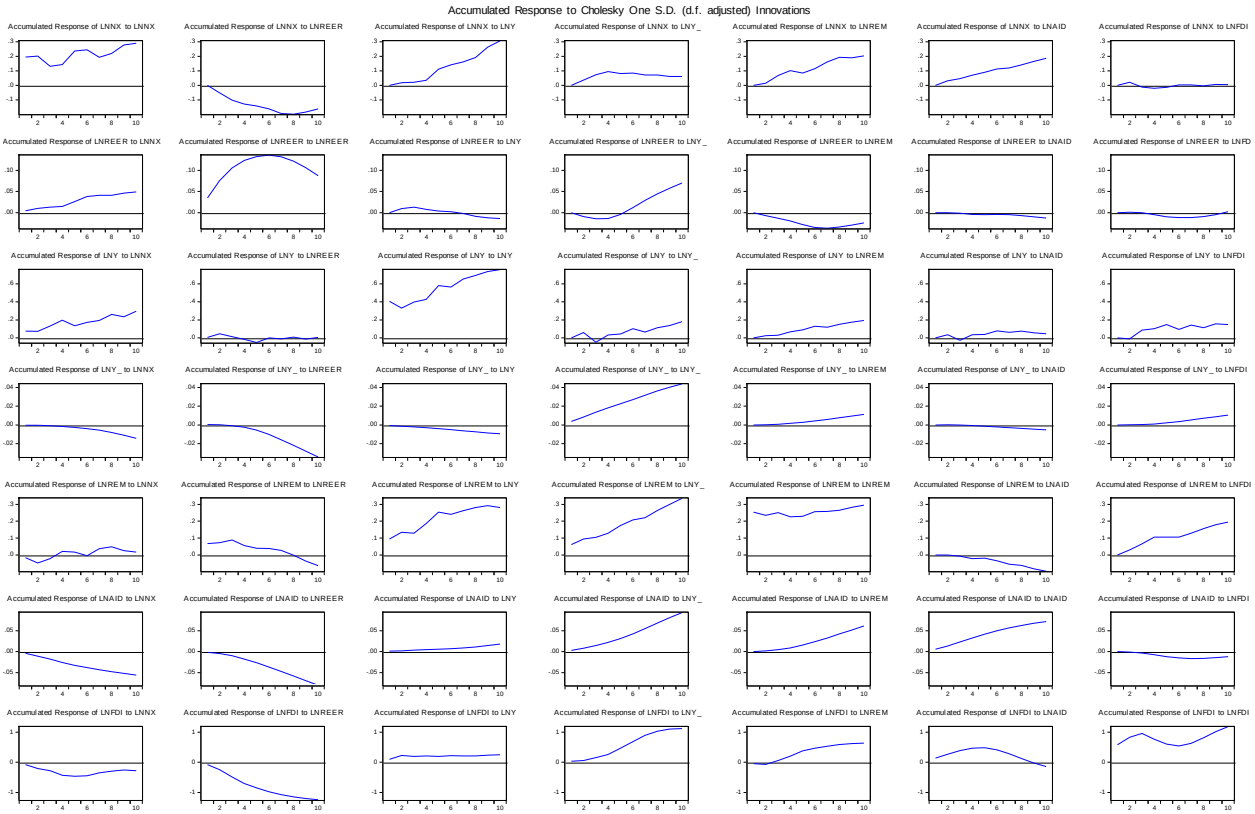
Dependent	R-squared	F(56,6)	Prob.	Chi-sq(56)	Prob.
res1*res1	0.874215	0.744649	0.7462	55.07553	0.5099
res2*res2	0.943428	1.786763	0.2396	59.43594	0.3516
res3*res3	0.983473	6.375648	0.0131	61.95878	0.2720
res4*res4	0.890978	0.875617	0.6496	56.13159	0.4699
res5*res5	0.776633	0.372529	0.9768	48.92788	0.7373
res6*res6	0.954007	2.222398	0.1580	60.10243	0.3295
res7*res7	0.959550	2.541620	0.1198	60.45164	0.3182
res2*res1	0.779185	0.378073	0.9751	49.08867	0.7318
res3*res1	0.970640	3.542122	0.0570	61.15031	0.2963
res3*res2	0.931880	1.465716	0.3354	58.70845	0.3765

