Foreign Exchange Rate Dynamics and Trade Balance: Empirical Evidence from Eastern Africa

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Abstract

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The objective of this dissertation is to examine the effect of real effective exchange rate on aggregate and sectoral trade balances for ten East African countries. Existing few empirical studies in East African countries have focused on cross-country analysis and are static in nature, they have not addressed the short-run and long-run effects of dynamic foreign exchange rate on the trade balance. This dissertation contributes to the literature in Eastern Africa by employing dynamic time series model known as autoregressive distributed lag model.

The empirical results confirmed the presence of cointegration among the variables for both aggregate and sectoral trade balances analysis. Individual country ARDL model estimation result has shown that real effective exchange rate improves the aggregate trade balance in five out of ten countries and statistically significant. Similarly, panel result has shown that elasticity of real effective exchange rate carries a correct sign and statistically significant, implying the importance of foreign exchange rate policy in improving the East African trade competitiveness.

The estimated real effective exchange elasticity in East African countries is very low but slightly increased after foreign exchange regime liberalization.

Sectoral empirical result has indicated that in the response of devaluation of the real effective exchange rate, the trade balance of all three sectors deteriorates in the short-run. However, the long-run real effective exchange rate has a positive effect on manufacturing and mining sectors. Agriculture sector trade balance worsens as a result of the devaluation of the domestic real effective exchange rate but after foreign exchange liberalization, devaluation has a positive impact on trade balance of each sector. The elasticity of agriculture sector is very low, and this is reflected in the aggregate trade balance. Finally, in both aggregate and sectoral trade balance analysis, the effect of real income pronounces more than real effective foreign exchange rate.

The policy implications of our findings are that East African countries are suggested to practice the systematic type of devaluation supplemented with other policy packages including further liberalization of foreign exchange regime that makes trade balance more elastic, especially in the agriculture sector. Moreover, policies that aim at improving trade balance on region should focus on internal production of both exports and imports, utilizing the full capacity of traditional products, diversification and gradually escape from traditional exports.

Keyword: ARDL Model, Eastern Africa, Foreign Exchange Rate, Trade Balance.

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Chapter 1: Introduction

This dissertation is an empirical investigation of the effect of real effective exchange rate on aggregate and sectoral trade balance in Eastern Africa. Theoretically, the real exchange rate is an important determinant of exports and imports because it is an essential economic indicator of country's international competitiveness. The Marshal-Lerner condition states that "if the sum of elasticities of imports and exports is greater than one or the effect of exchange rate on the trade balance is positive then devaluation improves trade balance"(Rose, 1991; Turkay, 2014). After the development of this theory, many studies were conducted for both developed and developing countries over the last 70 years. However, still, there is no unanimity in existing empirical literature about the relationship between foreign exchange rate and trade balance in developing countries. To say least, Miles (1979) on three Latin American countries and two South Asian countries; Bahmani-Oskooee (1991) on Malaysia; Rose (1990) on fourteen developing countries out of thirty developing countries; Upadhyaya (1997) on Cyprus, Greece, and Morocco; Agbola (2004) on Ghana and Shahbaz et al (2012) on Pakistan, have empirically shown that currency depreciation either worsens or does not improve trade balance. On the other hand, Lal and Lowinger (2002) on five South Asian countries; Mark (2006) on emerging economies; Aziz (2008) on Bangladesh and Eita (2013) on Namibia, provided empirical evidence which suggested that currency depreciation improves the trade balance.

Despite such lingering questions on the potency of devaluation to improve the trade balance, East African countries have made maximum use of currency devaluation in recent years with the intention to improve the trade balance. This practice would imply that East African countries are more inclined to have faith in the merits of devaluations to improve trade balance and to generate rapid economic growth. However, their trade balance is further deteriorating; see Punam et al. (2011). If the trade deficit continues, then the current account deficit deteriorates and that adversely affects the welfare of the people of the region.

Therefore, the efficiency of currency devaluation to bring about favorable trade balance and planned economic outcome targets in this region, in particular, is a touchy subject for researchers.

However, Unlike Asia and Latin America, the literature on the effect of devaluation on the trade balance in East African countries is very scanty. Such neglect is unfortunate especially when the effect of devaluation in developing countries has been characterized as one of the most controversial macroeconomic policies (Edwards, 1989a; P. Krugman and Taylor, 1978; Sahn, 1996). Existed very limited studies have methodological gaps. Because some studies were conducted by OLS which is invalid in time series data where most variables are non-stationary (Engle and Granger, 1987). Some of other studies observations were small and they used vector error correction method which may lead to invalid result (Toda, 1995) and most of the previous studies focused on an aggregate level. One of the criticisms of aggregate studies is using aggregate data that causes aggregation bias and significant price elasticity with one trading partner could be offset by an insignificant elasticity[1]of another partner. Moreover, the sign of real exchange rate effect may be different among sectors and some sectors might be in line with aggregate trade balance while others might be inconsistent with aggregate trade balance. Moreover, the previous studies in this region have inconclusive results. Therefore, these existed gaps open a new research area for the study of trade elasticities. Thus, this empirical study attempts to investigate the effect of real effective exchange rate on both on aggregate and sectoral trade balance in the short-run and long-run by using dynamic time series model known as autoregressive distributed lag model.

To investigate the effect of real effective exchange rate on the trade balance, ten Eastern African countries were chosen mainly based on data availability. These are Burundi, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Tanzania, and Uganda[2]. The data used in this dissertation were drawn from various institutions; World Bank (WB), International Monetary Fund (IMF), World Trade Organization (WTO) and

[1] Refer Bahmani-Oskooee and Goswami (2004) for details.

[2] . These countries are selected mainly based on availability of data. These all countries included in East Africa region but African Development Bank classification excludes Madagascar, Malawi and Mauritius.

Penn World Table (PWT Version 8.0). In the aggregate empirical analysis, the time series data were used at the annual frequency for the period 1970-2013 and for sectoral analysis, panel annual data for the period 1980-2013 were used.

To define the relevant set of economic variables that determine the ratio of exports to imports, the study followed three major econometric procedures both in aggregate and sectoral trade balance analysis. The first procedure is conducting the stationarity test by applying standard procedures of unit root tests namely the Augmented Dickey-Fuller (ADF) in aggregate trade balance analysis and Levin et al. (2002), Im et al. (2003), Maddala and Wu (1999), and Phillips and Perron (1988) in sectoral trade balance analysis. Both unit root and panel unit root tests were conducted based on the null hypothesis of a unit root. If all variables are found to be accepting the null of the common unit process at level but rejected the null hypothesis at first difference, we concluded that all variables are stationary at first difference. The second procedure is to test the null hypothesis of no cointegration against the existence of a long-run relationship among all variables. In the aggregate analysis, the presence of cointegration were traced by conducting F-test for the joint significance of the coefficients of the lagged levels of the variables. If the computed F-statistic falls above the upper bound critical value, then the null hypothesis of no cointegration was rejected. If it falls below the lower bound, then the null hypothesis could not rejected. Since cointegration test in panel data is relatively recent, few cointegration tests are documented in the literature. This study used test statistics proposed by Pedroni (2004) which is widely used in many kinds of literature for confirming cointegration among variables. It helped to test the long run relationship among sectoral exports to imports ratio, real effective exchange rate and real income in three sectors. The third procedure is estimating long-run, short-run and error correction term coefficients by using autoregressive distributed lags (ARDL) model for aggregate trade balance analysis and panel ARDL for sectoral trade balance analysis. To estimate ARDL equation for panel data, Pesaran et al. (1999) developed two estimators. These are mean group estimator and pooled mean group estimator. They helped to detect long-run and the short-run correlation between real exchange rate with sectoral trade balance. The choice of ARDl model was based on the following considerations. First, ARDL

does not impose a restrictive assumption that all variables must be integrated of the same order (Bahmani-Oskooee and Brooks, 1999). Secondly, while other cointegration techniques are sensitive to the size of the sample, the ARDL test is suitable even if the sample size is small (Gujarati, 2012). Thirdly, the ARDL technique provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous (Harris and Sollis, 2003). Fourth, ARDL estimates long-run, short-run, and error correction term coefficients simultaneously. In addition to the ARDL model, the other two alternative models were employed to ensure the robustness of the system and to confirm the reliability of the results.

This dissertation is organized as follows: Chapter two deals with an overview of foreign exchange reform and trade balance in Eastern Africa; Chapter three presents the empirical investigation on the effect of real effective exchange rate on the aggregate trade balance. It also attempts to compare the effect of real exchange rate on the trade balance in East African countries with the USA. In Chapter four, the effect of real exchange rate on agriculture, manufacturing and mining trade balances is investigated for the short-run and long-run periods. In addition, the speed of convergence to equilibrium is estimated and compared to each sector. Finally, in Chapter five, results, policy implications, and limitations are summarized.

Chapter 2: Foreign Exchange Reform and Trade Balance

Immediately after independence in the 1960's, most Sub-Saharan African economies, East African countries, in particular, followed by an inward oriented import substitute strategy supplemented by the widespread use of tariff and non-tariff barriers, combination of fixed nominal exchange rate and rapidly expanding aggregate demand. These all factors lead to overvalued currencies in almost all African countries. This policy choice resulted in an excess demand for foreign exchange rate demand and then reduced external competition in manufacturing sectors that were vital in increasing productivity and growth. These impacts culminate economic crises that engulfed the economies of the East African countries during early 1980's, see Wangwe (2003) and Mwakalobo (2009). Eastern Africa is comprised of Ethiopia, Kenya, Tanzania, Zimbabwe, Zambia, Mozambique, Madagascar, Rwanda, Burundi, Malawi, Somalia, Mauritius, Djibouti, Eritrea, Seychelles, South Sudan, and Comoros, based on UN Division (2010).

Many East African countries, undertook comprehensive reforms to liberalize their economies in the late 1980s and early 1990s (Mwakalobo, 2009). As part of the reforms, trade policy was directed towards the reduction of both tariff and non-tariff barriers to international trade, particularly their foreign exchange rate regimes. The reform program was under the umbrella of the International Monetary Fund (IMF), the World Bank (WB), and other donors, which reflected a new paradigm in East African development policy (Wangwe, 2003). Before liberalization, the foreign exchange regime of many of these countries was characterized by administrative controls over foreign exchange rate allocation and current account transactions, extensive rationing of foreign exchange. Because during 1980s, many policy makers in Africa and Eastern Africa, in particular, argued that emphasis on the passivity of the foreign exchange rate as an explaining factor for the economics crises during 1970s and 1980s, be quite misplaced. According to their view, devaluation of the real exchange rate will not be successful owing to the inflationary consequence of nominal devaluation; production in this region is not price elastic; imports price elasticities are not sensitive to

exchange rate. Following liberalization, East African countries like many other developing countries have used a regular basis, currency devaluation as a policy instrument to improve trade balance positions. In this chapter, an overview of foreign exchange rate, trade openness, financing capacity of merchandise exports and sectoral trade balance will be highlighted.

2.1. Devaluation of Foreign Exchange Rate

East African countries continue to make progress towards liberalizing their external environment by the progressive liberalization of their exchange rate regimes, lowering of their average tariffs and either reducing or avoiding exports taxes, see Mwakalobo (2009). For example, in Ethiopia except coffee, merchandise exports taxes are eliminated, and domestic currency was declined by about 201 percent in nominal terms and 25 percent in terms of real effective exchange rate against top ten trade partners' currencies, see Table 2.1.

Table 2.1: Growth Rates of Foreign Exchange Rate

Country	*NER*	*RERUS$*	*REER*
Burundi	288	24	40
Ethiopia	201	20	25
Kenya	249	-71	-52
Madagascar	368	130	134
Malawi	608	137	115
Mauritius	171	1	52
Rwanda	187	-22	-10
Seychelles	77	-36	44
Tanzania	541	47	60
Uganda	1050	32	47
Average	374	26	46

Source author's calculation from IMF data, 2015

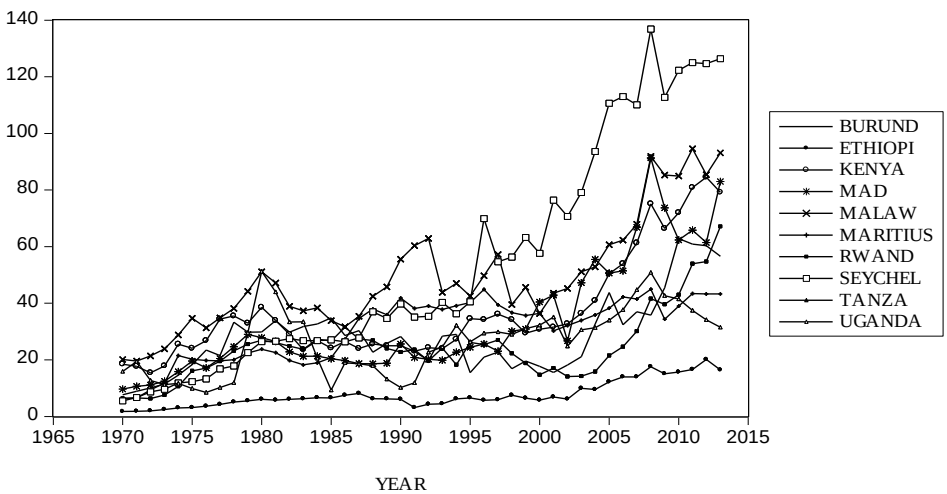
Table 2.1 shows percentage growth rate in the nominal exchange rate (NER), real exchange rate against US$ (RER) and real effective exchange against top ten trade partners' currencies (REER) in sampled East African countries from the year 1970 to 2013. Recently East African countries have devalued their currencies continuously. From 1970 to 2013, they have devalued their currencies on average by about 374 percent in terms of nominal against US$, by about 26 percent in real terms against US$ and 46 percent in terms of real effective exchange rate against top ten trade partners' currencies. The highest devaluation has been evidenced in Uganda's economy that devalued its currency by about 1050 percent at nominal terms against US$ while the lowest devaluation has been evidenced in Seychelles that devalued its currency only by about 77 percent against US dollar in nominal terms for last four decades. Despite high devaluation in terms of nominal value, the translation of nominal devaluation to real devaluation is low. Inability to turn nominal devaluation to real currency devaluation appears to be one reason why these countries trade balance has been worsening so significantly. The translation of nominal devaluation to real devaluation depends on accompanying macroeconomic policies such as credit (monetary policies), fiscal policies and wage indexation policies. It should be noted that even though devaluation follows disciplined monetary and fiscal policies, nominal devaluation might not translate to real devaluation equi proportionally in the medium term and long term due to offsetting factors such as an increase in price. It is expected that the effect of nominal devaluation on real exchange rate will be partially eroded through time.

2.2. Trade Openness

The Africa's place in the global economy has been marginalized and explained by the fact that the continent has been characterized by a lack of capacity and will to influence the world market; that Africa has been a source of raw materials to industrial developments in the today's developed countries. During the 1970s and 1980s, many African countries had faced severe economic crises. As a result, in the late 1980s and early 1990s, many Sub-Saharan African countries and East African countries, in particular, undertook comprehensive reforms. As indicated in Figure 2.1, in the early 1990s, many East African countries have

shown substantial progress towards their participation in the world trade; partly this was due to structural reforms such as reduction in tariff and non-tariff measures and other trade barriers towards global trade involvement. The level of trade has a stable increasing trend after the 1990s, though slightly slow in most of the countries in this region. The extreme variability of openness is quite evident. While Malawi's trade value was 49 percent of her GDP, Ethiopia's trade value to GDP was just 7.61 percent on average for the last four decades. This might be due to the size of the economy (Alesina and Wacziarg, 1998)[3]. The fascinating scenario is openness in all countries of the region has been increasing from year to year as evidenced in Figure 2.1. The highest improvement of openness has been evidenced in Seychelles, which improved from 5.5 percent in 1970 to 126 percent in 2013, and poor progress of openness has been evidenced in Ethiopian economy[4].

Figure 2.1: Trade Openness



Source author's calculation based on IMF data, 2015

[3] The smallest economic unit, a household, sells most of his endowment (labor) and buys (imports) most of his consumption. A household is a small economic unit and has a very high degree of trade openness. The conclusion of the above argument is that the smaller the country the more open it should be.

[4] See Table 6.1 in Appendix 1.

2.3. Pre and Post Foreign Exchange Reform Trade Openness

The failure of the import–substitution strategy and debt crises in the early 1980s led to a new consensus on the importance of trade liberalization, exports in growth strategies and foreign exchange rate reform. This new consensus was the main focus of reforms initiated by SSA countries and developing the world in general from the early 1980s; within this framework of the structural adjustment program, since the mid-1980s the formulation and implementation of wide-range trade liberalization measures have been undertaken by most SSA countries with the support of International Monetary Fund (IMF) and World Bank (WB). Trade liberalization in Eastern Africa took place because of pressure from IMF and WB. Trade liberalization has expected to drive economic integration and promote export growth in the region then increase trade openness. The share of trade in GDP (trade openness) is an indicator of economy's ability to integrate itself into global markets. Trade liberalization is expected to have a positive effect on country's openness. Table 2.2 shows trade openness before and after ten years of foreign exchange regime liberalization. Average trade openness in the region has been increased from 25 percent before foreign exchange regime liberalization to 36 percent after liberalization; Seychelles has experienced the highest share of trade in GDP (118 percent) after liberalization while landlocked Ethiopia has shown the lowest share of trade in GDP (6 percent) after liberalization. Trade openness has increased in six countries out of ten sampled countries in the region. In the landlocked countries, Rwanda and Uganda, openness has worsened after foreign exchange regime liberalization while there has been no change in Ethiopia and Madagascar.

Table 2.2: Trade Openness

Country	Foreign Exchange Regime Liberalization Year	Before Liberalization	After Liberalization	Status
Burundi	2003	20	47	Better
Ethiopia	1992	6	6	No change
Kenya	1993	25	33	better
Mada.	1988	23	23	No change
Malawi	1986	40	49	better
Mauritius	1985	21	37	better
Rwanda	1995	24	19	worse
Seychelles	2003	55	118	better
Tanzania	1995	9	10	better
Uganda	1987	26	22	worse
Average		25	36	Better

Source author's calculation based on IMF data,2015

2.4. Trade Balance

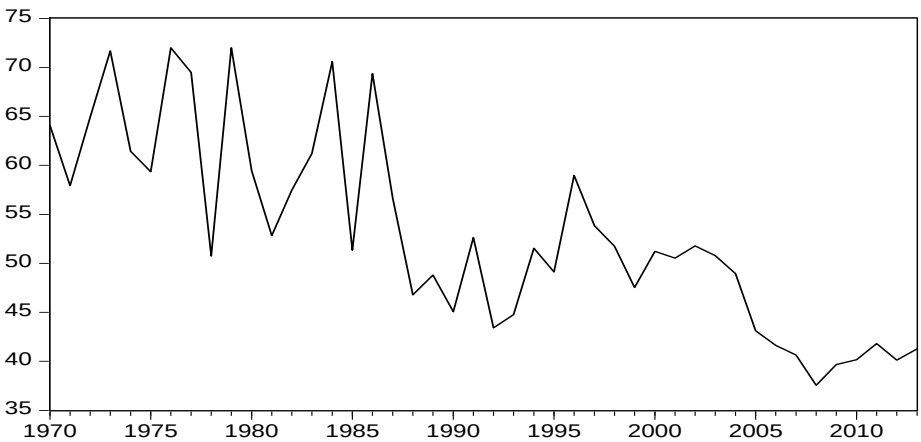
Trade Liberalization is expected to promote exports and imports, but the effect is not symmetrical. Trade liberalization, however, has increased imports more than exports, which has created high levels of the trade deficit in developing countries (Santos-Paulio and Thrilwall, 2004).