res4*res1	0.887757	0.847418	0.6698	55.92868	0.4775
res4*res2	0.934313	1.523969	0.3150	58.86172	0.3712
res4*res3	0.948430	1.970484	0.1999	59.75110	0.3411
res5*res1	0.950560	2.059975	0.1836	59.88526	0.3366
res5*res2	0.806538	0.446675	0.9475	50.81187	0.6710
res5*res3	0.859845	0.657315	0.8119	54.17021	0.5444
res5*res4	0.848206	0.598699	0.8546	53.43696	0.5725
res6*res1	0.841754	0.569923	0.8746	53.03051	0.5880
res6*res2	0.869930	0.716592	0.7674	54.80562	0.5201
res6*res3	0.947124	1.919174	0.2101	59.66883	0.3438
res6*res4	0.804537	0.441005	0.9502	50.68581	0.6756
res6*res5	0.823842	0.501079	0.9184	51.90207	0.6307
res7*res1	0.980486	5.383463	0.0204	61.77063	0.2776
res7*res2	0.913741	1.134970	0.4852	57.56571	0.4170
res7*res3	0.973097	3.875457	0.0461	61.30513	0.2916
res7*res4	0.929501	1.412645	0.3554	58.55859	0.3817
res7*res5	0.853687	0.625142	0.8356	53.78228	0.5593
res7*res6	0.810193	0.457342	0.9423	51.04218	0.6626

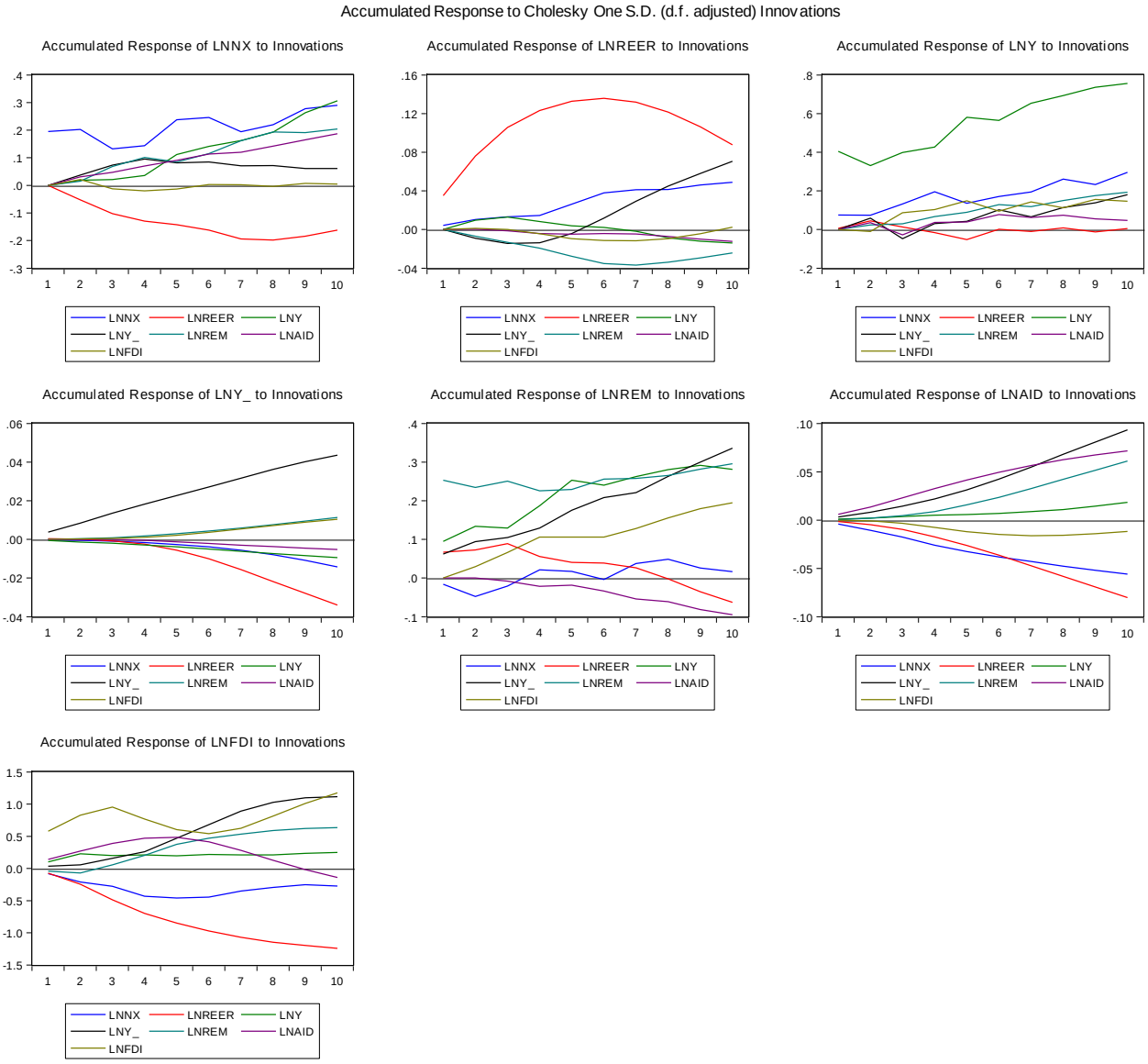
Annex C6: Stability test(AR root graph)