In spite of efforts such as liberalizing foreign exchange rate regime, easing merchandise export taxes, reducing tariffs, the capacity of merchandise exports to finance merchandise imports in all East African countries has been deteriorating except Seychelles's trade balance which has shown some improvement but still it is at the bottom, see Table 6.2 in Appendix1. The worst trend has been evidenced in the case of Ethiopia in which financing capacity of merchandise exports to finance merchandise imports declined from 71 percent in 1970 to 25 percent in 2013[5]. On average, the trade balance has been very low for Seychelles, Rwanda,

[5] See Table 6.2 in Appendix1

Ethiopia, Burundi and Tanzania. However, Mauritius has been leading the region by average financing capacity of merchandise imports by its merchandise exports. In Mauritius, on average 74 percent of merchandise imports have been financed by merchandise exports for the last four decades.

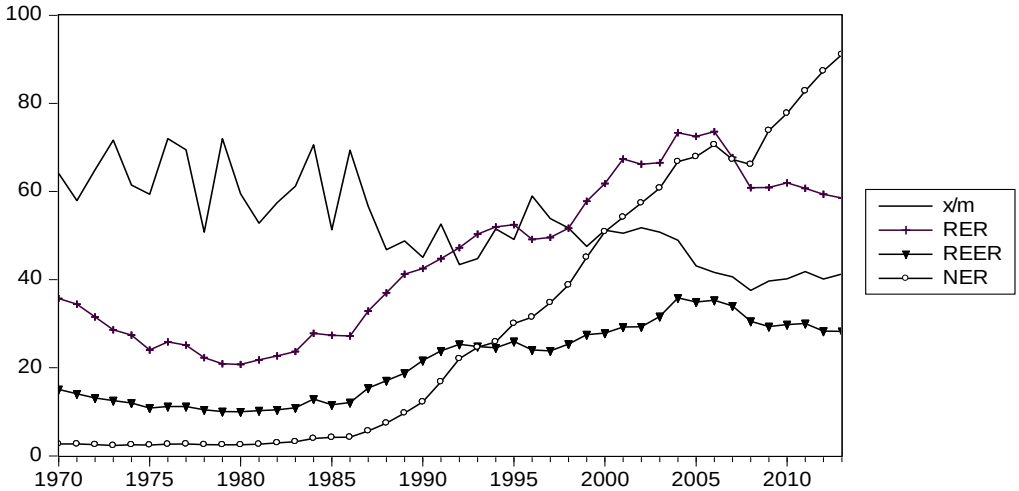
Figure 2.2: Merchandise Exports to Imports Ratio



Source author's calculation from IMF data, 2015

As we can see from the Figure 2.2, average exports capacity to finance imports of goods in the region has been declining from year to year. The trend has been very volatile; this is due to the nature of merchandise exports of the region. The merchandise exports in the region are dominated by agriculture commodity, which is susceptibility to high volatility due to weather condition and world commodity market prices. Because of low and declining financing capacity of exports, the outlook on the external position is for the trade account to deteriorate further as merchandise imports rise faster than merchandise exports, see Santos-Paulio and Thrilwall (2004). Thus, East African countries will continue to need further improvements in current transfers so as to prevent the current account position from worsening. Figure 2.3 shows the trend of average financing capacity of export and exchange rate for ten Eastern African countries. The relationship trend between average nominal foreign exchange rate (NER), average real foreign exchange rate (RER) against the US $, average real effective foreign exchange rate against top trade partners currencies and average merchandise exports to merchandise imports ratio (X/M) does not show any pattern.

Figure 2.3: Trend of Trade Balance and Foreign Exchange Rate



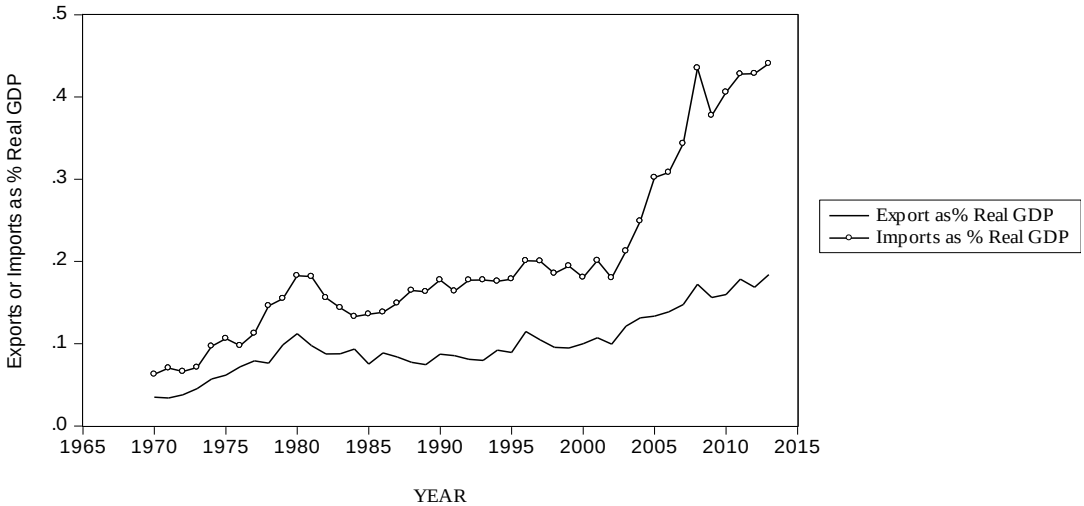
Source author's calculation from IMF data, 2015

2.5. Ratio of Merchandise Exports and Imports to GDP

Figure 2.4 shows the average (1970-2013) merchandise exports and merchandise imports as a percentage of RGDP in sampled Eastern African countries. The average trade balance in Eastern Africa has been worsening recently as shown by the gap between merchandise exports as a percentage of RGDP and merchandise imports as a percentage of RGDP. The widening of the gap between exports and imports is due to that fact that countries in this region export relatively inelastic traditional goods and import relatively elastic goods. In 1970, the highest deficit as a percentage of RGDP was 11 percent in Tanzania while the lowest deficit was zero in Uganda. In 2013, the highest trade deficit as a percentage to RGDP was 39 percent in Burundi and lowest was 8 percent in Tanzania. In Burundi and Seychelles trade balance has been deteriorating further and worse than all other countries. During the period 1970-2013, the highest deficit as a percentage of RGDP (57 percent) was experienced by Seychelles in 2008 and highest surplus as a percentage of RGDP (11 percent) was evidenced in Tanzanian economy in 1979[6].

[6] . Figure 6.2 in Appendix1shows each country's exports and imports of goods as percentage of real GDP

Figure 2.4: Average Merchandise Exports and Imports as Percentage of GDP



Source author's calculation from IMF data, 2015

After discussion on the trend of financing capacity of merchandise exports during sampled period, now let us compare the funding capacity of exports before and after foreign exchange regime liberalization in the region. Table 2.3 shows the distribution of financing capacity of merchandise exports in the sampled countries before and after ten years of foreign exchange rate liberalization. In six out of seven countries, financing capacity of export was worsened. On average financing capacity of merchandise exports has been deteriorated from 59 percent before ten years of foreign exchange liberalization to 55 percent after ten years of liberalization. This result is consistent with Santos-Paulio and Thrilwall (2004) empirical result. Foreign exchange devaluation is expected to stimulate merchandise exports and reduce merchandise imports growth but the effect is not as expected. Despite the vigor of export response in most countries in the region, merchandise imports increased as a percentage of GDP for all countries except Madagascar, Rwanda, and Tanzania. Table 2.3 shows the status of merchandise exports and merchandise imports as a percentage of GDP before ten years of liberalization of foreign exchange rate and after ten years of foreign exchange liberalization. On average merchandise exports per real GDP response to foreign exchange rate liberalization is lower than imports response as a percentage of real GDP. Average merchandise exports as a percentage of real GDP has been increased from 9 percent

for ten years before liberalization to 12 percent for ten years after liberalization. While average merchandise imports as a percentage of real GDP has been increased from 16 percent on average in ten years before liberalization to 24 percent in ten years after foreign exchange rate liberalization.

Table 2.3: Post and Pre-Foreign Exchange Rate Regime Liberalization Trade Balance

Country	Lib.	x/m			x/GDP			m/GDP		Status
	year	Pre	Post	Status	Pre	Post	Status	pre	Post	
Burundi	2003	40	18	Worse	6	7	increase	15	40	Increase
Ethiopia	1992	41	35	Worse	2	2	No change	4	5	increase
Kenya	1993	61	64	Better	9	13	increase	18	20	increase
Mada.	1988	78	73	Worse	10	9	decline	13	12	decline
Malawi	1986	78	70	Worse	17	20	increase	23	29	increase
Mauritius	1985	73	77	Better	9	16	increase	12	21	increase
Rwanda	1995	52	27	Worse	6	4	decline	18	15	decline
Seychelle	2003	36	48	Better	15	38	increase	41	80	increase
Tanzania	1995	31	48	Better	2	3	increase	7	7	No change
Uganda	1987	77	50	Worse	11	7	decline	13	15	increase
Average		59	55	worse	9	12	increase	16	24	increase

Source authors calculation Based on IMF data, 2015

2.6. Overview of sectoral Trade

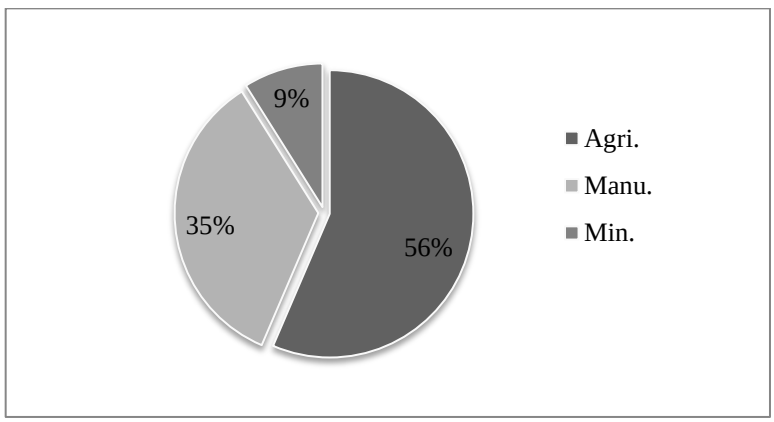
2.6.1. Sectoral Distribution of Merchandise Exports

Figure 2.5 shows the average share of sectoral merchandise exports for ten East African countries during the year 1995-2013. Agriculture proportion of exports dominated share of manufacturing and mining sectors except Mauritius where agriculture export share was only about 30 percent on average for the last two decades[7]. The agriculture sector has a significant share, which comprises about 56 percent of total merchandise exports in this region. manufacturing exports have about 35 percent share of the total exports. The highest share is

[7] . See Table 6.3 in Appendix1, which Shows Mauritius's manufacturing export share is about 68 percent and agriculture share is only about 30 percent on average for the year 1995-2013.

in Mauritius with 68 percent thanks to the policy of export processing zones that started in the 1970s while the export share of manufacturing is lower than Kenya. The minimum share of manufacturing export was evidenced in Seychelles and Ethiopia with about 6 percent and 8 percent respectively[8]. Figure 2.5 shows that share of mining sector export is extremely very low in East African countries.

Figure 2.5; Merchandise Exports Distribution by Sector

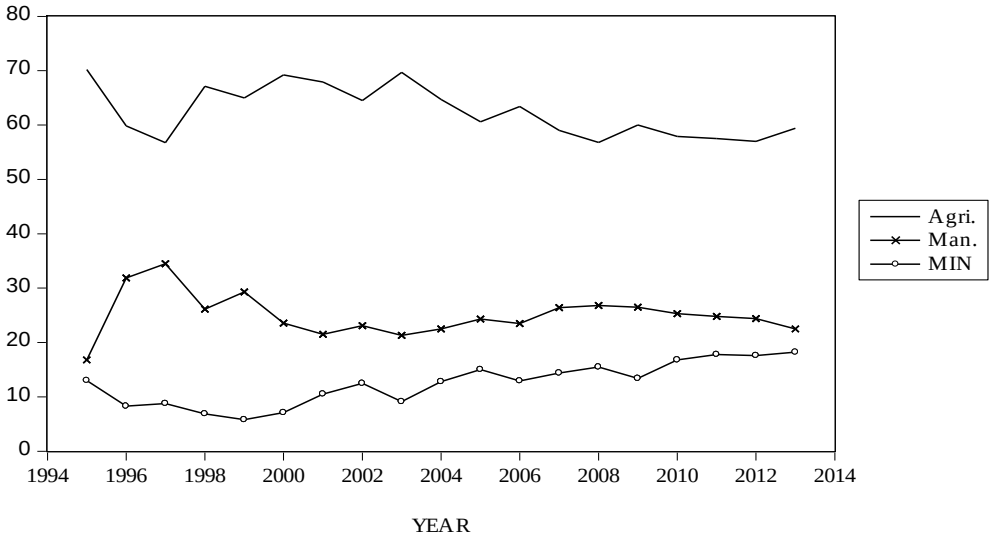


Source: author's calculation based on WTO data, 2015

The share of agriculture exports dominates and has about 56 percent of total merchandise exports in the region. Even though the progress is slow, the mining sector exports share has shown an improvement from year to year, see Figure 2.6. As quoted by Mans Söderbom and Teal (2001), the poor performance many African economies have been associated with the low growth of exports in general and manufacturing exports in particular. As indicated in Figure 2.6, the share of manufacturing exports is very low as compared to the share of agriculture exports and it has been declining after 2008[9]. Colliner and Gunning (1999) identified the factors that explain the poor performance of manufacturing exports. One of the constraints for the poor performance of manufacturing exports is a real overvaluation of the domestic currency. This study attempted to assess the effect of the real effective exchange rate on sectoral trade competitiveness in Chapter four.

[8] See Table 6.3 in Appendix1.
[9] Refere Fig 6.3 in Appendix1.

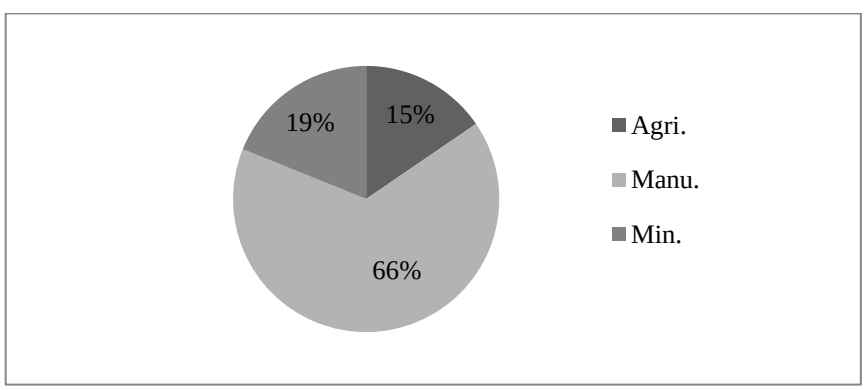
Figure 2.6: Trend of Exports by Sector



Source: Author's calculation Based on WTO data

2.6.2. Sectoral Distribution of Merchandise Imports

Figure 2.7: Merchandise Exports Distribution by Sector

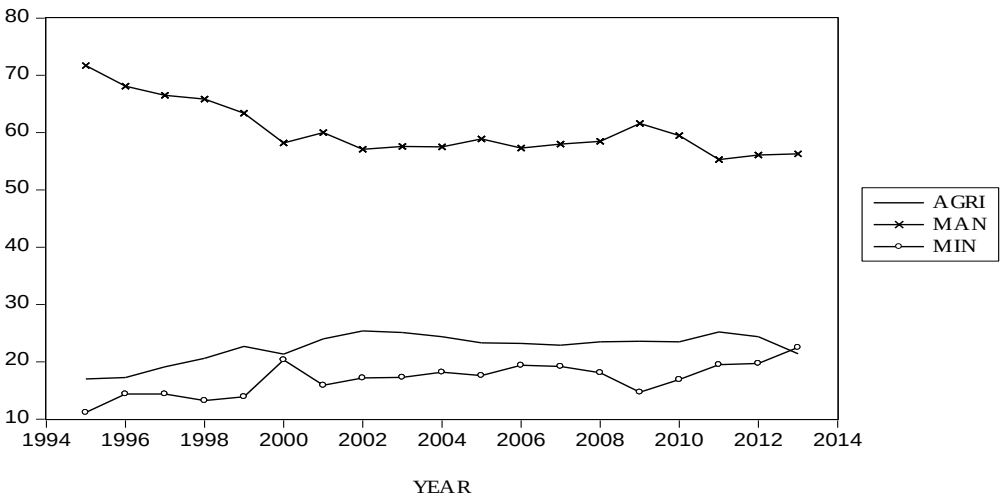


Source: author's calculation based on WTO data

Figure 2.7 shows the sectoral share of imports during the period 1995-2013. For this period, the imports of manufacturing sector dominated agriculture and mining sector imports in the region. It is believed that mostly manufacturing imports are demand-driven from the combined effect of regional growing population and growing per capita income. Thus, this sector has a significant share, which comprises about 66 percent of total merchandise

imports. The second highest share is held by mining and fuel sector, which is dominated by fuel merchandise imports and has a share of 19 percent. The agriculture sector has the least share in merchandise imports and has about 15 percent share. This is not surprising in the agrarian economy where agriculture has the highest share of GDP. As we can see from Figure 2.8, the share of manufacturing exports is very significant but shows some tendency of declining while the share of mining and agriculture share is low.

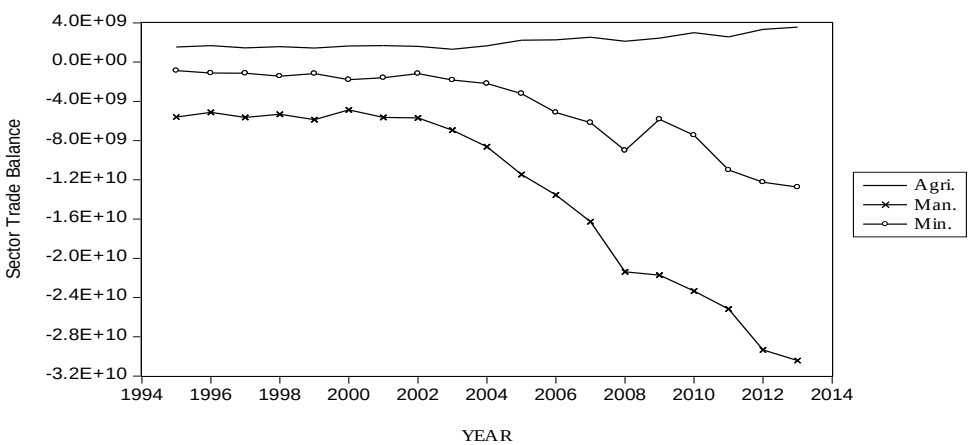
Figure 2.8: Trend of Imports by Sector



Source: author's calculation based on WTO data

2.6.3. Sectoral Trade Balance

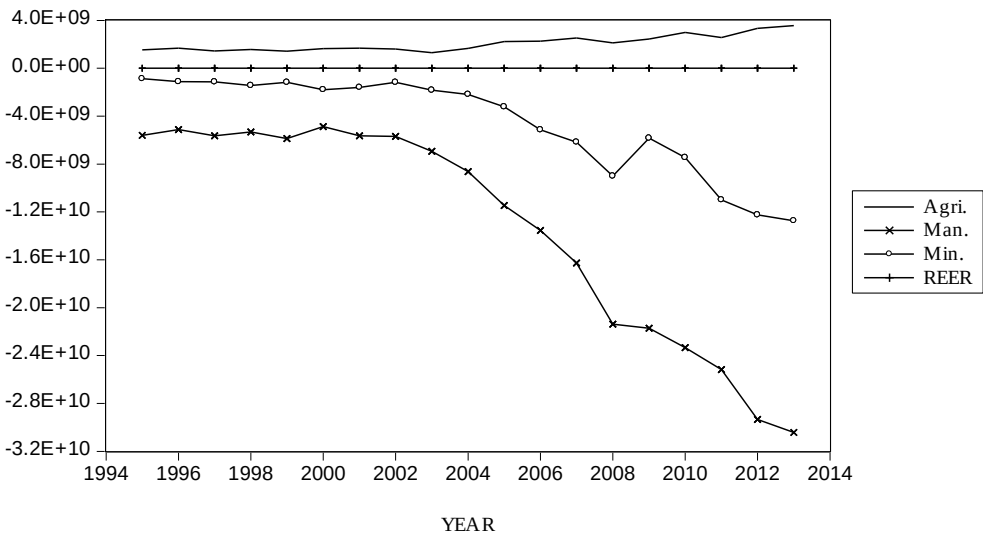
Figure 2.9: Trend of Trade Balance by Sector



Source: author's calculation based on WTO data.

Figure 2.9 indicates the three sectors trade balances in sampled countries. The Trade balance varies widely among sectors in the region as shown by the gap between the three trade balance figures. This region is net exporters of agriculture goods; thus, its trade balance is surplus while in manufacturing and mining sector the region is net importer and trade deficit has been worsening from year to year. The highest trade deficit has been shown by the manufacturing sector, and its deficit has been rapidly increasing. The region is net fuel importer due to this mining sector also facing trade deficit and worsening as region's economy is growing. Like aggregate trade balance, the relationship trend between average real effective exchange rate (REER) and sectoral trade balances does not show any pattern.

Figure 2.9: Trade Balance by Sector and Real Effective Exchange Rate



Source: author's calculation based on WTO data

Chapter 3: Foreign Exchange Rate Dynamics and Aggregate Trade Balance

3.1. Introduction

Theoretically, the real exchange rate is an important determinant of exports and imports because it is an essential economic indicator of country's international competitiveness. The marshal-Lerner condition states that "if the sum of elasticities of imports and exports is greater than one then devaluation improves trade balance" as cited in Rose (1990, 1991), Hacker and Hatemi-J (2004), Turkay (2014). However, in some cases, the trade balance is continued to fall even when Marshal-Lerner condition is fulfilled (Bahmani-Oskooee,1985). After the development of this theory, many studies were conducted for both developed and developing countries over the last 70 years but still there is no unanimity in existing empirical literature about the relationship between foreign exchange rate and trade balance in developing countries in particular (Onafowora, 2003; Ahmad and Yang, 2007).

Despite such persistent questions on the potency of devaluation to improve the trade balance, East African countries have made maximum use of currency devaluation in recent years with the intention to improve the trade balance. This practice would imply that East African countries are more inclined to have faith in the merits of devaluations to improve trade balance and to generate rapid economic growth. However, their trade balance has been further deteriorating in all countries; see Punam et al. (2011), Mwakalobo (2009) and see Table 6.2 in Appendix1. If the trade deficit continues, then the current account deficit deteriorates and adversely affects the welfare of the people of the region. Therefore, the efficiency of currency devaluation to improve trade balance in this region is a touchy subject for researchers. However, the literature on the effect of devaluation in Sub-Saharan and East African countries, in particular, is very scanty, and the findings are inconclusive. Moreover,

some of the existing studies have focused on cross-country analysis and are static in nature, they have not addressed the short-run and long-run effects of dynamic foreign exchange rate on the trade balance and used ordinary least square even though several variables in the trade balance model exhibited non-stationary. Therefore, the null hypothesis will be wrongly rejected (Engle and Granger, 1987) and others used vector error correction method (VECM) for small observations (Toda, 1995). To fill these gaps, we investigated the relationship between trade balance and real effective exchange rate empirically by using dynamic time series model namely autoregressive distributed lag model and two other alternative procedures.

3.2. Objectives of the study.

Despite major structure reforms such as foreign exchange regime liberalization for the last four decades, the trade balance has been worsening in Eastern Africa, see Mwakalobo (2009) and Punam et al (2011), and Table 6.2 in Appendix one. On the other hand, international institutions (WB and IMF) suggested more reforms including further devaluation of domestic currency. For example, in Ethiopia despite significant domestic currency devaluation for the last three decades; recently, in 2014, World Bank suggested a further devaluation of the domestic currency to solve the problem of trade deficit but the government was reluctant to do so (http://www.bloomberg.com/news/articles/2014-07). A similar scenario is true for other countries in this region. Therefore, the efficiency of currency devaluation to bring about favorable trade balance and planned economic outcome targets in this region, in particular, is a touchy subject for researchers. In this chapter, we attempt to find out the effects of real effective exchange rate on the trade balance in East African countries. Specifically, it investigates the existence of a long-run relationship between trade balance and real effective exchange rate. Furthermore, it examines the effects of real effective exchange rate on the trade balance in the short-run and long run, and indicates policy implications.

3.3. Significance of the study

To the best of our knowledge, empirical study on trade elasticity and the Marshall-Lerner condition for many East African countries is scanty and, no formal study has been conducted for Eastern Africa region. Existing very limited country-level empirical studies have methodological gaps and inconclusive results. This study attempted to fill these gaps and adds knowledge for the purpose of policy decisions in Eastern Africa by using the dynamic time series model. Furthermore, there is still a debate on the effect of real exchange rate on the trade balance in general. Therefore; this study provides some academic contributions for existing knowledge on the dynamic relationship between exchange rate and trade balance. This study further uses as a supplementary reference for Central Bank of a country in the region in its formulation of monetary and supervisory policies. Quantifying both the short and long-run relationship between the trade balance and the exchange rate is important because if such a stable long-run does not exist, the depreciating of the exchange rate does not seem to be a reasonable way of improving country's competitiveness on the long-run basis. If the long-run relationship does exist, it is necessary to establish whether depreciation is significant or not. Finally, this study helps and encourages others to conduct further study on this topic in Eastern Africa.

3.4. Review of Literature

3.4.1. Review of Theoretical Literature

As vividly explained by Reinhart (1995), devaluation has often been used by developing countries to reduce large external imbalances, correct perceived "overvaluations" of the real exchange rate, increase international competitiveness, and promote merchandise exports growth. However, devaluation can only accomplish these tasks if it translates into a real devaluation and if trade flows respond to relative prices in the significant and predictable way. This clearly shows that the nominal devaluation is not a goal in itself. However, it is discussed by Edwards (1989) that in theory and under most common conditions, nominal devaluation will affect a trade in three main ways. First, devaluation will usually have an

expenditure reducing effects. To the extent that devaluation pushes domestic price level goes up, there will be a negative wealth effect that will reduce the real domestic currency denominated nominal assets, including domestic money. A lower real value of assets will reduce expenditure on all goods. Second, it will tend to have an expenditure switching effect. This effect involves shifting in the pattern of domestic demand from tradable goods towards non-tradable goods, and the pattern of domestic production from non-tradable to tradable goods. The combined effect of expenditure reducing and expenditure switching will, of course, improve the external situations of the country. Third, devaluation will increase the domestic price of imported intermediate inputs.

Despite the existence of a plethora of theoretical and empirical studies that examined the relationship between exchange rate devaluation and trade balance, there are still heated debates over the impact of devaluation on trade balance both in the case of developed and developing countries (Ahmad and Yang, 2007). Since the significance of our study lies in understanding how changes in the exchange rate can affect the balance of trade in the long-run and the short-run, we need to assess the different approaches in the evaluation of this situation. Ever since the failure of the presumption of automatic adjustment of the balance of payments, three approaches have been developed in investigating the impact of exchange rate changes on balance of payments. However, empirically elasticity approach is popular, and our study is also based on the idea of elasticity approach[10]. Each approach is discussed as follows but we focus on elasticity approach because our study is built on this theory.

10 Keynesian based Absorption Approach and the Monetary Approach both focus on the macroeconomic linkages and identities, rather than the microeconomic relationships of the Elasticity Approach. Thus, the relationship between the trade-exchange rate issue and other macroeconomic variables could be better understood under these two approaches. However, relatively few empirical studies investigated these two approaches. This might be due to the fact that both approaches were not substantially improved to cope with dramatic changes in the nature of the current account balance in post-Bretton Woods era, which left these two approaches underdeveloped and rudimentary (Abbas Ali et al. , 2014).

Elasticity Approach

The elasticity approach concentrates on the balance of trade, which is one of the main subcategories of current account balance, and it assumes that international relative prices are main explanatory variable determining current account balance. This approach provides an analysis of what happens to trade balance when a country devalues its currency and conditions that must prevail in the foreign exchange market for a devaluation or depreciation of the currency to improve the trade balance starting from equilibrium; see Hoontrakul (1999). In elasticity approach, trade balance adjustment path is viewed by elasticities of demand for imports and exports. The elasticity of demand is defined as the quantity responsiveness of demand for imports and exports or services to change in prices (Sugema, 2005). Bickerdike (1920) was the first to develop the idea of elasticity by modeling nominal import and export prices as functions of import and export quantities (Brooks, 1999) and later Robinson (1947) and Metzler (1945) contributed to the elasticity approach by clarifying and detailing the Bickerdike's ideas. Bickerdike-Robinson-Metzler condition implies that the change in the foreign currency value of trade balance depends on the import and export supply and demand elasticities and the initial volume. According to this approach, devaluation affects trade balance through reducing the quantities of imports because of increase in the prices of imported goods; secondly, increase in exports because of the decrease in the prices of exported goods; net results of these impacts depend on exports and imports elasticities.

The elasticity approach revolves around the questions of volume and value responses to changes in real exchange rate. Figure 6.3 in Appendix 2 shows the case of domestic elasticity of supply in a devaluating country and lower prices as a result of devaluation increases foreign demand for domestic goods. However, if demand is inelastic, the volume of goods will not rise to the extent that value of merchandise exports decline as a result of fall in the price of merchandise exports (Marshall and Groenewegen, 1996). A similar notation goes for the domestic elasticity of demand. If the domestic demand for imported goods is elastic, then the pattern of domestic demand will be changed. In summary, if the decline in value of

imports is greater than the decrease in value of domestic exports, trade balance will improve. If the sum of exports and imports elasticity exceeds unity or trade balance elasticity is positive, then devaluation improves the trade balance; see Figure 6.4 in Appendix 2. This condition is known as Marshall-Lerner condition (Rose, 1991; Hacker and Hatemi-J., 2004; Turkay, 2014). Marshall-Lerner condition is a further extension of the elasticities approach. The condition could be seen as an implication of work of Bickerdike (1920). Nevertheless, it was named after Alfred Marshall and Abba-Lerner because Marshall is considered as the father of elasticity as concept and Abba-Lerner (1944) for his later exposition of it, as cited by Brooks (1999). As discussed above, in Marshall-Lerner condition, for a devaluation to have a positive impact on foreign trade performance, the sum of absolute values of demand elasticity of exports and imports of goods must be greater than unity.

$$\left| ή x + ή m \right| > 1 \qquad (3.1)$$

Consider a small one percent devaluation which leads to one percent fall in the foreign price of domestic exports. If the demand for exports rises by less than one percent, foreign exchange rate earnings will fall; if the demand rises by more than one percent, foreign exchange earnings will raise, and if demand rises exactly one percent, foreign exchange earnings will remain the same.

In keeping with Pugel and Lindert (2000), the central message of the elasticity approach is that there are two direct effects of devaluation on the trade balance , one which works to reduce, and the other one works to worsen. These are price effect and volume effect. The price effect clearly contributes to worsening of trade balance because exports become cheaper measured in foreign currency, and imports become expensive measured in the home currency. The volume effect obviously contributes to the improving of trade balance. This is due to the fact that exports become cheaper should encourage an increased volume of exports and the fact that the imports become expensive should lead to a decreased volume of imports. The net effect depends on whether volume or price effect dominates.

There is a general consensus by most of the economists that elasticity is lower in the short-run than in long-run, in which case Marshall-Lerner condition may not be fulfilled although it generally holds over the long-run leads to the phenomenon of what is popularly known as the J-curve effect (Niehans, 1984). The J-curve dynamic view came into existence after three decades of Marshall-Lerner condition generalization (V. Brown et al., 1996). The idea underlying the J-curve effect is that in short-run, exports volumes and imports volumes do not change much, so that the price effect outweighs the volume effect leading to deterioration in the trade balance, see Figure 6.5 in Appendix 2 for more clarification. Three of the most important reasons advanced in explaining the J-curve effect are a time lag in both producers and consumers' response, and imperfect competition (Södersten and Reed, 1994).

Driskill (1981), made a refinement of elasticity approach by incorporating income effect into the analysis. In this study, it is asserted that the impacts of changes in foreign exchange rates on the balance of trade cannot be explained with an elasticity, which is calculated by seeing only the variations in the prices and quantities of goods, and so income effect should be added to the model. According to the study, if autonomous money expenditure remains constant, allowing for income effect does not alter marshal-Lerner condition for successful devaluation but the magnitude of the effect on the trade balance is altered.

Absorption Approach

Absorption approach due to Alexander (1952) and Johnson (1967) and popularized by Miles (1979) was developed to overcome some of the shortcomings of the elasticity approach. The major purpose of the absorption is to integrate the balance of payments with the functioning of the total economy in general equilibrium framework. The balance of payments disequilibrium on current account is viewed as the outcome of the difference between the decisions to produce and spend, or to save and invest (Hallwood and Macdonald, 2000).

$$Y = C + I + G + X - M \qquad (3.2)$$

Where C denotes consumption; I denote investment, G is government expenditure, X represents exports and M represents imports and defining domestic absorption as A=C+I+G and Trade balance as TB=X-M then

$$\text{TB} = Y - A \quad \text{(3.3)}$$

That is, the trade balance is the difference between income (Y) and absorption (A). Alternatively

$$\text{TB} = S - I \quad \text{(3.4)}$$

With this framework, devaluation can be evaluated in terms of whether it raises income(Y) relative to absorption (A) or saving (S) relative to investment (I). Therefore, understanding how devaluation affects both income and absorption are central to the absorption approach (Pilbeam, 1998). Policies to raise income are termed expenditure-switching policies and include tariffs, import quotas, export subsidies and devaluation. Policies to reduce spending are termed expenditure reducing policies and include higher taxes, lower government expenditure, higher interest rates (Hallwood and MacDonald, 2000; Santos-Paulino and Thirlwall, 2004).

Monetary Approach

The monetary approach was pioneered by Frenkel (1976). The elasticity and absorption approaches apply to the trade account of the balance of payments, neglecting the capital movements. Thus, the essence of the monetary approach to the balance of payments is that it takes the balance payments as a whole (the current and capital account) and the fundamental basis of the monetary phenomenon and not a real phenomenon. It is argued that any disequilibrium in the balance of payments is a reflection of disequilibrium in money markets. An excess supply of money leads to a loss of international reserves (deficit) and an excess demand for money leads to a gain in international reserves and changes in the level of

reserves are the mechanisms by which the balance between the supply and demand for monetary is restored.

The monetary approach argues that currency depreciation can only be successful if it increases the nominal demand for money relative to the supply, as the price level rises, or by reducing the real supply of money in relation to the real demand (Santos-Paulino and Thirlwall, 2004). The monetary approach emphasizes that devaluation will have only a transitory beneficial effect on the balance of payments only so as the authorities do not simultaneously engage in the expansionary open market operation. According to this theory, the balance of payment deficit is solely a monetary phenomenon mainly caused by the excess of money supply (Dunn Jr and Mutti, 2004). Thus, currency devaluation has an impact on the balance of payment only through its effect on real money supply. Therefore, devaluation increases the balance of payment by increasing domestic prices and thereby reducing the real money supply. Devaluation fails if they are followed by a further increase in nominal money supply that reestablishes the original disequilibrium.

3.4.2. Review of Empirical Literature

As we discussed in theoretical literature part, Alfred Marshall-Lerner, Abba-Lerner, and their followers suggested that competitive advantage in international market could be created by the devaluations or depreciation of domestic currency. Domestic exports become cheaper for foreign importers when a one a nation devalues its currency. On the other hand, imports demand decreases because imports for the same country becomes expensive by the devaluation of domestic currency and they formulated a condition for the devaluation to be effective (Rose, 1991; Hacker and Hatemi-J., 2004; Turkay, 2014). This condition is known as Marshall-Lerner condition and states “if the sum of elasticities of demand for imports and exports are greater than one, then trade balance improves by devaluation”. After the development of this theory, many studies were conducted over the last 70 years; however, there is no unanimity in existing literature pertaining to the relationship between exchange rate and trade balance in general and developing countries, in particular. To say, least, Miles

(1979) by using ordinary least square model in three Latin American countries and two South Asian countries could not find any evidence that supports exchange rate improves the trade balance. Rose (1990) has examined the relationship between the real exchange rate and real trade balance for a variety of developing countries by using the three-stage least square technique. Despite the use of data at two frequencies for thirty countries, he could not find a strong, stable effect of exchange rate on the trade balance. Upadhyaya (1997) tested the effectiveness of devaluation on the trade balance in eight developing countries from Asia, Europe, Africa and Latin America. At that time, a unique and new methodology known as distributed lag model was used to estimate the long-run effect of devaluation on the trade balance. The estimated results suggested that devaluation, in general, does not improve trade balance in the long run. in some countries such as Cyprus, Greece, and Morocco even has a perverse effect. Agbola (2004) estimated a long relationship between Ghana's trade balance, real domestic and foreign income, domestic and foreign interest rate by using Stock –Watson dynamics of ordinary least square. The result suggested that devaluation does not improve trade balance of Ghana in the long run. The response of the moment in the exchange rate appeared to be characterized by M-curve phenomenon. Similarily, Damoense and Agbola (2004) came with evidence that supports the view that devaluation of real exchange rate worsens trade balance. By using vector error correction model, they have empirically shown that currency depreciation worsens trade balance in South Africa. Hsing (2008), using vector error correction method, showed that exchange rate has a negative effect on the trade balance in Peru and Latvia. Shahbaz et al. (2012) examined the relationship between dynamics of real exchange rate and trade balance of Pakistan by applying autoregressive distributed lag model. They confirmed the existence of a long-run negative relationship between real exchange rate and trade balance. Yol and Baharumshah (2007) investigated the dynamic effect of real exchange rate on ten African countries by using fully modified ordinary least square. The fully modified least square results indicated that real exchange depreciation worsens trade balance in Tanzania, with no effect found in Ghana, Morroco, and Senegal. Foreign income improves the trade balance in two countries but worsens it in another three,

similarly, domestic income negatively affects the trade balance in four countries but improves in another three countries.

On the other side, Himarios (1985) employed open economy model using quarterly data from eight less developed countries and found that in most of the LDCS, effective exchange rate, and trade balance are cointegrated, and devaluation improves trade balance in the long run. Bahmani-Oskooee (1991) using cointegration method showed that in long run devaluation improves trade balance in most of the LDCS. Bahmani-Oskooee and Malixi (1992), by using cointegration method, showed that devaluation could be successful in LDCS. Rawlins and Praveen (1993) studied the effect of real exchange rates on the trade balance in nineteen countries in the Sub-Sahara Africa. The results of the ordinary least square method, which they employed, showed that real exchange rate depreciation did improve trade balance in seventeen of the nineteen countries in the year of devaluation, although real exchange rates fail to revert to their pre-devaluation levels. Zhang Z. (1999) by using maximum likelihood cointegrating method on China; Baharumshah (2001) by using cointegration method on Malaysia and Thailand; Bahmani-Oskooee (2001) using cointegration method on most non-oil exporting Middle East countries proved the existence of a positive relationship between exchange rate and trade balance in the long run. Lal and Lowinger (2002b), using vector error correction model, found the effectiveness of exchange rate to improve trade balance in the long run for five South Asian countries. Onafowora (2003) also examined the short run and long run effects of real exchange rate on trade balance by applying vector correction method in Thailand, Malaysia, and Indonesia, bilateral with Japan and USA. The empirical evidence suggested trade balance improves following devaluation in these countries. Sugema (2005) examined the effect of real exchange rate on the trade balance in Indonesia by using fully modified ordinary least square. The FMOLS result suggested that trade balance improves following devaluation through an increase in exports and a collapse in imports. Because the elasticity of imports on the real exchange rate is greater than that of exports, improvement in trade balance would mainly come from fall in imports. It was also found that export performance could have been far better if Indonesia did not suffer from banking problems and socio-political turbulence. Mark (2006) by using

general moment method on emerging countries; Hsing (2008) by using vector error correction model on Brazil proved as exchange rate improves trade balance in the long run. Aziz (2008) estimated the effect of real exchange on the trade balance in Bangladesh by using cointegration method, and the results demonstrated that real effective exchange rate has a positive effect on the trade balance in both short run and long run. This study also tested Marshal-Lerner condition in Bangladesh by using impulse response method and confirmed the existence of J-curve. Yao and Amzath (2010) and Eita (2013) by using vector error correction method on Cote d'Ivoire and Namibia respectively, provided empirical evidence which suggested that currency depreciations, in general, do improve trade balances.