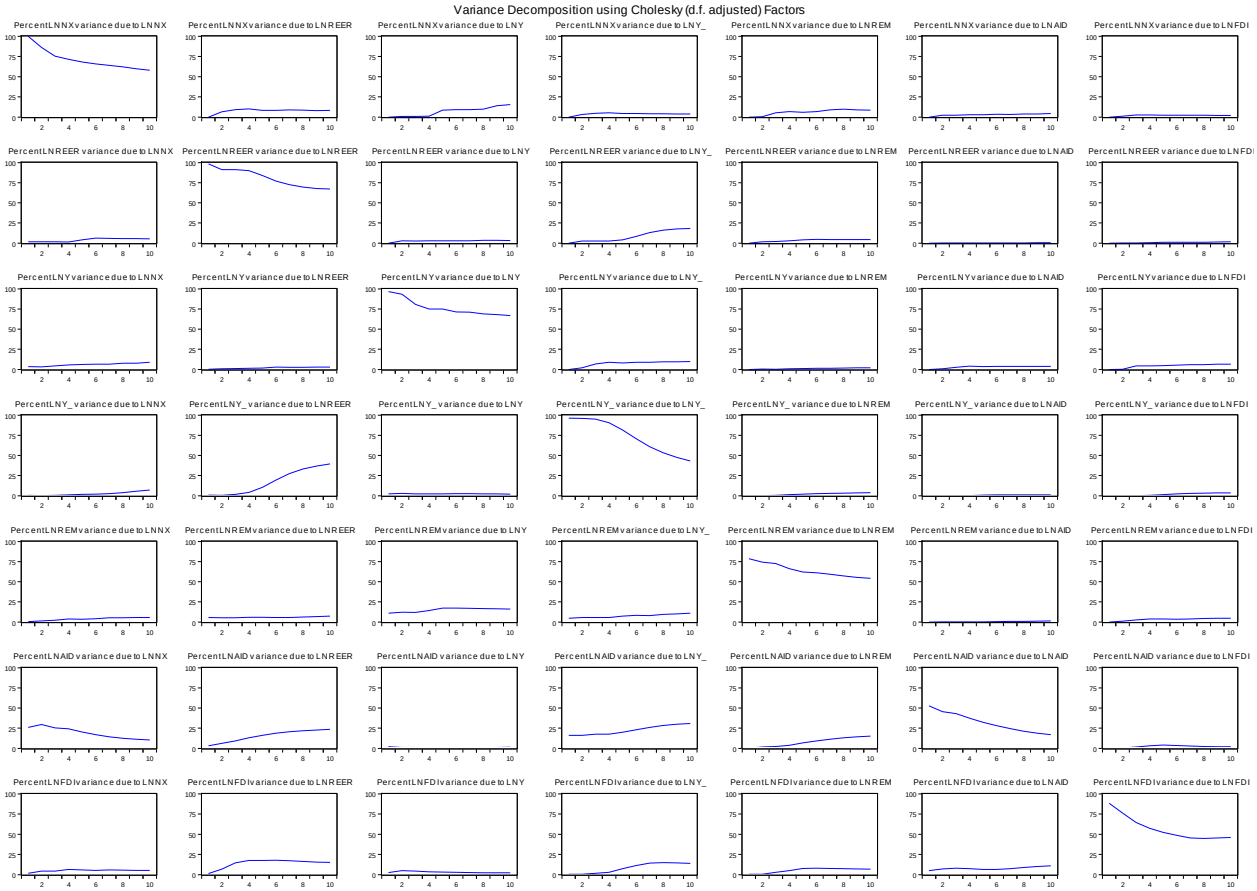
Annex C7: Accumulated impulse response function in graph



Annex C8: Accumulated impulse response function in combined graph



Annex C9: Variance decomposition in graph



Annex C10: Variance decomposition in combined graph