In Eastern Africa very limited studies are conducted and some of the studies have methodological gaps. Moreover, the results are mixed. These unresolved issues called us to conduct this study in this region where there is a persistent trade deficit. Some of the empirical studies in East African countries are summarized in Table 3.1

Table 3.1: Summary of Empirical Literature on Eastern Africa

Country	Period	Author's Name	Methodology Type	Effect
Burundi	1971Q1–2008Q4	Bahmani-O.andGelan (2012) [11]	bounds testing and VECM	-
Ethiopia	1974-2014	Gebeyehu (2014)	ARDL	+
	1980-2003	Haile Asmamaw(2003)	OLS	-
Kenya	1977-2002	Yol and Baharumshah (2007)[12]	Panel FMOLS	+
	1996Q1-2011Q4.	Caporale et al (2014)	OLS	+
	1963- 2012	Kennedy (2013)	VECM	-
Malawi	1980 -2010	Kwalingana et al (2012)	VECM	Not sig.
	1967–1996	Musila (2002)	open-economy IS- LM-AS	+
Madaga	1960-1982	Arize (1987)	Simultaneous	not sig
Tanzania	1977-2002	Yol and Baharumshah (2007)	Panel FMOLS	-
	1971Q1–2008Q4	Bahmani-O.andGelan (2012)	bounds testing andVECM	-
Uganda	1977-2002	Yol and Baharumshah (2007).	Panel FMOLS model	+

Source: Author's collection in 2014, +(-) shows improvement (worsening) of trade balance after devaluation .

[11] . This study investigated the effect of exchange rate on trade balance in nine African countries: Burundi, Egypt, Kenya, Mauritius, Morocco, Nigeria, Sierra Leone, South Africa and Tanzania and found that depreciation was favorable only in case of Egypt, Nigeria, and South Africa.

[12] . The country FMOLS results show that real exchange rate deprecation improves trade balance for Botswana, Egypt, Kenya, Nigeria, Tunisia and Uganda but no effect for Ghana, Morocco, Senegal and negative effect for Tanzania. Foreign real income significantly affects trade balance favorably only in the case of Senegal, Tunisia and Uganda and adversely in the case of Egypt and Ghana in the long run.

3.5. Data and Econometric Model Specification

3.5.1. Data Sources and Description

Data sources

In empirical analysis exports to imports ratio, real effective exchange rate, own gross domestic product and top ten trade partners' trade-weighted real gross product were used. These series are at the annual frequency for the year 1970-2013. The starting year,1970, was selected because of the absence of the data before 1970 for many of the sampled countries in this region. Data for the exchange rate, consumer price index, imports and exports of goods were obtained from IMF database except Madagascar and Seychelles that their merchandise imports and exports were procured from Penn World Table database version 8. Both own and trade partners' real gross domestic product data were collected from World Bank database. The countries included in the study are Burundi, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Tanzania, and Uganda. The inclusion of the countries and the sample sizes are determined by the availability of relevant data.

Data Description

An exchange rate is the price of one nation's currency in terms of another nation's currency. Changes in exchanges rates are given various names depending on the kind of exchange regimes prevailing. Under the floating regime system, a fall in the market price of a currency is called depreciation while a rise in market value of the currency is called appreciation. We refer to a discrete official reduction in the otherwise fixed par value of the currency as devaluation; revaluation is the antonym describing discrete rising of official par value. Appreciation or revaluation is a rise in the price of country's currency in terms of foreign currency while depreciation or devaluation is a fall in the price of a country's currency in terms of foreign currency. Devaluation and depreciation are similar. Devaluation is generally used for discrete change in the exchange rate brought about as a matter of policy, whereas depreciation occurs gradually through the working of the foreign exchange rate market.

The real effective exchange rate (REER) is a key macroeconomic about the price, which plays an important role in the broad allocation of resources in production and spending behavior in the economy. The increase in the real effective exchange rate, hereafter defined as devaluation. We preferred to use the term devaluation rather than depreciation in this study because the foreign exchange system in this region is highly managed floating. The real effective exchange rate as a measure of competitiveness also determines and influences the performance of the export sector. We could not find real effective exchange rate data for East African countries from any data sources so that we constructed real effective exchange rate based on top ten trade partners' trade weight as follows.

REER $=\sum_{j=1}^{n}(RER_{ij} * \Theta_j)$ and $RER_{ij}=NER_{ij}*(\frac{CPI_j}{CPIi})$,based on Thapa (2002) .

Where,

NER is the nominal exchange rate against trade partner 'j'

n is a number of trade partners

CPI_i is consumer price index of domestic country 'i'

CPI_j is consumer price index of trade partner 'j'

Θ_j is average trade weight of trade partner 'j' for the year 1970-2013 and calculated as $\Theta_j = \frac{(Export(ij)+imports(ij))}{\sum_j^n(exports(ij)+imports(ij))}$, see Boumbouya (2009)

j=1, 2…, 10: top trade partners and exports and imports are average for year 970-2013.

3.5.2. Econometric Model and Techniques

To estimate an empirical model of the trade balance, the study postulated that a country's trade balance depends on the real effective exchange rate, real domestic income and trade-weighted top ten trade partners' real income based on Bahmani-Oskooee and Niroomand (1998). Following Bahmani-Oskooee and Brooks (1999), Gupta-Kapoor and Ramakrishnan (1999), Lal and Lowinger (2001), the trade balance is defined as the ratio of exports to imports. This makes the trade balance insensitive to units of measurement and allows for a logarithmic transformation (Boyd et al., 2001). Thus, an increase in the ratio implies trade

improvement while the decrease in the ratio shows the worsening of trade balance. Trade balance can be expressed as:

$$\ln(X/M) = \mathrm{f}(\mathrm{REER}, \mathrm{Yd}, \mathrm{Yf}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(3.5)}$$

From the above mathematical function, therefore, the trade balance equation can be specified in log-linear form as follows.

$$\ln(\mathrm{X/M})_{\mathrm{it}} = \alpha_{\mathrm{it}} + \delta_1 \mathrm{lnREER}_{\mathrm{it}} + \delta_2 \mathrm{lnY}\delta_{\mathrm{it}} + \delta_3 \mathrm{lnYf}_{\mathrm{it}} + \varepsilon_{\mathrm{it}} \ldots\ldots\ldots\ldots\ldots\ldots \text{(3.6)}$$

Where,

$\mathrm{Ln(X/M)}_{\mathrm{it}}$ is natural log of the ratio of merchandise exports to imports for a country 'i' at time t.

$\mathrm{Ln(REER)}_{\mathrm{it}}$ is natural log of the real effective exchange rate for country 'i' at time t.

$\mathrm{Ln(Yd)}_{\mathrm{it}}$ is natural log of own real GDP for a country 'i' at time t.

Ln$(Yf)_{it}$ *is* natural log of trade-weighted real GDP of top ten trade partners for country 'i'[13] at time t.

To estimate the effect of real effective exchange rate on the trade balance, autoregressive distributed lag (ARDL) model was used. The autoregressive distributed lag, hereafter ARDL model, deals with a single cointegration and was introduced originally by Pesaran and Shin (1999) and further extended by Pesaran et al. (2001).The choice of this model was based on the following considerations. Unlike other cointegration techniques, the ARDL does not impose a restrictive assumption that the entire variables under study must be integrated of the same order. In other words, the ARDL approach can be applied regardless of whether the underlying regressors are integrated of order one [I (1)], order zero [I (0)] or fractionally integrated. The F-test has a nonstandard distribution and does not depend on whether the variables included in the ARDL model are I (0) or I (1) and on the number of regressors in

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[13] . $\mathrm{Yf}=\sum_{j=i}^{n}(\Theta_{j*}\mathrm{Y}_{j})$, Yf is trade weighted top ten trade partners real GDP for country 'i'; $\Theta_{j,}$ average trade weight of trade partner country for year 1970-2013, j=1, 2,… 10, top ten trade partners. Yj, is real GDP for 'j' foreign trade partner country (Chinn, 2006).

the system and whether the ARDL contain an intercept and or a trend order (Bahmani-Oskooee and Brooks, 1999). Secondly, while other cointegration techniques are sensitive to the size of the sample[14], the ARDL test is suitable even if the sample size is small (Gujarati, 2012). The model can be used with limited sample about 30 observations to 80 observations (Narayan, 2004). Thirdly, the ARDL technique provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous (Harris and Sollis, 2003). Given our sample size is small and variables are fractionally integrated, this approach is appropriate for our analysis.

Recently many researchers have used ARDL model to analyze the effect of real exchange rate on trade balance; to list some of them, El-Sayed Mettwally Abd-El-Kader (2013) found that real exchange rate and domestic income improves trade balance while foreign income deteriorates trade balance in Egypt. Similarly, Emran and Shilpi (2010) found that the effect of real exchange on the trade balance in India and Sri Lanka is positive in the long run while Shahbaz et al. (2012) found that real exchange rate has a negative effect on the trade balance in Pakistan in the long run. Trinh (2014) has shown the presence of J-curve effect relationship between real exchange rate and trade balance in Vietnam. The result also indicates that real exchange rate has an impact on the trade balance in the short run. A depreciation of real exchange rate immediately creates a significant negative effect on the trade balance. However, this negative effect is not last long, and trade balance improves in the fifth quarter of post depreciation. A new equilibrium will establish after twelve quarters. Boyd et al. (2001) confirmed the presence of Marshall-Learner condition for eight OCED countries. Overall this study suggested that the Marshall-Lerner condition holds in the long run with statistically significant results in five countries out of eight OCED countries. Stucka (2004) found that devaluation improves trade balance in Croatia. On average, a permanent one percent depreciation of domestic currency results in an improvement of the trade balance between 0.94 percent and 1.3 percent. On average, the new equilibrium is established after

[14]. One explanation is related to the common criticism of the Johansen's techniques related to the number of observations. According to some studies, like that by Toda (1995) less than 100 observations can lead to misleading results.

approximately 2.5 years. The average length of the adverse effect of permanent depreciation is moderately above quarter and the study confirmed evidence for J-curve effect in Croatia. Kyophilavong et al. (2013) tested the existence of J-curve phenomenon in Laos's economy using quarterly data over the period 1993-2013. The ARDL bound test approach empirical result confirmed the existence of J-curve phenomenon in the case of Laos. The effect of real depreciation of Laos's currency on the trade balance is insignificant in the long run while in the short run, real exchange rate depreciation has the inverse effect. In long-run. the impacts of the depreciation of Turkish lira on the trade balance is positive (Halicioglu,2008a) while Halicioglu (2008b) showed the long run effect of devaluation is ineffective in Turkey. Razafimahefa and Hamori (2005) found as Marshall-Lerner condition met in Mauritius and did not meet in Madagascar. Finally, Bahmani-Oskooee and Kara (2005) confirmed ML condition met in most of the developed countries but not meet in some of developed Eastern Europe countries.

Based on Pesaran et al. (2001), the long-run ARDL representation of equation (3.6) can be written as follows:

$$Ln(X/M)_t=\alpha+\delta_0 ln(X/M)_{t-1}+\delta_1 lnREER_{t-1}+\delta_2 lnYd_{t-1}+\delta_3 lnYf_{t-1} \quad \ldots\ldots(3.7)$$

Where, δ_0, δ_1, δ_2, δ_3, are the long-run multipliers of the underlying ARDL model.

Finally, for further inferences and to ensure the robustness of the model and the reliability of ARDL results, fully modified ordinary least square model, hereafter called FMOLS[15], and dynamic ordinary least square, hereafter called DOLS[16], estimation techniques were used. Before the estimation of long-run and short-run elasticities, stationarity and cointegration tests were conducted. Thus, to define the relevant set of economic variables that determine

[15] .This procedure is based on Philips and Hansen (1990) and has two direct advantages (Al Sawaie, 2006): the problem of endogeneity among time series variables, which may lead to serial correlation, can be solved and it asymptotically eliminates the sample bias. The FMOLS is popular in conventional time series econometrics; it is believed to eliminate endogeneity in the regressors and serial correlation in the errors.

[16] .This procedure is advocated by Stock and Watson (1993) involves estimation of long-run equilibrium via dynamic ordinary least square (DOLS), which corrects for potential simultaneity and small size bias among regressors by incorporating the lags and leads of regressors.

the ratio of exports to imports ratio of a sampled country; this study followed three major econometric procedures.

Unit Root Test

The ARDL approach does not require knowledge about the order of integration of variables in searching for cointegration relationships; however, DOLS and FMOLS, for estimating long-run relationships, require knowledge of the integration properties, see Pesaran et al. (1999). For this purpose, the standard and widely used procedures of unit root test namely the Augmented Dickey-Fuller test, hereafter ADF test was employed as a prior diagnostic test before the estimation of the model to examine the stochastic time series properties of explanatory variables and exports to imports ratio in sampled period. The null hypothesis is "the ADF is the series" (which should be in level form) is not –stationary, i.e. it contains unit root value. Series that were found to be stationary need to be adopted and those found not stationary were required to be differenced to make them stationary (Gujarati, 2012). This reason enabled to avoid the problems of spurious result that are associated with non-stationary time series models in the study. The cumulative distribution of the ADF test statistics is given in MacKinnon (1991). The ADF test based on Asteriou and Stephen G. Hall (2007) is given by the following equation .

$$\Delta X=\lambda T+\phi X_{t-i}+\sum_{i=1}^{p} \delta\gamma\Delta X_{t-i}+e_{t-i} \quad (3.8)$$

Where,

X represents the variables tested for unit root test.

Φ is a stationary random error.

δ denotes parameters to be estimated.

Δ is the difference operator.

ε is error term.

T is the time trend, and p is the number of lags included to avoid the problem of autocorrelation in the residuals. The lag length was selected based on the minimum Schwarz Bayesian Criterion.

Hypothesis

Ho: $\phi=0$, i.e. series x has unit root; therefore, the variable need to be differenced to make it stationary.

H1: $\phi<0$, i.e. series x has no unit root; therefore, the data is not stationary and does not need to be differenced.

Cointegration Test

The second procedure is to test the null hypothesis of no cointegration (long-run relationship) against the existence of a long-run relationship between exports to imports ratio, exchange rate, and other explanatory variables. In order to investigate the presence of long-run relationship among variables, bound test approach by Pesaran et al. (2001) was used. The ARDL bound test was based on Wald test (F-statistic), and the presence of cointegration was traced by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. The F-test is a test of hypothesis of no cointegration among variables against the existence cointegration among variables based on equation (3.7) and expressed as follows:

H0:$\delta_{0=}\delta_{1=}\ \delta_{2=}\ \delta_{3=}0$, i.e. there is no cointegration among variables.

H1:$\delta_0 \neq \delta_1 \neq \delta_2 \neq \delta_3 \neq 0$, i.e. there is cointegration among variables.

The asymptotic distribution of the Wald test is nonstandard under the null hypothesis of no cointegration among variables. Pesaran et al. (2001) give two critical values for the cointegration test. The lower critical bound assumes all variables are I (0) meaning that there is no cointegration among variables. The upper bound assumes that all variables are I (1) meaning that there is cointegration among variables. When computed F-statistic is greater than the upper bound critical value, then the H0 is rejected (the variables are cointegrated). If the F-statistic is below the lower bound critical value, then H0 cannot be rejected (there is no cointegration among variables). When the computed F-statistics falls between the lower and upper bound, then the results are inconclusive. However, in such case, Canetti (1991) and

Kremers et al. (1992) as cited in Bahmani-Oskooee (2004) suggested an efficient way of establishing cointegration is applying the ECM version of the ARDL model.

Estimation Methods

Finally, If a unique long-run relationship exists between the variables of interest, we estimate an ARDL long-run model and error correction representation for dependent variable exports to imports ratio based on Pesaran et al. (2001). The order of lags in ARDL model can be selected by either the Akaike information criterion (AIC) or Schwarz Bayesian criterion (SBC) before the chosen model is estimated by ordinary least square but in this study lag length that minimizes SBC was selected. Schwarz Bayesian criterion (SBC) was preferred to AIC because it tends to define more parsimonious specifications (Pesaran and Shin,1995; Acaravci and Ozturk, 2012). Once an optimum lag length was selected, the next step in this stage was estimating the model by ordinary least square.

Based on Pesaran et al. (2001), by re-parameterization of ARDL equation (3.7), we found the ECM-ARDL form equation.

$$\Delta \ln(X/M)_t = \alpha + \sum_{i=1}^{n} B_0 \Delta \ln(X/M)_{t-i} + \sum_{i=0}^{n} B_1 \Delta \ln REER_{t-i} + \sum_{i=0}^{n} B_2 \Delta \ln Yd_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta \ln Yf_{t-i}$$
$$+ \varphi ECT_{t-1} + \delta_0 \ln(X/M)_{t-1} + \delta_1 \ln REER_{t-1} + \delta_2 \ln Yd_{t-1} + \delta_3 \ln Yf_{t-1} + \varepsilon_t \quad \ldots\ldots(3.9)$$

Where,

The parameter ε is an error term.

The parameters β_0, β_1, β_2, β_3 are the short-run dynamic coefficients.

φ represents error correction coefficient or speed of adjustment which is expected to negative, and ECT_t represents error correction term and defined as

$$ECT_t = \ln(X/M)_{t-1} - \alpha - \delta_1 \ln REER_{t-1} - \delta_2 \ln Yd_{t-1} - \delta_3 \ln Yf_{t-1} \quad \ldots\ldots(3.10)$$

Theoretically, the real effective exchange rate is expected to increase exports to imports ratio, which implies improvement of trade balance. It is agreed that increase in real effective exchange rate improves the global competitiveness of a nation's exports by making

merchandise exports relatively cheaper, shifting production from non-tradable to tradable, trade from illegal to legal and devaluation makes imports expensive and hence discourages it. The combined effect of increased competitiveness and discouraged imports is expected to improve the trade balance. Based on this, we expect that $\delta_1 > 0$, i.e. increase in real exchange rate increases the ratio of exports to imports, implying improvement of trade balance.

Following the classical theory, the impact of domestic income[17] on exports to imports ratio is not clear. Hence, the sign of coefficient δ_2 is ambiguous, δ_2 **(?)**, see (Narayan and Narayan, 2005) and (Petrović and Gligorić, 2010). If the estimate of δ_2 is positive, it means that an increase in real domestic income (Yd) increases imports volume. However, if the estimate of δ_2 *i*s negative, it means an increase in real domestic income (Yd) is due to an increase in production of import-substituted goods. Thus, the sign of δ_2 would depend on whether supply side factors dominate the demand side factors.

It is now well understood that supply-driven output growth is due to an increase in productivity, which leads to an improvement of trade balance. Historical examples are Germany and Japan during the 1960s and in the 1970s, China in the 1990s and 2000s, on the other hand, the demand-driven increase in output example in the USA in the 1970s and 2000s, end up with the deterioration of trade balance, see (Petrović and Gligorić, 2010). The impact of the domestic real income variable on the ratio of exports to imports is ambiguous. Higher income level stimulates demand for imports and increases the supply of domestic production of tradable goods, leaving the ultimate impact on the ratio of exports to imports somewhat indeterminate and essentially an empirical issue.

[17] The sign of the income variable is often predicted to be positive. It can be negative if increase in domestic production exceed the increase in the domestic demand for the types of products imported or if imports from certain countries tend to be inferior goods. In the traditional import demand literature, the income coefficient interpreted as an excess domestic demand elasticity (Magee, 1975).

Theory suggests that the volume of exports ought to increase when the real income and then purchasing power of the trading partners rises, and vice versa. A growing economy results in increased exports through increased productivity and low inflation levels. These factors lead to increased competitiveness and expansion of production capacity. Therefore, according to the classical theory, the estimate of δ_3 could be either negative or positive. The sign of δ_3 would depend on whether supply side factors dominate the demand side factors. Thus, the impact of an increase in real income of the main trading partners is ambiguous, δ_3 **(?)**, as which makes the difficult for determination of the sign, see (Narayan and Narayan, 2005) and (Petrović and Gligorić, 2010). Therefore, whether demand-side factors dominate supply side factors or vice versa are primarily an empirical issue.

3.6. Empirical Results and Discussions

3.6.1. Unit Root Test Results

Using the standard augmented Dickey-Fuller unit root testing procedure, we tested whether the univariate process of each variable in the sample countries contain unit roots. The selection of optimal length was based on SBC criterion, and the optimum lag length is one; see Table 6.5 in Appendix 2.

Table 3.2: ADF Unit Root Test Results

		With intercept					*With Intercept and trend*				
		I(0)		I(1)			I(0)		I(1)		
Country	Variable	t-stat	Prob	t-stat	Prob.		t-stat	Prob	t-stat	Prob	
Burundi	ln(X/M)	-1.48	0.54	-9.72	0.00	I(1)	-4.55	0.00	-9.58	0.00	I(0)
	lnREER	-3.78	0.01	-3.98	0.00	I(0)	-3.19	0.10	-4.45	0.01	I(1)
	lnYd	-0.63	0.85	-5.06	0.00	I(1)	-1.18	0.90	-4.99	0.00	I(1)
	lnYf	-2.96	0.05	-4.73	0.00	I(0)	-0.72	0.97	-5.39	0.00	I(1)
Ethiopia	ln(X/M)	-2.50	0.12	-7.70	0.00	I(1)	-3.38	0.07	-7.72	0.00	I(1)
	lnREER	-1.21	0.66	-5.51	0.00	I(1)	-1.40	0.85	-5.44	0.00	I(1)
	lnYd	2.47	1.00	-6.57	0.00	I(1)	-0.01	1.00	-8.06	0.00	I(1)
	lnYf	-1.02	0.74	-5.71	0.00	I(1)	-3.96	0.02	-5.70	0.00	I(0)
Kenya	ln(X/M)	-1.73	0.41	-7.79	0.00	I(1)	-3.23	0.09	-7.78	0.00	I(1)
	lnREER	0.27	0.97	-6.23	0.00	I(1)	-0.33	0.99	-6.79	0.00	I(1)
	lnYd	2.47	1.00	-6.57	0.00	I(1)	-0.01	1.00	-8.06	0.00	I(1)
	lnYf	-1.02	0.74	-5.71	0.00	I(1)	-3.96	0.02	-5.70	0.00	I(0)
Madagas	ln(X/M)	-3.64	0.01	-8.58	0.00	I(0)	-3.61	0.04	-8.49	0.00	I(0)
car	lnREER	-1.71	0.42	-6.31	0.00	I(1)	-1.88	0.65	-6.28	0.00	I(1)
	lnYd	-1.39	0.58	-6.49	0.00	I(1)	-1.76	0.71	-6.33	0.00	I(1)
	lnYf	-0.99	0.75	-5.38	0.00	I(1)	-3.72	0.03	-5.34	0.00	I(0)
Malawi	ln(X/M)	-4.27	0.00	-7.42	0.00	I(0)	-4.34	0.01	-7.33	0.00	I(0)
	lnREER	-0.87	0.79	-6.23	0.00	I(1)	-2.27	0.44	-6.22	0.00	I(1)
	lnYd	-0.75	0.82	-7.84	0.00	I(1)	-2.93	0.17	-7.72	0.00	I(1)
	lnYf	-0.99	0.75	-7.36	0.00	I(1)	-2.90	0.17	-7.46	0.00	I(1)
	ln(X/M)	-2.65	0.09	-8.36	0.00	I(1)	-2.85	0.19	-8.28	0.00	I(1)
Mauritiu	lnREER	-2.27	0.19	-4.81	0.00	I(1)	-2.60	0.28	-4.81	0.00	I(1)
s	lnYd	-1.03	0.73	-6.17	0.00	I(1)	-2.12	0.52	-6.30	0.00	I(1)
	lnYf	-3.63	0.01	-1.95	0.31	I(0)	-2.64	0.26	-3.29	0.08	I(0)
	ln(X/M)	-2.56	0.11	-8.57	0.00	I(1)	-2.60	0.28	-8.52	0.00	I(1)
Rwanda	lnREER	-1.83	0.36	-4.71	0.00	I(1)	-2.46	0.35	-4.81	0.00	I(1)
	lnYd	-1.03	0.73	-6.17	0.00	I(1)	-2.12	0.52	-6.30	0.00	I(1)
	lnYf	-3.63	0.01	-1.95	0.31	I(0)	-2.64	0.26	-3.29	0.08	I(1)
Seychell											
es	ln(X/M)	-3.41	0.02	-8.58	0.00	I(0)	-3.36	0.07	-8.48	0.00	I(1)
	lnREER	-1.77	0.70	-4.82	0.00	I(1)	-1.77	0.70	-4.93	0.00	I(1)
	lnYd	-1.77	0.70	-4.91	0.00	I(1)	-1.77	0.70	-4.93	0.00	I(1)
	lnYf	-3.75	0.01	-4.38	0.00	I(0)	-0.93	0.94	-5.28	0.00	I(1)
	ln(X/M)	-6.60	0.00	-14.44	0.00	I(0)	-6.65	0.00	-14.44	0.00	I(0)
Tanzania	lnREER	-1.90	0.33	-3.63	0.01	I(1)	-2.87	0.18	-3.59	0.04	I(1)
	lnYd	2.60	1.00	-2.99	0.04	I(1)	0.04	1.00	-4.17	0.01	I(1)
	lnYf	0.81	0.99	-5.89	0.00	I(1)	-3.02	0.14	-6.14	0.00	I(1)
	ln(X/M)	-2.61	0.10	-8.13	0.00	I(1)	-2.61	0.28	-8.08	0.00	I(1)
	lnREER	-1.35	0.60	-4.34	0.00	I(1)	-2.81	0.20	-4.28	0.01	I(1)
Uganda	lnYd	2.15	1.00	-2.67	0.09	I(1)	1.30	1.00	-6.27	0.00	I(1)
	lnYf	-1.87	0.34	-4.66	0.00	I(1)	-0.90	0.95	-4.97	0.00	I(1)

Source: Extracted by author from Regression Output put using E-views version 9, 2015

As reported in Table 3.2, for all the ten countries, the null hypothesis of no unit root cannot be rejected for some variables at level. However, the null hypothesis of unit root test is rejected for all variables at conventional significance levels in all countries. Thus, ADF test suggests the existence of mixed integration with the trend and without trend except Ethiopia, Kenya and Uganda without trend; and Mauritius and Uganda with the trend. Natural log of exports to imports ratio, natural log of the real effective exchange rate, natural log of real domestic income and natural log of top ten trade partners' trade weight real income are non-stationary at a level along with intercept only and with linear trend. All other variables are integrated at the first difference except for some variables in few countries. Log of exports to imports ratio for Madagascar, Malawi, Seychelles, and Tanzania; log of the real effective exchange rate for Burundi; top ten trade partners' trade weight real income for Burundi, Mauritius, Rwanda, Seychelles and log of real domestic income in Kenya are integrated at level. As opposed to the results, economic reasoning has the difficulties in explaining some of the stationarity results obtained. It is hard to imagine that real effective exchange rate is a difference or trend stationary process. Indeed, a steadily depreciating or appreciating currency does not coincide with real world facts (Stuck, 2004). When dealing with short time series, as in the case with developing countries; it is plausible that those seem to have a unit root.

3.6.2. Cointegration Test Results

The ARDL bound procedure, developed by Pesaran et al. (2001) involves two stages. The first stage is testing for cointegration regardless of the unit root characteristics of the variables and the second stage is an estimation. In Table 3.3, the computed F- statistics for all countries falls above upper bounds of the critical values at 5 percent or 10 percent except Kenya, Malawi, and Madagascar. This estimation indicates that there is cointegration relationship among the variables. Canetti (1991) and Kremers et al. (1992) suggested that in an inconclusive case, an efficient way of establishing cointegration is by applying the ECM version of the ARDL; thus, this works for Kenya, Malawi, and Madagascar.

Table 3.3: ARDL Bound Test for Cointegration

Significance Level		*5 percent*		*10 percent*	
Country	F-stat.	I(0)	1(1)	I(0)	1(1)
Burundi	5.4	2.79	3.67	2.37	3.2
Ethiopia	4.5	2.79	3.67	2.37	3.2
Kenya	2.79	2.79	3.67	2.37	3.2
Madagascar	3.0	2.79	3.67	2.37	3.2
Malawi	2.75	2.79	3.67	2.37	3.2
Mauritius	3.78	2.79	3.67	2.37	3.2
Rwanda	9.1	2.79	3.67	2.37	3.2
Seychelles	3.4	2.79	3.67	2.37	3.2
Tanzania	7.0	2.79	3.67	2.37	3.2
Uganda	5.2	2.79	3.67	2.37	3.2

Source: Extracted by author from Regression Output put using E-views version 9, 2015

3.6.3. Long Run and Short Run Error Correction Estimation Results

Since a unique long-run relationship existence was confirmed between the variables of interest, we estimated an ARDL long-run and short-run dynamics coefficients for trade balance (Pesaran et al., 2001). Before estimation, optimum lag length should be decided. The lag length for data was chosen based on SBC criterion. From this, the lag length that minimizes SBC[18] was selected, and the optimum order of lag length indicated by SBC criteria is one for all countries, see Table 6.5 in Appendix 2.

Long Run Estimation Empirical Results

Empirical results of long-run models by ARDL together with estimates from FMOLS and DOLS are presented in Table 3.4. The robustness of the long-run results is verified partly by the fact that three methods provide sign consistent results in all countries except Tanzania. As indicated in Table 3.4, the sign of long-run elasticity of exports to imports ratio respect to real effective exchange rate is positive for Ethiopia, Kenya, Madagascar, Mauritius, Rwanda,

[18] According to Pesaran and Shin (1995, 1998), the SBC is generally used in preference to other criteria because it tends to define more parsimonious specifications. In this research, the small data sample is another reason to prefer SBC. If the ARDL model is chosen by AIC instead, the estimates lack desirable properties. This is because while SBC is a consistent model selection criterion, for detail see (Hasem, 1999).

and Seychelles. This result indicates that a devaluation of real effective exchange rate increases exports to imports ratio, implying an improvement in the trade balance in the long-run. This finding suggests that a devaluation of the real foreign exchange rate would stimulate exports and discourage imports in the long- run. This result is consistent with conventional theory. However, for Seychelles, it is statistically insignificant. The estimated long-run elasticity of exports to imports ratio respect to the real exchange rate is inelastic in all countries except Rwanda (i.e., the absolute value of elasticity is less than one). In Rwanda, the elasticity of merchandise exports to merchandise imports ratio to the real effective exchange rate is relatively elastic and ranges from 1.00 (DOLS) to 1.10 (FMOLS), and the sign is consistent with all three models. This coefficient shows that a one percent devaluation of real effective exchange rate improves trade balance by about 1 to 1.10 percent in Rwanda.

To compare the long-run elasticities of East African countries with USA's economy and to examine the robustness of our model, we estimated long-run elasticities of exports to imports ratio respect to real effective exchange rate and real income. The sign of price elasticity is consistent with theoretical expectation and relatively elastic. Thus, the ratio of exports to imports elasticity on the real effective exchange rate is higher in absolute values in the USA than all East African countries. As indicated in Table 3.4, a 1 percent devaluation of the real effective exchange rate in the USA improves trade balance by 1.2 percent, implying that long-run price elasticities are relatively elastic and high as compared to each one of the East African countries. The result is consistent with previous studies by Bahmani-Oskooee and Ratha (2004), Bahmani-Oskooee and Brooks (2001) who estimated the long run exchange rate elasticities of the USA on Japan (1.7), Germany (0.7) and United Kingdom (1.35).

Table 3.4: Estimated Long-run Elasticity

Dependent Variable Δln(X/M)

Long run		*ARDL*		*FMOLS*		*DOLS*	
Country	Variable	Coeffi	Prob.	Coeffi	Prob.	Coeffi	Prob.
Burundi	LNREER	-0.38	0.30	-0.55	0.03	-0.36	0.24
	LNYd	-0.55	0.29	-0.75**	0.03	-0.42	0.31
	LNYf	-0.96	0.12	-0.52	0.21	-0.95	0.06
	C	40.47***	0.00	33.47***	0.00	37.15***	0.00
Ethiopia	LNREER	0.59***	0.00	0.59***	0.00	0.60***	0.00
	LNYd	0.05	0.79	0.03	0.78	0.07	0.70
	LNYf	-0.82***	0.00	-0.92***	0.00	-0.94***	0.00
	C	22.88***	0.00	23.77***	0.00	23.40***	0.00
Kenya	LNREER	0.29	0.64	0.97***	0.00	0.70***	0.00
	LNYd	1.81*	0.09	3.32***	0.00	2.40***	0.00
	LNYf	-2.48**	0.05	-3.95***	0.00	-3.03***	0.00
	C	25.17***	0.01	26.55***	0.00	24.06***	0.00
Madagascar	LNREER	0.34**	0.02	0.25*	0.09	0.37**	0.03
	LNYd	-0.12	0.82	-0.94*	0.06	-0.55	0.31
	LNYf	-0.51	0.35	-0.36	0.49	-0.73	0.26
	C	14.61	0.11	30.35***	0.00	30.81***	0.00
Malawi	LNREER	-0.50	0.17	-0.61***	0.01	-0.57*	0.09
	LNYd	0.27	0.79	0.01	0.98	0.07	0.95
	LNYf	0.39	0.83	0.05	0.96	-0.07	0.97
	C	-3.41	0.90	0.15	0.99	2.09	0.94
Mauritius	LNREER	0.51*	0.08	0.61***	0.01	0.32**	0.05
	LNYd	-0.95**	0.02	-0.01	0.98	-1.02***	0.00
	LNYf	0.52	0.30	0.05	0.96	0.74***	0.01
	C	5.15	0.40	0.15	0.99	0.98	0.77
Rwanda	LNREER	1.02***	0.00	1.10***	0.00	1.00***	0.00
	LNYd	0.12	0.40	0.22**	0.04	0.11	0.31
	LNYf	0.34*	0.06	0.12	0.42	0.28**	0.04
	C	-18.75	0.00	-15.17	0.00	-16.71	0.00
Seychelles	LNREER	0.20	0.62	0.20	0.59	0.04	0.92
	LNYd	-0.39	0.61	-1.38	0.16	-1.01	0.25
	LNYf	2.04	0.16	3.62***	0.01	2.95*	0.08
	C	-50.11*	0.06	-75.81***	0.00	-63.91**	0.03
Tanzania	LNREER	0.15	0.28	-0.01	0.98	-0.29	0.26
	LNYd	1.23	0.82	0.66	0.37	0.12	0.87
	LNYf	-1.69	0.98	-1.12	0.23	-0.54	0.51
	C	15.95	9.47	14.58	0.13	12.28	0.10
Uganda	LNREER	-0.25	0.35	-0.40	0.15	-0.11	0.75
	LNYd	-1.40**	0.04	-0.82*	0.06	-0.95	0.18
	LNYf	4.02***	0.00	2.60***	0.00	2.58**	0.05
	C	-72.03***	0.00	-51.83***	0.00	-49.79**	0.03
	LNREER	1.2**	0.02	0.46**	0.04	0.67**	0.02
USA	LNYd	-1.39**	0.05	-0.74*	0.07	-1.11***	0.00
	LNYf	0.96*	0.09	0.33	0.29	0.59***	0.01
	C	11.75**	0.02	11.76***	0.00	14.76***	0.00
		Coeffi	Prob.	Coeffi	Prob.	Coeffi	Prob.
	LNREER	0.22***	0.00	0.36	0.27	0.27***	0.00
Panel	LNYd	0.28**	0.03	0.26	0.34	0.07	0.58
	LNYf	-0.29*	0.09	-0.37	0.34	-0.06	0.73

***, **, * denote 1 percent, 5 percent, and 10 percent level of significance,

The price elasticity of demand for exports is low in Sub-Sahara African countries in general, suggesting that the exports in the region still consist primary commodities mainly agriculture commodities. Import duties, export taxes, control of foreign exchange rate before reform expectedly erode the positive effect of devaluation and have a significant negative effect on exports. Furthermore, the price elasticity of demand for imports in SSA is inelastic as the region is fast becoming an importer of food items as a consequence of rising population (Rakotoarisoa et al., 2011).The involvement of government in the economy in Sub-Sahra Africa (SSA) is very significant as result government spending is very high. This high government spending may reduce the effectiveness of real exchange rate; this is empirically proved by Kim and Lee (2015).

Generally, the low exchange rate elasticity in the region like Eastern Africa is not surprising. Because this region is characterized by the exports of primary commodities and inferior manufacturing exports in the global market, high inflation, low policy credibility, less export diversification, high dependency on imported inputs for manufacturing processing, high population growth, and low infrastructure development. These all together make supply and demand elasticities to devaluation or depreciation very low. This result gives direction for policy makers, as devaluation only is insufficient policy instrument to improve the trade balance. According to Gulhati et al (1985), a policy package is required that combine devaluation with reducing outlays, more trade liberalization, improved budget controls and measures to reduce population growth. Based on this what is necessary for SSA and Eastern Africa in particular is a set of policies (of which domestic production, and exchange rate is critical) that will bring about diversification in structure of production, corresponding change in supply of production for both exports and imports, shifting from traditional agriculture products to tradable products and reducing government deficit.

The theory is ambiguous with regarding expected direction of the relationship between the trade balance and own and trade partners' real income. For example, an increase in own or trade partners' real income can lead to an increase in the supply of goods including tradable goods of a particular country or that of its trading partners. Table 3.4 reveals exports to

imports ratio elasticity respect to own real income is positive for five countries out of ten sampled countries (Ethiopia, Kenya, Malawi, Rwanda, and Tanzania) but it is statistically significant only for Rwanda and Kenya in FMOLS model. The positive sign suggests that own real GDP increases the ratio of merchandise exports to merchandise imports ratio; implying the improvement of trade balance. This finding shows that supply side factors have been important in driving output growth in these countries, and consequently enhancing its exports. As domestic GDP increases, these countries either substitute more and more of merchandise imports and or export more. Due to these reasons exports to merchandise imports ratio rises as own income increases. The result is consistent with some previous empirical studies such as Yol and Baharumshah (2007) in the case of Morocco and Tanzania and Bahmani-Oskooee and Cheema (2009) in the case of Pakistan. Similarly, it is in line with Waliullah et al. (2010) in the case of Pakistan; Petrović and Gligorić (2010) in the case of Serbia; Onafowora (2003) in Thailand, Malaysia with USA and Japan, Canada, Netherlands.; Hsing (2008) on Brazil and Ecuador; Yusoff (2010) in the case of Pakistan. Other historical examples are those of Germany and Japan in the 1960s and 1970s; China in 1990s and 2000s, see Petrović and Gligorić (2010). On the contrary, for Burundi, Madagascar, Mauritius, Seychelles, and Uganda, exports to imports ratio elasticity respect to own real GDP is negative suggesting that increase in own real GDP worsens trade balance in long-run. This finding shows that demand side factors have been important in driving output growth in these countries and consequently enhancing their merchandise imports, but it is statistically significant only for Burundi, Mauritius, and Uganda. Thus, in these countries, increase in own real GDP increases imports more than exports, and then increases the ratio of imports to exports. This finding highlights the need of policy direction in which the countries are advised to implement the policy that focuses on the production of import-substituted goods and boosting exportable production.

An increase in top 10 trade partners' real GDP in Burundi, Ethiopia, Kenya, Madagascar, and Tanzania has a negative effect on the ratio of exports to imports of goods consistently in all three models. This implying an increase in top 10 trade partners' real GDP worsens trade

balance in these countries[19] but it is statistically significant only for Burundi, Ethiopia, and Kenya. This result may be justified as a rise in foreign real gross domestic production is due to an increase in the foreign production of import substitute goods and or production of exportable goods. On the other side, we need to recognize that outlook for world market trade in primary commodities, which today dominates East African exports is not favorable, for example, demand for coffee and tea in developed countries is saturated. Substitution by synthetics has affected cotton and skins adversely. Sugar has been hit by protectionist policies and international competition with more sugar-rich countries like India, Brazil, and Thailand. Thus, when their real GDP increases, their merchandise exports to imports ratio to these countries rises. As a result, as their GDP increases, their exports compete with East African exports in both domestic and foreign market. The result is consistent with some previous empirical studies by Yol and Baharumshah (2007) in the case of Egypt, Ghana, Morocco and Gebeyehu (2014) in the case of Ethiopia. In contrast, in Malawi, Mauritius, Seychelles, Rwanda and Uganda, top 10 trade partners' real GDP is found positive; implying an increase in top trade partners' real GDP improves the trade balance.

After a thorough investigation of the effect of the real effective exchange rate, own real GDP and trade partner's real GDP for each sampled countries, we applied three models by pooling all sampled countries' data together. The Panel results show that real effective exchange rate and domestic income improves trade balance while trade partners' trade weight real income worsens trade balance in this region. A one percent devaluation of the real effective exchange rate in this region improves trade balance by about 0.22 to 0.27 percent. The sign of exports to imports ratio elasticity respect to real effective exchange rate is consistent with theoretical expectation, but the price elasticity is low and inelastic (0.22 to 0.27). The magnitude of the elasticity is consistent with the elasticities found by previous empirical

[19] This may not be surprising where East African exports are dominated by primary goods (agriculture raw material food items+ores,fuels and minerals share 69 percent and manufacturing share 27 percent of total exports: source author's calculation based on UNCT 2014 data) whose income elasticity is very low . Since primary commodities, which generally have a low income elasticity, account for the greatest share of merchandise exports from Sub–Saharan Africa, any increase in merchandise exports to European Monetary Union countries induced, say, by economic growth in Europe will be limited (de Macedo Jorge, 2001).

studies for South Asian countries; Bangladesh (0.08), Nepal (0.25) while contrasts with Japan (3.9), Korea (5.4), and Thailand(1.1), see Lal and Lowinger (2002a,b) and in Argentina (1.2), see Kalyoncu et al. (2009).

Since the USA is one of top ten trade partners to all ten sampled East African countries, the effect of real exchange rate against US$ and real GDP of the USA on the trade balance was investigated. This outcome helps us to ensure the robustness of the system and to confirm the reliability of our empirical results found in three models above**.** As reported in Table 3.5, the long-run elasticity of exports to imports ratio with respect to real exchange rate against US$ is positive for all countries except Burundi, Malawi, and Uganda. The result is consistent with the previous results presented in Table 3.4. This result shows that devaluation of real exchange rate leads to an improvement in the trade balance in the long-run. In all countries, the three models provide a consistent sign, implying the robustness of the result except Seychelles and Tanzania. In Burundi, Malawi, and Uganda, export to import ratio elasticity on the real exchange rate is consistently negative in three models. This result shows that devaluation of real exchange rate against US$ worsens trade deficit in the long-run. However, for Malawi, it is found that elasticity is statistically insignificant .

As explained in the above discussion, the theory is ambiguous with regarding expected direction of the relationship between the trade balance and trade partners' real income. Similarly, it is true against USA's real GDP. For example, an increase in USA's real income can lead to an increase in the aggregate supply of goods including tradable goods of the USA to East African countries and goods that can substitute merchandise imports from East African countries. In contrast, an increase in real income will boost demand for East African goods. Whether demand-side factors dominate supply side factors or vice versa, are essentially determine the sign of the real income elasticity. Table 3.5 shows that exports to imports ratio elasticity respect to USA's real GDP is positive and statistically significant only for Rwanda, Seychelles, and Uganda out of ten sampled countries. Positive coefficient suggests that as USA's real GDP increases, the exports to imports ratio raises, implying the improvement of trade balance.

Table 3.5: Estimated Lon Run Elasticities with the USA

Dependent variable in Δln(X/M)

Long run		ARDL		FMOLS		DOLS	
country	Variable	Coeffi	Prob.	Coeffi	Prob.	Coeffi	Prob.
Burundi	LNRER	-0.05	0.88	-0.55**	0.03	-0.40	0.23
	LNYd	-0.38	0.35	-0.75**	0.03	-0.38	0.41
	LNYus	-1.06**	0.02	-0.52	0.21	-1.20**	0.04
	C	39.17***	0.00	33.47***	0.00	43.82***	0.00
Ethiopia	LNRER	0.56***	0.00	0.59***	0.00	0.57***	0.00
	LNYd	0.03	0.88	0.03	0.78	0.03	0.85
	LNYus	-0.92***	0.00	-0.92***	0.00	-0.91***	0.00
	C	23.70***	0.00	23.77***	0.00	23.60***	0.00
Kenya	LNRER	0.51	0.13	1.03***	0.00	0.80***	0.00
	LNYD	1.27	0.17	2.27***	0.00	1.93***	0.00
	LNYus	-1.84*	0.08	-2.74***	0.00	-2.46***	0.00
	C	21.53**	0.03	21.58***	0.00	22.21***	0.00
Madagascar	LNRER	0.36**	0.02	0.21	0.15	0.45***	0.00
	LNYd	0.04	0.93	-0.71*	0.07	0.03	0.95
	LNYus	-0.72*	0.09	-0.05	0.91	-0.94**	0.05
	C	17.43**	0.04	16.11**	0.05	23.65	0.01
Malawi	LNRER	-0.46	0.46	-0.32	0.46	-0.41	0.53
	LNYd	-0.46	0.26	-0.12	0.71	-0.25	0.47
	LNYus	3.18	0.37	0.75	0.77	1.86	0.58
	C	-81.52	0.39	-18.26	0.79	-47.74	0.60
Mauritius	LNRER	1.00***	0.01	0.55***	0.00	0.79***	0.00
	LNYd	-0.21	0.57	0.49***	0.00	-0.52***	0.00
	LNYus	0.38	0.43	0.10	0.55	0.01	0.97
	C	12.50**	0.02	5.90***	0.00	8.52***	0.00
Rwanda	LNRER	0.86***	0.00	1.06***	0.00	1.01***	0.00
	LNYd	0.03	0.85	0.18	0.13	0.03	0.78
	LNYus	0.42*	0.07	0.13	0.42	0.27*	0.09
	C	-20.37***	0.00	-16.10***	0.00	-16.65***	0.00
Seychelles	LNRER	-0.11	0.77	-0.18	0.60	0.04	0.93
	LNYd	-0.43	0.52	-1.15**	0.03	-1.21*	0.09
	LNYus	1.68	0.11	2.91***	0.00	2.80***	0.02
	C	-42.36**	0.02	-64.47***	0.00	-60.64***	0.00
Tanzania	LNRER	0.23	0.49	-0.03	0.92	-0.09	0.69
	LNYd	1.02	0.12	-0.18	0.77	0.28	0.56
	LNYus	-1.65*	0.09	-0.05	0.96	-0.66	0.34
	C	22.29	0.11	5.09	0.74	12.45	0.21
Uganda	LNRER	-0.13	0.61	-0.38*	0.06	-0.18	0.49
	LNYd	-1.56***	0.01	-0.70	0.13	-1.33**	0.02
	LNYus	3.78***	0.00	2.48***	0.01	3.41***	0.00
	C	-75.02***	0.00	-55.47***	0.00	-69.22***	0.00
	LNRER	0.23***	0.00	0.37***	0.00	0.27***	0.00
Panel	LNYd	0.19**	0.02	0.14	0.44	0.08	0.33
	LNYus	-0.18*	0.08	-0.24	0.82	-0.14	0.21

***, **, * denote 1 percent, 5 percent, and 10 percent level of significance

Source: Extracted by author from Regression Output put using E-views version 9, 2015

On the other hand, in Burundi, Ethiopia, Madagascar and Tanzania, the elasticity of exports to imports ratio respect to USA's real GDP has a negative sign. Negative coefficient suggests that as real GDP of USA increases, the exports to imports ratio declines; implying the deterioration of trade balance. This may be because either the rise in USA's real GDP might be due to an increase in the foreign production of import-substitute goods or the USA's supply side factors dominate demand side factors. This shows that USA's imports from East African countries decline and or their merchandise exports to East African countries rise as their real GDP increases.

Similar to Table 3.4 panel results, Table 3.5. results consistently show that real exchange rate sign is positive and statistically significant. From the three panel models, we can conclude that real exchange rate against US$ increases exports to imports ratio in the region except few countries. The sign of exports to imports ratio elasticity respect to real exchange rate against US$ is consistent, and when the value of the domestic currency falls against US dollar by one percent, exports to imports ratio rises by about 0.23 to 0.37 percent.

Short Run Dynamics Estimation Empirical Results

Table 3.6 shows the short run and error term dynamics estimation results. Apart from a robust a long-run relationship, our short-run error correction model is statistically well-behaved. The sign of error correction term coefficient (ECT) which measures the speed of adjustment to restore equilibrium in the dynamic model has a negative sign and statistically significant at 5 percent for all countries. Negative coefficient ensures that the series is non-explosive so that long-run equilibrium can be attained. The magnitude of estimates for ECT (-1) measures the single period response of the dependent variable to its deviation from the equilibrium. For example in the case of Tanzania, ECT(-1) value =-0.90, implies that about 90 percent deviation from long-run export to import ratio during this year will be corrected in next year; indicates that following a shock, convergence to equilibrium is swift. While in Kenya, ECT (-1) value =-0.30, implies that last year's deviation between actual exports to

imports ratio and the equilibrium ratio is corrected in this year by about 30 percent after a shock, implying adjustment is relatively slow.

Table 3.6: Error Correction Representation of the Selected ARDL Model

Country	Δ(lnREER)	Δ(lnYd)	Δ(lnYf)	ECT(-1)
Burundi	0.59	-0.61	8.77***	-0.79***
	(0.20)	(0.38)	(0.00)	(0.00)
Ethiopia	0.18	0.09	0.82	-0.62***
	(0.27)	(0.74)	(0.21)	(0.00)
Kenya	0.79***	-1.80***	0.06	-0.30***
	(0.00)	(0.00)	(0.93)	(0.00)
Madag	0.30**	-1.45	3.04***	-0.54***
	(0.06)	(0.45)	(0.00)	(0.00)
Malawi	-0.04	0.75	-1.89	0.64***
	(0.85)	(0.15)	(0.29)	(0.00)
Mauritius	-0.10	0.10	-0.80***	-0.37***
	(0.27)	(0.64)	(0.00)	(0.00)
Rwanda	0.71***	1.08***	2.17***	-0.80***
	(0.01)	(0.00)	(0.00)	(0.00)
Seychelles	0.34	-0.71	1.67	-0.58***
	(0.49)	(0.19)	(0.21)	(0.00)
Tanzania	-0.19	-4.55***	-2.30	-0.90***
	(0.37)	(0.00)	(0.18)	(0.00)
Uganda	0.02	-7.12***	-0.41	-0.67***
	(0.93)	(0.00)	(0.87)	(0.00)
Panel	0.23	0.07	1.13***	-0.22*
	(0.27)	(0.81)	(0.00)	(0.00)

P-values in parentheses; ***, **, * denote 1 percent, 5 percent and 10 percent level of significance.
Source: Extracted by the author from Regression Output put using E-views version 9, 2015.

The speed of adjustment for exports to imports ratio of sampled countries may vary because of difference in openness, commercial policies, and exchange rate policies and extent of their exchange rate disequilibrium before devaluation. If exchange rate changes were undertaken from a position of high disequilibrium, the response times of the volume of imports and exports to currency depreciation might be correspondingly longer (Anil K. Lal. et al., 2002a,b). In Kenya, Madagascar, Rwanda, short-run exports to imports ratio elasticity respect to real effective exchange rate is positive and statistically significant; indicates that real effective exchange rate improves trade balance in short-run. In all other countries, the real effective exchange rate is insignificant in short-run. Panel ARDL result shows that in short-run real effective exchange rate has a positive effect on exports to imports ratio, implying a devaluation of real effective exchange rate improves trade balance in Eastern

Africa, but it is statistically insignificant. The effect of real exchange rate on the trade balance is positive in both short run and long run. This finding shows that there is a little evidence for J-curve hypothesis for aggregate trade balance in East Africa countries. This result is consistent with empirical findings on France, Italy and UK by Kim,S.(2001). Based on Kim S.(2001), J-curve effect suggests that exchange rate depreciation may result in an initial nominal trade balance deficit since the value effects are immediate but volume effects are delayed. Similarly, according to Obstfeld (2003), the depreciation of real exchange rate is often synonymous with a deterioration of trade balance of a given country in the short run, because most imports and exports orders are placed several months in advance. The value of the pre-contracted level of imports rises in terms of domestic products, which implies that there is an initial fall in the current account. Moreover, if there are a high import contents of exports, firms may need some time to adopt new production techniques. The increase in prices of imports may be offset partly or fully by the substitution of imported goods by local goods but an adjustment in the capacity of domestic firms requires time. Besides, to increase their sales abroad, exporters may need to adjust their capacity to reach foreign consumers, which may also take time. In the long run, when these adjustments have taken place, real exchange rate depreciation may improve the current account.

In Burundi, Madagascar, Rwanda, exports to imports ratio elasticity respect to trade partners' real GDP is found positive and relatively elastic. The result shows a rise in trade partners' real GDP improves the trade balance in short-run. In contrast, foreign real income worsens trade balance for Mauritius in the short run. Panel ARDL result shows that in the short run, growth in foreign real GDP improves trade balance for Eastern Africa. A merchandise exports to imports ratio elasticity respect to own real GDP is negative and statistically significant in Kenya, Tanzania, Uganda; implying in short-run domestic real GDP worsens trade balance. However, in Rwanda, the short-run effect of own real GDP on the ratio of exports to imports is positive and statistically significant. This result proves growth of domestic real GDP worsens trade balance in the short-run. ARDL panel result shows that domestic income improves trade balance for Eastern Africa in the short run, but it is

statistically insignificant. This result confirms the absence of J-curve pattern relationship between real effective exchange rate and aggregate trade balance in Eastern Africa.

Long-Run Elasticities after Structural Breakdown.

Even though stability test did not show any need for a structural break for ARDL model estimation, we estimated the long elasticities by breaking periods into pre and post foreign exchange regime liberalization. In addition, the effect of membership to WTO (Dw) on the aggregate trade balance was roughly analyzed. Table 3.7 shows that in both pre and post-foreign exchange regime liberalization, the real exchange rate has a positive effect on the trade balance. As the value of the domestic currency falls in terms of top trade partners' currencies, trade balance improves. A one percent increase in the real effective exchange rate improves merchandise trade balance by about 0.10 to 0.37 percent which is less than real effective exchange rate elasticity after foreign exchange rate liberalization (0.24 to 0.42). This result is consistent with the study by Kim, S. (2015). His finding shows that the depreciation of real exchange rate and the improvement of current account are larger in countries under more floating exchange regimes than under less flexible exchange rate regimes. The increase in elasticity after foreign exchange rate regime change from fixed to floating regime is associated with an increase in exportable and import substitute production in the home, elimination of export tax and mainly decline in pass-through of the foreign exchange rate to domestic consumer price index. For example, a study by Razafimahefa (2012) confirmed exchange rate pass –through to domestic prices in Sub-Sahara African countries is partial and incomplete, and significantly decreased since the mid-1990s because of stability in macroeconomic policy and an increase in income. In addition, this study found that the foreign exchange pass- through is very low in flexible regime than in fixed exchange regime. Another study by Hunegnaw (2015) confirmed that foreign exchange pass through to consumer price in Ethiopia is insignificant.

Before liberalization, the effect of domestic income on the trade balance is negative while the effect of top ten trade partners' real income is positive. During our observation periods,

the protectionist policy was in practice that was failed to produce exportable as well as import substitute goods. As a result, the effect of the rise in domestic income worsens trade balance. After foreign exchange regime liberalization, many other comprehensive reforms were undertaken. These reforms may promote growth on the supply side through a more efficient allocation of resources, encouraging investments in production for exports and local consumption. According to Parikh and Stirbu (2004), trade deficits tended to rise with economic growth in some Asian economies while there is no such evidence for either Latin American or African economies rather economic growth in the domestic economy in this region reduced current account deficit in the 19th century. The result is consistent with emerging economies like China in which rapid economic growth after liberalization improves trade balance and leads to surplus (Zhu and Kotz, 2011). In contrast, top ten trade partners' real GDP worsens trade balance for this region. This result is consistent with the study by Zakaria (2014) on Pakistan.

Table 3.7: Long-Run Elasticities after Structural Breakdown

Dependent Variable :Δln(X/M)

Before Structure Break						
Model	Panel ARDL		Panel FMOLS		Panel DOLS	
	Coff.	Prob.	Coff.	Prob.	Coff.	Prob.
LNREER	0.22***	0.00	0.36	0.27	0.27***	0.00
LNYd	0.28**	0.03	0.26	0.34	0.07	0.58
LNYf	-0.29*	0.09	-0.37	0.34	-0.06	0.73
Pre Foreign Exchange Rate Regime Liberalization						
LNREER	0.10***	0.00	0.35***	0.00	0.37***	0.00
LNYd	-0.49***	0.00	-0.34*	0.10	-0.24**	0.05
LNYf	0.43***	0.00	0.15	0.66	0.27	0.13
Post Foreign Exchange Rate Regime Liberalization						
LNREER	0.24***	0.00	0.33***	0.00	0.42***	0.01
LNYd	0.47***	0.00	0.35***	0.00	0.18	0.31
LNYf	-0.44*	0.06	-0.68***	0.00	-0.28	0.29
Membership to WTO						
LNREER	0.22***	0.00	0.18***	0.00	0.22***	0.00
LNYd	0.29**	0.02	0.54***	0.00	0.19	0.14
LNYf	-0.46**	0.03	-0.66***	0.00	-0.27	0.20
Dw	0.12	0.12	0.30***	0.00	0.22**	0.02

***, **, * denote 1 percent, 5 percent, and 10 percent level of significance.
Source: Extracted by author from Regression Output put using E-views version 9, 2016

Trade liberalization in Eastern Africa took place both in multilateral WTO process and through a regional process. The membership to WTO was partly as a result of pressure from international organizations such as World Bank and International Monetary Fund to liberalize their economies, and due to export promotion policies adopted by Eastern African governments. Most of the East African countries liberalized foreign trade and privatized national industries. Trade liberalization has therefore been an important driver of economic integration and export growth in Eastern Africa.

It is argued that developing countries have hardly benefited from WTO, but as indicated in Table 3.7, there is strong evidence that membership in WTO has a positive effect on the trade balance in East African countries. Among sampled countries, Ethiopia is not a member of WTO and Seychelles has joined very recently in 2015. The empirical result suggests accession to WTO improves the trade balance.

Error Correction Results after Structural Breakdown

Table 3.8: Dynamic Error Correction Empirical Results after Structural Breakdown

Dependent Variable: Δln(X/M)

Variable	*Before Structure Breakdown*		*Pre Fx Lib.*		*Post Fx Lib.*	
	Coff.	Prob.	Coff.	Prob.	Coff.	Prob.
ECT(-1)	-0.22*	0.00	-0.47***	0.00	-0.37***	0.00
ΔLNREER	0.23	0.27	-0.13	0.60	0.10	0.59
ΔLNYD	0.070	0.81	-0.33	0.53	0.75*	0.07
ΔLNYF	1.13***	0.00	1.41*	0.09	0.25	0.75
Obs.	430		217		203	
No.countires	10		10		10	

***, **, * denote 1 percent, 5 percent, and 10 percent level of significance
Source: Extracted by author from Regression Output put using E-views version 9, 2016

As indicated in Table 3.8 most of the variables in the short run are insignificant. However, the error correction coefficient is found negative and significant. The pre-foreign exchange liberalization speed of adjustment is higher than post foreign exchange rate liberalization speed of adjustment. This is consistent with the previous study by Baffes et al (1999) where the study found that very high speed of adjustment is estimated for countries with rigid labor markets and inflexible exchange regimes and vice versa (Botswana and Uganda).

3.6.4. Diagnostic Test Empirical Results

The R^2 and adjusted- R^2 are measures of goodness of fit which seem to suggest reasonably a good fit of the data set for every country. As reported in Table 3.9, the highest goodness of fit in ARDL model is evidenced for Rwanda as indicated by 89 percent R^2 and 87 percent adj.R^2. The lowest value is evidenced for Malawi, which has 49 percent R^2 and 39 percent adj.R^2. The calculated F-statistic for every sampled country is statistically significant at a 1 percent level of significance, thus, explanatory variables taken jointly have an effect on trade balance of each country.

To test heteroscedasticity we applied Breusch Pagan test, and it was tested against null hypothesis "there is homoscedasticity in the model". The test result shows that we cannot reject null hypothesis meaning that there is no problem of heteroscedasticity in all countries except Ethiopia and Madagascar. However, when lag two was included in the specification, the problems of heteroskedasticity was solved in both countries. The estimated results of lag two are reported in Table 6.8 in Appendix 2.

There are different methods in order to detect a serial correlation. These include graphical methods as well as statistical tests. The most well know test is a test, which is developed by two statisticians namely Durban and Watson and the test is known as Durban-Watson (DW) statistics. Durban-Watson statistics result for each country approximately nearest to 2. This implies that there is no serial correlation in the model. Hence, it is concluded that residuals of the model are not correlated. However, the test is not valid in our case[20] so that it is advised to use Breusch-Godfrey Serial Correlation LM test and our test results show the absence of the problems of serial correlation in all countries at 5 percent significance level.

To examine the stability of long-run coefficients with short-run dynamics, we followed Pesaran (1997) and checked by applying CUSUM (cumulative sum of recursive residual) [21].

[20].DW Test is not applicable when our regression model includes lagged dependent variable as explanatory variable. (Asteriou and Hall, 2007).

[21] These tests are developed by R. L. Brown et al. (1975).

If we plot the figure, and the CUSUM statistics stays within the critical bounds of 5 percent significance level represented by a pair of straight lines drawn at 5 percent level of significance, the null hypothesis of coefficients in the error correction models are stable (R. L. Brown et al., 1975). As indicated in Figure 6.6 in Appendix 2, if either of the lines is crossed, the null hypothesis of coefficient constancy can be rejected at the 5 percent level of significance. The straight lines represent critical bonds at 5 percent significance level. In all countries, the CUSUM plot does not cross the critical bounds, indicating that no evidence of any significant structural instability at 5 percent critical bounds[22]. Stability of the estimated elasticity suggests that the models can be considered stable enough for forecasting and policy analysis. Finally, Jarque Bera test (χ^2_N) was conducted to examine the null hypothesis of normality of the model. For all countries, we cannot reject the null hypothesis at 5 percent. Thus, the model passed Jarque Bera test for each country suggesting that the errors are normally distributed.

Table 3.9: Diagnostic Tests Result

Country	R^2	$\bar{R}^2$	DW-St	F-St.	Prob	CUSUM	χ^2_{SC}		χ^2_{HE}		χ^2_N	prob
							F-Sat	Prob	Fstat	Prob		
Burundi	0.80	0.76	2.25	20.47	0.00	Stable	0.11	0.08	0.57	.77	2.01	0.36
Ethiopia	0.81	0.78	1.81	21.71	0.00	Stable	1.15	0.29	2.55	0.03	1.09	0.58
Kenya	0.74	0.69	2.12	14.46	0.00	Stable	1.22	0.28	2.27	0.11	0.77	0.69
Mad	0.62	0.55	2.07	8.24	0.00	Stable	0.00	1.00	2.78	0.02	0.33	0.84
Malawi	0.49	0.39	1.96	4.77	0.00	Stable	0.02	0.90	0.46	0.86	0.70	0.70
Mauritius	0.76	0.71	1.71	15.9	0.00	Stable	1.21	0.28	1.02	0.44	0.38	0.09
Rwanda	0.89	0.87	2.21	40.93	0.00	Stable	0.29	1.45	0.22	0.34	0.33	0.84
Seychelle	0.81	0.77	1.62	20.95	0.00	Stable	3.09	0.09	0.78	0.61	1.30	0.52
Tanzania	0.62	0.55	1.82	8.28	0.00	Stable	0.48	0.49	0.82	0.58	1.62	0.44
Uganda	0.62	0.54	2.13	8.08	0.00	Stable	0.43	0.52	1.73	0.13	1.38	0.49

Note: χ^2_{SC}, χ^2_N, χ^2_H are Lagrange multiplayer for tests of residual correlation, normality and heteroskedasticity respectively. These statistics are distributed as Chi-squared varies.
Source: Extracted by the author from Regression Output put using E-views version 9, 2015.

[22] Figure 6.6 in appendix 2 shows the graphical representation of CUSUM Plot.

3.7. Summary and Conclusion

The objective of this chapter is to investigate short-run and long-run effects of exchange rate on trade balance for East African countries. To achieve this aim, the study followed three econometric procedures. The first procedure is conducting the stationary test by applying standard procedures of unit root test namely ADF. ADF confirmed the existence of mixed integration of variables at the level, I(0) and at first difference, I(1). The second procedure is to test the null hypothesis of no cointegration among variables by using ARDL bound procedures. Computed F-statistic for all countries falls above upper bounds of the critical values at 5 percent and 10 percent except Kenya, Madagascar, and Malawi but the existence of cointegration between variables for these three countries is proved by applying the ECM version of the ARDL model. This result indicates that there is a long-run cointegration relationship among the variables in all countries. The third procedure is estimating long-run, short-run and error correction term coefficients by using ARDL Model.

Individual country's ARDL model estimation result has shown that real effective exchange rate is a positive determinant of the trade balance in seven out of ten countries, suggesting that a depreciation of real effective exchange rate would improve trade balance but it is statistically insignificant for Seychelles and Tanzania. In contrast, an increase in real effective exchange rate worsens trade balance in Burundi, Malawi, and Uganda.

In Burundi, Madagascar, Mauritius, and Uganda, own real GDP carries a negative sign and statistically significant, implying that an increase in own real income causes domestic consumers to demand more of foreign goods that lead to worsening of trade balance. While own real GDP carries a negative sign and statistically significant for Kenya and Rwanda; implying an increase in domestic real GDP improves trade balance in the long-run. Top ten trade partners' real GDP affects trade balance favorably and it is statistically significant only in Mauritius, Seychelles, and Malawi. In contrast, top ten trade partners' real GDP carries a negative sign and statistically significant in Burundi, Ethiopia, and Kenya, indicating that top ten trade partners' real GDP worsens trade balance.

The ARDL results for real effective exchange rate, own and top ten trade partners' real GDP is consistent for all countries except Tanzania with the sign of other two alternative models namely FMOLS and DOLS, has shown the robustness and reliability of the long-run estimates of the ARDL model. The structural break based on foreign exchange regime liberalization has shown that there is the difference in magnitude of price elasticity and a sign of foreign and own real GDP before and after foreign exchange regime liberalization. Slightly higher elasticity was evidenced in post-foreign exchange regime liberalization than pre-liberalization. Domestic income improves trade balance before foreign exchange rate regime liberalization but improves trade balance after foreign exchange regime liberalization, and the reverse is true for foreign income. The error correction term or the speed of adjustment is varied among the sampled countries; this might be because of difference in openness, commercial policies, and exchange rate policies and importantly based on the extent of their exchange rate disequilibrium before devaluation.

Finally, based on the findings of this study, important policy implication is derived. The elasticity of real effective exchange rate carries a correct sign and statistically significant in panel data analysis. This tells us the importance of foreign exchange rate policy in improving the region's trade competitiveness. However, it is inelastic and less than the elasticity of real effective exchange rate with the USA, but the magnitude of the elasticity increases after foreign exchange liberalization. This result suggests reducing of barriers that make devaluation less effective in improving the trade balance. In addition, policies intended to improve trade balance on the country should focus on the internal supply side that gives a conducive environment for the production of exportable goods and import substitute goods. Entirely depending on the external policy (devaluation) only may not bring expected trade balance improvement in the region since countries in this region are price takers on the international market, and would thus not able to influence the external demand sufficiently for their merchandise exports through price incentives that arise from devaluation. However, real effective exchange rate change remains important policy instrument to improve trade balance for many of East African countries.

Chapter 4: Foreign Exchange Rate Dynamics and Sectoral Trade Balance

4.1. Introduction

Numerous studies have investigated the effect of exchange rate on the trade balance in both developed and developing countries using different models and econometric methods but with few exceptions, all studies focus on the aggregate trade balance, not sectoral one. One of the criticisms of aggregate studies is using aggregate data that causes aggregation bias and significant price elasticity with one trading partner[23] may offset by others insignificant effect. Furthermore, the sign of real exchange rate effect may be different among sectors, and some sectors might be in line with aggregate trade balance while others might be inconsistent with aggregate trade balance[24]. Therefore, these open a new research area for the study of sectoral trade elasticities especially for African countries where disaggregated studies are very limited. Among few studies that attempted to investigate the response of sectoral trade balance to change in the exchange rate are Houthakker and Magee (1969) who estimated price elasticity for different commodities in the USA and they found that price elasticities are low for raw materials but high for finished manufactures. Meade (1988) who focused on non-oil industrial supplies, capital goods excluding automobiles, and consumer goods, and found that trade balance responds differently in each sector. Carter and Pick (1989) studied the effect of a depreciation of dollar on trade balance of USA agriculture sector and found that depreciation worsens trade balance in the short run and improves in the long-run. Doroodian Sr et al. (1999), who examined the relationship between exchange rate and USA's agriculture and manufacturing sectors and found that while trade balance of manufacturing improves following the dollar depreciation, trade balance of agriculture sector worsens and

[23] Refer Bahmani-Oskooee and Goswami (2004) for details.

[24] Ardalani and Bahmani-Oskooee (2007) suggested that depreciations may have a negative impact on sectoral trade balances in the long-run even though generally a depreciation of the domestic currency will lead to an improvement of the aggregate trade balance in long-run.

then improves in the long-run[25]. Doyle (2001) concluded that exchange rate has a non-significant effect on agriculture trade balance. Cho et al. (2002) found exchange rate volatility has a negative effect on agriculture trade balance. Yazici (2006) found that in short-run, agriculture, mining and manufacturing sector trade balances are worsening while in the long-run both manufacturing, and mining sector trade balances improve but agriculture sector trade balance worsens as a result of depreciation in the case of Turkey. Baek and Koo (2009) found that in the long-run while US's agriculture exports are highly negatively affected by the exchange rate, US's agriculture imports are not affected; in the short-run, on the other hand, the exchange rate is found to have significant effects on both imports and exports. Chebbi and Olarreaga (2011) confirmed that in the long-run devaluation of real exchange worsens agriculture trade balance while improves manufacturing trade balance in Tunisia. Similarly, Study by Huchet-Bourdon and Korinek (2011) found that exchange rate volatility affects trade flows only slightly. Exchange rate levels, on the other hand, affect trade in all agriculture, mining and manufacturing sectors but do not explain their entire trade imbalances .The study confirmed that exports are more sensitive than imports to changes in exchange rate level. Besides the impacts of exchange rates on exports in agriculture to be more pronounced than that for manufacturing. The justifications they provided for this is the homogeneity of agriculture products as compared to manufacturing goods, and price transmission mechanisms may be different in agriculture sector as compared with the manufacturing sector. Recently Kim et al. (2012) have shown that price elasticities of merchandise imports are quite different across goods by using their new methodology and found that consumer goods, non-durable goods, capital goods and machinery have higher elasticities than cereals, fuels, crude oil and minerals in the case of South Korea.

[25] This could explain why some studies using aggregate data fail to support J-curve hypothesis-perhaps the J-curve effect does not apply overall. Indeed, Hsing (2008) examined US trade with seven South American trading countries over the last 20 0r 30 years. This studied showed that a J-curve exists only for Chile, Ecuador and Uruguay while lack of support is found for Argentina, Brazil, Colombia, and Peru. This finding therefore suggests that the conventional wisdom of pursuing real exchange rate depreciation in order to improve the trade balance may not apply in some countries.

A study on Sub-Saharan African countries by Sekkat and Varoudakis (2000) suggested that exchange rate mismanagement in SSA countries has reduced the incentives for exporters to increase their penetration in foreign markets. On the contrary, African countries such as Mauritius and Tunisia that have been successful in significant expanding manufactured exports have implemented cautious exchange rate policies, inducing steadily declining real exchange rate. According to this study, weak export performance reduces the ability to pay for imported foreign capital goods and hence, reduces the future capacity of production. This is harmful to both exports and economic growth.

The effect of real exchange rate on the aggregate trade balance in East African countries was examined in Chapter three. The results confirmed that real exchange rate improves aggregate trade balance in the region as a whole and country level devaluation improves trade balance and statistically significant for Ethiopia, Kenya, Madagascar, Rwanda, and Mauritius. In contrast, it worsens for Malawi, Burundi, and Uganda. As far as our knowledge, there is no study that investigated the effect of real exchange rate on the sectoral trade balance in Eastern Africa on a regional level. This chapter examined and compared the effect of real exchange rate on trade balance on three sectors, namely agriculture, manufacturing and mining sectors in Eastern Africa by using trade balance model of Dornbusch (1980) and Meese and Rose (1990). Investigating how trade balance of each sector responds if the exchange rate is used as a policy instrument is very critical. In case, if given exchange rate generates an undesirable impact on a particular sector, then corrective measures can be adopted to insulate that sector from the negative impact on total trade over the period.

4.2. Objectives of the Study

The aim of this chapter is to examine and compare the effect of real exchange rate on trade balance on three sectors, namely agriculture, manufacturing and mining sectors in Eastern Africa. Specifically, it investigates the existence of a long-run relationship between sectoral trade balance and real exchange rate; examines the short-run and long-run effects of real exchange rate on the sectoral trade balance and finally, it indicates policy implications.

4.3. Significance of the study

Investigating how trade balance of each sector responds to the real exchange rate as policy tool helps to identify in which sector real foreign exchange rate has a positive effect and in case a given exchange rate generates an undesirable impact on a particular sector , then corrective actions can be adopted to insulate that sector. In Eastern Africa, the share of agriculture sector dominates all other sectors. In Eastern Africa, aggregate trade balance, therefore, will reflect the behavior of agriculture sector; however, how other sectors respond to the dynamics of the exchange rate cannot be inferred from the study of aggregate trade balance behavior. The sectoral trade balance analysis will help policy makers to infer the magnitude and direction of each sector reaction to change in exchange rate. It also helps as a reference for the central bank for policy-making decision and for further research in this region on this topic.

4.4. Data and Econometric Model Specification

4.4.1. Data Sources and Description

This study employed annual panel data for ten East African countries from the year 1980-2013. We began with the year 1980 because of the absence of sectoral exports and imports data series before the year 1980. The study used annual data for domestic real GDP, trade partners' real GDP, sectoral imports, and exports. Each sector exports and imports were procured from Word Trade Organization (WTO). All ten East African countries real gross domestic product was collected from Penn World Table Version 8 (PWT). Both trade partners' and East African countries' exchange rate and consumer price index were collected from International Monetary Fund (IMF). All top ten-trade partners' real gross domestic product was collected from World Bank (WB). The real exchange rate was obtained by employing the domestic and US price indices. The exchange rate is defined as national currency per one unit of foreign currency. Since we could not find real effective exchange rate for East African countries from any data sources, we constructed real effective exchange rate based on top 10 trade partners' trade weight as REER $= \sum_{j=1}^{n}(RER_{ij} * \Theta_j)$ and

$RER_{ij}=NER_{ij}*(\frac{CPI_j}{CPIi})$, based on Thapa (2002). Where NER is the nominal exchange rate against trade partner j; n is number of trade partners; CPI_i is consumer price index of domestic country and CPI_j is consumer price index of trade partner j ;Θ_j is average trade weight of trade partner j for the year 1970-2013 and

$\Theta_j=\frac{(Export(ij)+imports(ij))}{\sum_{j=1}^{n}(exports(i)+imports(ij))}$,where j=1,2…10, top trade partners, see Boumbouya (2009) and exports and imports are average for 1970-2013.

4.4.2. Econometric Model Specification

Since a trade balance is a function of various macroeconomic variables such as real outputs, exchange rates, and income, etc., there is bound to be direct or causal feedback between the trade balance and such macro variables. For this reason, Dornbusch (1980), and Meese and Rose (1990) formulated a simple relationship between trade balance and the real exchange rate by assuming that a domestic economy produces exportable and importable goods which it consumes. Under such an assumption, trade balance is defined in terms of US $ as follows:

$$TB_s= (Pd_s.Xs) - (NER.Pf_s.M_s) \quad (4.1)$$

Where,

X_s is the quantity of 's' sector exports.

Pd_s is the domestic price of 's' sector exports.

M_s is the quantity of 's' sector imports.

Pf_s is the foreign price of merchandise imports in foreign currency.

and NER is the nominal exchange rate expressed in domestic currency units per unit of foreign currency.

By dividing Eq. (4.1) by Pd_s, we can obtain the real trade balance (TB_s) equation in terms of domestic goods as

$$TB_s= X_s-(RER.M_s) \quad (4.2)$$

Where $RER = NER.CPIj/CPIi$

Consequently, if we express exports and imports demand equations as functions of real exchange rates, foreign real GDP and own real GDP respectively,

$X_s = f(RER, Yd, Yf)$ and $M_s = f(REER, Yf)$)……..……..…….....……..……. (4.3)

Where Yf is the real foreign GDP and Yd is real own GDP. we obtain the following trade balance equation.

$TB_s = F(RER, Yd, Yf)$)……...……...…….. (4.4)

Following Bahmani-Oskooee and Brooks (1999), Gupta-Kapoor and Ramakrishnan (1999), Lal and Lowinger (2001), the trade balance is defined as the ratio of exports to imports. The important advantage of this ratio is that it is insensitive to the unit of measurement as it can be easily interpreted as nominal or real foreign exchange rate. Secondly, it is emphasized that in logarithmic models, this ratio gives the Marshall-Lerner condition exactly rather than approximating it. Furthermore, this study will use real exchange rate instead of nominal exchange rate. Finally, domestic and foreign incomes will be in real terms. An increase in the ratio implies trade improvement while the decrease in the ratio shows worsening of trade balance. Thus, Trade balance can be expressed as:

$Ln(X_S/M_S) = F(REER, Yd, Yf,)$ …….……...……...…...… (4.5)

From the above theoretical framework, therefore, sectoral trade balance function may be specified in log-linear form as follows.

$Ln\,(X_S/M_S)_{s,it} = \delta_1 lnREER_{it} + \delta_2 ln(Yd)_{it} + \delta_3 ln(Yf)_{it} + \varepsilon_{it}$……..……...…….(4.6)

Where,

$Ln(X_S/M_S)_{it}$ is natural log of the ratio of exports to imports of sector 's' at time t. For agriculture sector it is defined as ln(Xa/Ma); for manufacturing sector, it is defined as ln(Xm/Mm) and for Mining sector it is defined as ln(Xmi/Mmi).

Ln $(REER)_{it}$ *is* natural log of the real effective exchange rate for *country i at time t*.

Ln $(Yd)_{it}$ *is* natural log of domestic real GDP for country i at time t and

Ln $(Yf)_{it,}$ is natural log of trade weighted real GDP[26] of top ten trade partners for country i at time t.

To define the relevant set of economic variables that determine the ratio of merchandise exports to merchandise imports of a sampled country, this study followed three major econometric procedures. Firstly, panel unit root tests were employed as a prior diagnostic test before the estimation of the model to examine the stochastic time series process properties of explanatory variables and exports to imports ratio in sampled periods. Series that were found to be stationary were adopted, and those found not stationary were differenced to make them stationary (Gujarati, 2012). This enabled to avoid the problems of spurious result that are associated with non-stationary time series models in the study. The second step is to test the null hypothesis of no cointegration against the presence of cointegration among the variables. The final step is an estimation of the coefficients of the explanatory variables. According to Pesaran et al. (2001), if a unique long-run relationship exists between the variables of interest, we estimated a conditional panel ARDL long-run model for trade balance. The lag length for panel data was chosen based on Schwarz Bayesian Criteria (SBC).

Panel Unit Root Tests

As the cointegration tests can be performed only when the panels are non-stationary, therefore the stationarity of the variables has to be examined before the panel data analysis

[26] $Yf=\sum_{j=i}^{n}(\Theta_{j*}Y_j)$, Yf is trade weighted top ten trade partners real GDP for country i; $\Theta_{j,}$ average trade weight of trade partner country for year 1970-2013, j=1,2, …, 10 top ten trade partners. Yj, is real GDP for j foreign trade partner country (Chinn, 2006).

inorder to avoid a spurious regression problem. However, the introduction of such tests in ARDL was not necessary; it was introduced to test just to make sure that no series exceeds I(1)[27] (Pesaran et al , 1999) and because we applied other alternative models. For panel stationarity test, Levin et al. (2002), hereafter LLC; Im et al. (2003), hereafter IPS; Maddala and Wu (1999), hereafter Fisher-ADF and Phillips and Perron (1988), hereafter PP are widely used as panel unit root tests[28]. Panel unit root tests are less likely to commit a type II error than unit root tests that are applied to individual series as explained by Levin et al. (2002)[29].

LLC (Levin et al., 2002) panel unit root test was conducted based on the null hypothesis of a unit root. If all variables were found to be accepting the null of the common unit process at level but rejected the null hypothesis at first difference and then we concluded that all variables are stationary at first difference. Their model takes the following form (Chang, 2009).

$$\Delta Y_{it} = \alpha i + \rho Y_{i,t-1} + \sum_{k=1}^{n} \phi_i \Delta Y_{it-j+} \delta_{it} + \theta_t X_{it} + \varepsilon_{it} \quad \ldots\ldots (4.7)$$

Where,

i= 1, 2, …, N cross-sectional units or series that are observed over periods

t=1, 2,…, T number of periods

X stands for the exogenous variables in the model, including any fixed effects

ρ represents the autoregressive coefficients and disturbances.

ε_{it} represents the residuals that are assumed to be mutually independent idiosyncratic disturbances. This model also allows for two ways of fixed effects, one coming from the α_i

[27] Asteriou and Monastiriotis (2004) indicated when some variables are I(2) the estimations are not consistent.

[28] Refer Asteriou and Hall (2007) for detail.

[29] Levin et al. (2002) demonstrated that implementing a unit root test on a pooled cross section data set, rather than performing separate unit root tests for each individual series, can provide dramatic improvements in statistical power , allows us to test the various approaches with different degree of heterogeneity between individuals. Powers of panel and group t-statistics are roughly twice as large as the other test statistics according to Peter Pedroni (2004). For detail of each test methods refer Baltagi et al. (2001).

and the second from the $\theta_{t.}$ so that we can have both units specific fixed effects and unit specific time trends. The unit specific fixed effects are very important because they allow heterogeneity since the coefficient of lagged Y_i is restricted to be homogeneous across all units of the panel. Where θ_t is a deterministic component, which could be zero or one, ε_{it}, is the fixed effects as well as time trend, which follow a stationary process.

The null hypothesis of this test is that

H0: $\rho = 0$; H1: $\rho < 0$

As the LLC test is criticized for being restrictive and biased by imposing ρ to be homogeneous across all i; so Pesaran et al. (1997) extended the LLC test allowing heterogeneity on coefficient $Y_{i,t-1.}$ Im et al. (2003), hereafter IPS allows for a heterogeneous coefficient of $Y_{i,t-1}$ by proposing an alternative test procedure based on averaging individual unit root test statistics. By doing so, IPS suggested an average of the Augmented Dickey-Fuller (ADF) test when μ_{it} is serially correlated with different serial correlation properties across sectional units and their model is given by

$$\Delta Y_{it} = \alpha_i + \rho_i Y_{i,t-1} + \sum_{k=1}^{n} \phi_i \Delta Y_{it-j+}\delta_{it}+\theta_t + \mu_{it} \quad (4.8)$$

Thus, the null hypothesis of this test is that all series are non-stationary processes under the alternative that a fraction of series in the panel is assumed to be stationary.

The null hypothesis of this test is that

H0: ρi = 0 for all i; H1: $\rho < 0$ *for* at least one i

Pesaran et al. (1997) formulated their model under the restrictive assumption that T should be the same for all cross sections, requiring a balanced panel to compute the t-test statistic. Their t-statistics is nothing else than the average of the individual ADF t-statistics for testing that ρi=0 for all i (denoted by $t_{\rho i}$;t=1/N$\sum_{i=1}^{N}$ tρi.

Maddala and Wu (1999) attempted to improve some degree of the drawbacks of all previous tests by proposing a model that could be estimated with unbalanced panels. They are in line with assumptions of heterogeneity, but they disagree with the use of average ADF statistics by arguing that it is not the most effective way of evaluating stationarity. Assuming that there are N unit root tests, the MW test takes the following way of evaluating stationarity.

$$\pi_i = -2\sum_{i=1}^{n} \ln \pi_i \quad \text{.....(4.9)}$$

Where π_i is the probability limit values from ADF unit root tests for each cross-section i. The π statistic will follow a $\chi 2$ distribution with 2N degree of freedom as $T_i \rightarrow \infty$ for finite N, where N is the number of countries in the panel. A big benefit is that the test can handle unbalanced panels.

Panel Cointegration Test

As the standard practice, the next step to unit root test is finding of long-run relationships among the specified set of variables, using the Johansen cointegration technique. However, the power of the Johansen's test in a multivariate system with small sample sizes can be severely limited. Due to this problem, the panel cointegration approach was developed. For panel cointegration regression models, the asymptotic properties of the estimators of the regression coefficients and the associated tests are different from those of time series cointegration models. Adding cross-section dimensions to the time series dimension in order to combine the method of dealing with non-stationary data from the time series increases the data and power from the cross-section. Thus, as the time and cross-section dimensions increase, panel test statistics and estimators converge in distribution to normally distributed random variables. Since testing for cointegration in panel data is relatively recent, few cointegration tests are documented in the literature. This study used test statistics proposed by Peter Pedroni (2004) which is widely used in many kinds of literature.

Pedroni panel cointegration tests were conducted based on the null hypothesis of no cointegration against the alternative hypothesis of long relationship exists. Pedroni proposed

several tests for cointegration in panel data models that allow considerable heterogeneity. The good features of Pederson's tests are the fact that they allow multiple regressors, for cointegration vector to vary across different sections of the panel and for heterogeneity in the errors across cross-sectional units. The Pedroni model has the following form:

$$Y_{it} = \alpha_i + \delta_t + \sum_{m=1}^{m} \theta m_i \, Zm_{it+}\mu_{it} \quad (4.10)$$

Where,

i= 1, 2, 3,…m, for each country in the panel

t=1, 2, 3, T refers to the time period.

Y_{it} is a dependent variable.

θm_{it} is a set of independent variables.

μ_{it} denotes estimated residuals which represent deviations from the long-run relationship.

The parameters α_i and δ_t allow for the possibility of country specific fixed effects and deterministic trend, respectively.

Seven different cointegration techniques are proposed to capture the 'within' and 'between' effects in his panel, and tests can be classified into two categories. The first category which includes four tests and is based on pooling along the 'within' dimension (pooling the Autoregressive or AR coefficients across different sections of the panel for the unit root test of residuals). The second category includes three tests based pooling the 'between 'dimensions (averaging the AR coefficients for each member of the panel for the unit root tests of residuals).

Estimation Methods

Finally, to identify long-run and short-run relationships between dependent and independent variables the study used ARDL model. The ARDL model was used due to the existence of stationary mixed-order variables and small observations. To estimate ARDL equation,

Pesaran et al. (1999) developed two estimators[30]; mean group estimator; hereafter MG and pooled mean group estimator; hereafter PMG to detect long-run and the short-run correlation between variables for panel study. The MG[31] estimator imposes no restriction on parameters of ARDL specification and derives the long-run parameters obtained from individual ARDL estimates. The main shortcoming of this estimator is that it does not allow certain parameters to be the same across the panel. To overcome this shortcoming, PMG estimator is suggested by Pesaran et al. (1999). The PMG estimator constraints the long-run parameters to be the same but allows intercepts, error variances, error correction term and the short-run parameters to differ freely across countries.

The unconstraint specification for the ARDL system of equations for t=1,2,…,t, time periods and j=1,2,.., n a number of countries. A dependent variable $\ln(X_s/M_s)$ is formulated as follows based on Loayza and Ranciere (2006) and Asteriou and Stephen G. Hall (2007).

$$\ln(Xs/Ms)\,jt = \alpha j + \sum_{i=1}^{n} \delta_{0j} \ln\left(\frac{Xs}{Ms}\right)_{j,t-i} + \sum_{i=0}^{m} \delta_{nj} \ln Z_{jn,t-i} + \mu_j + \varepsilon_{jt} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(4.11)$$

Where,

i=1, 2, 3.., N: number of lags

t=1, 2, 3…, T: number of periods

$Ln(X_s/M_s)$: exports to imports ratio for sector‘s’.

j=1, 2, 3, 4,….., 10: number of countries

$Z_{j,t-1}$ is the (Kx1) vector of explanatory variables which includes REER,Yd,Yf for country j.

$\delta_{n=}$ are the (kx1): coefficients of vectors

μ_j : the country specific effect and ε_{it} is error term.

[30] Refer Asteriou and Hall (2007) for detail.

[31] The least restrictive procedure and it allows for heterogeneity of all the parameters (imposes no cross-country restriction); It consists of estimating separate regressions for each country and computing averages of the country-specific coefficients. The assumptions are quite strong – require that the group-specific parameters are distributed independently of the regressors, and the regressors are strictly exogenous. This estimation model does not take into account that the same economic conditions tend to be common across countries in long-run for detail see Pesaran et al. (1999).

In principle, the panel can be unbalanced n, m, may vary across countries, see Rancierem (2006) and Asteriou and Stephen G. Hall (2007). This model can be re-parameterized as a VECM system.

$$\Delta \ln(Xs/Ms)_{jt} = \phi_j(\ln(Xs/Ms)_{j,t-1} - \alpha_j - \delta_{jn}\ln(Zn_{j,t-1})) + \sum_{i=1}^{n-1} \beta_{j0}\Delta\ln(Xs/Ms)_{j,t-i} + \sum_{i=0}^{m-1} \beta_{jn}\Delta Zn_{j,t-i} + \mu_j + \varepsilon_{jt} \quad (4.12)$$

$$ECT_{jt} = \phi_j\ (\ln(X_s/M_s)_{j,t-1} - \alpha j - \delta_{j1}\ln REER_{j,t-1} - \delta_{j2}\ln Yd_{j,t-1} - \delta_{j3}\ln Yf_{j,t-1)}.$$

Where,

REER is the real effective exchange rate.

Yd is own real GDP

Yf is trade weight foreign real GDP.

t denotes time, and i represent lags.

The parameters β_{jn} n = 1, 2, 3, are the short-run dynamic coefficients while the parameters δ_n n = 1, 2, 3, are the long-run coefficients and θ_j represents error correction coefficient and if θ_j=0, then there would be no evidence of a long-run relationship. This parameter is expected to significantly negative under the prior assumption that variables return to long-run equilibrium.

The pooled mean group restrictions are that the elements of δ_j are common across countries while α_j, β_j, and θ_j can vary across countries while in the mean group, all can vary across the group because there is no restriction. All dynamics and ECM terms are free to vary under PMG. Estimation of this model is by maximum likelihood. Again, it is proved that under some regularity assumptions, the parameter estimates of this model are consistent and asymptotically normal for both stationary and non-stationary regressors. Both MG and PMG estimations require selecting the appropriate lag selection for the individual country equations. This selection was made using the SBC criterion.

We assumed that in long-run countries in this region are expected to have similar sectoral structure, income levels, technologies, the extent of liberalization, monetary policies but in

the short-run monetary policy, exchange rate policy, the extent of liberalization, income level, and other external and internal shocks are expected to be heterogeneous. Therefore, it is reasonable to argue that country heterogeneity is particularly relevant in the short-run. Moreover, as the time span is very short, the MG estimator has no enough degree of freedom. Hausman test can be used to verify whether there is a significant difference between the PMG and MG. The null hypothesis to test the difference between PMG and MG is 'estimation is not significant'. If the null hypothesis is not rejected, then they are not significantly different; in this respect, we used the PMG estimator since it is efficient. The alternative hypothesis here is that there is a difference between PMG and MG. There is another estimator named dynamic fixed effect estimator; hereafter DFE estimator which restricts all slopes of coefficients to be equal across countries but allows intercepts to be different, see Blackburne and Frank (2007) and Loayza and Ranciere (2006). DFE calculates standard error while making an allowance of intergroup correlation. This model is subject to simultaneous equation bias from endogeneity between the error term and the lagged dependent variable. The Hausman test can be easily performed to measure the extent of this endogeneity, see Blackburne and Frank (2007) and Loayza and Ranciere (2006). Finally to ensure the robustness and the reliability of the PMG[32] empirical results, we employ other two econometric methods namely, panel FOLS and panel DOLS methods.

4.5. Empirical Results and Discussion

4.5.1. Panel Unit Root Test Results

As we have discussed above, the study used the following panel unit root techniques namely LLC, ADF, IPS, PP. Table 4.1 and Table 4.2, reports the panel unit root test results for real effective exchange rate, real domestic income, and foreign income. The null hypothesis cannot be rejected but for agriculture and mining exports to imports ratio, the null

[32] The PMG is an intermediate estimator because it involves both pooling and averaging. One advantage of the PMG over the Panel FMOLS and DOLS models is that it can allow the short-run dynamic specification to differ from country to country while the long-run coefficients are constrained to be the same.

hypothesis is rejected, thereby suggesting the existence of fractional integration for each sector.

Table 4.1: Panel Unit Root Test with Intercept only

			I(0)	
Variables	LLC	ADF	IPS	PP
Ln(Xa/Ma)	-2.08**	-2.25**	40.82**	48.89***
	(0.02)	(0.01)	(0.00)	(0.000)
Ln(Xm/Mm)	-2.35**	-1.12	37.68**	45.24***
	(0.01)	(0.13)	(0.010)	(0.01)
Ln(Xmi/Mmi)	-3.84)***	-4.00***	54.75***	54.13***
	(0.00)	(0.00)	(0.00)	(0.00)
LnREER	-2.38***	-1.18	33.57**	49.52***
	(0.01)	(0.12)	(0.03)	(0.00)
LnYd	2.45	7.19	3.19	3.01
	(0.99)	(1.00)	(1.00)	(1.00)
LnYf	-3.96***	0.58	15.43	24.83
	(0.00)	(0.72)	(0.75)	(0.21)
I(1)				
Ln(Xa/Ma)	-6.81***	-9.79***	129.24***	272.02***
	(0.00)	(0.00)	(0.00)	(0.00)
Ln(Xm/Mm)	-11.74***	-13.45***	172.14***	200.83***
	(0.00)	(0.00)	(0.00)	(0.00)
Ln(Xmi/Mmi)	-12.27***	-13.48***	174.43***	522.30***
	(0.00)	(0.00)	(0.00)	(0.00)
LnREER	-11.17***	-11.45***	149.56***	148.02***
	(0.00)	(0.000)	(0.00)	(0.00)
LnYd	-12.048***	-11.803***	155.420***	167.88***
	(0.000)	(0.00)	(0.00)	(0.00)
LnYf	-11.59***	-9.48***	119.15***	127.36***
	(0.00)	(0.00)	(0.00)	(0.00)

P-values in parentheses; ***, **, * denote 1 percent, 5 percent and 10 percent level of significance.
Source: Extracted by the author from Regression Output put using E-views version 9, 2016.

Table 4.2: Panel Unit Root Test with Intercept and Trend

Variables	LLC	ADF	IPS	PP
		I(0)		
Ln(Xa/Ma)	-6.29***	-5.57***	63.99	77.21***
	(0.00)	(0.00)	(0.00)	(0.00)
Ln(Xm/Mm)	-1.77***	-0.31	30.07*	31.48**
	(0.04)	(0.38)	(0.069)	(0.049)
Ln(Xmi/Mmi)	-4.98**	-5.26***	64.45***	53.53***
	(0.00)	(0.00)	(0.00)	(0.00)
LnREER	0.88	0.69	15.61	20.05
	(0.81)	(0.75)	(0.74)	(0.46)
LnYd	-0.7	1.21	15.23	14.46
	(0.24)	(0.89)	(0.76)	(0.81)
LnYf	1.44	3.87	8.46	5.70*
	(0.93)	(1.00)	(0.99)	(0.10)
		I(1)		
Ln(Xa/Ma)	-16.76***	-15.86***	189.95***	453.94***
	(0.00)	(0.00)	(0.00)	(0.00)
Ln(Xm/Mm)	-9.83***	-12.23***	149.76***	578.62***
	(0.00)	(0.00)	(0.00)	(0.00)
Ln(Xmi/Mmi)	-11.16***	-11.84***	153.13***	215.02***
	(0.00)	(0.00)	(0.00)	(0.00)
LnREER	-8.69***	-10.85***	133.29***	313.05***
	(0.00)	(0.00)	(0.00)	(0.00)
LnYd	-11.33***	-11.07***	141.09***	221.75***
	(0.00)	(0.000)	(0.00)	(0.00)
LnYf	-11.51***	-8.66***	99.98***	156.94***
	(0.00)	(0.00)	(0.00)	(0.00)

P-values in parentheses; ***, **, * denote 1 percent, 5 percent and 10 percent level of significance.
Source: Extracted by the author from Regression Output put using E-views version 9, 2016.

4.5.2. Panel Cointegration Test Results

After finding that the variables are stationary in difference or integrated into order one, we can now apply cointegration test to scrutinize the relationship between the variables and we tested whether there is a cointegration relationship among variables in each sector. Table 4.3

reports the results of the cointegration with and without interaction variable. With the exception of panel V-statistic, Panel rho statistic and group rho statistic with trend; the other four test statistics rejected the null hypothesis of no cointegration at 5% significance level.

Table 4.3: Panel Cointegration Test

Test	With intercept Statistics	P-Value	With trend and Intercept Statistics	P-Value
Agriculture sector				
With dimension				
Panel v-Statistic	2.93***	0.00	0.95	0.17
Panel rho-Statistic	-3.15***	0.00	-2.01**	0.02
Panel PP-Statistic	-6.56***	0.00	--7.60***	0.00
Panel ADF-Statistic	-4.21***	0.00	-2.98***	0.00
Between Dimension				
Group rho-Statistic	-2.46**	0.01	-1.066	0.59
Group PP-Statistic	-8.29***	0.00	-8.08***	0.00
Group ADF-Statistic	-5.13***	0.00	-3.79***	0.00
Manufacturing sector				
With dimension				
Panel v-Statistic	2.98***	0.00	0.78	1.00
Panel rho-Statistic	-2.97**	0.02	-0.97	0.17
Panel PP-Statistic	-4.31***	0.00	-3.59***	0.00
Panel ADF-Statistic	-1.62*	0.05	-4.62***	0.00
Between Dimension				
Group rho-Statistic	0.14	0.56	0.99	0.84
Group PP-Statistic	-4.06***	0.00	-3.58***	0.00
Group ADF-Statistic	-3.59***	0.00	-2.90***	0.00
Mining Sector				
With dimension				
Panel v-Statistic	3.36***	0.00	1.53*	0.06
Panel rho-Statistic	-2.53***	0.01	-1.34*	0.09
Panel PP-Statistic	-4.80***	0.00	-4.85***	0.00
Panel ADF-Statistic	-5.24***	0.00	-2.28***	0.00
Between Dimension				
Group rho-Statistic	-1.4*	0.08	0.31	0.38
Group PP-Statistic	-6.54***	0.00	-6.37***	0.00
Group ADF-Statistic	-2.68***	0.00	-2.59***	0.01

***, **, * denote 1 percent, 5 percent, and 10 percent level of significance.
Source: Extracted by the author from Regression Output put using E-views version 9, 2015.

This study used Peter Pedroni (1999, 2004)) method for panel cointegration. Table 4.3 presents the results of the panel cointegration tests of Peter Pedroni (1999,2004). Pederson's seven test statistics were calculated ‘without time dummies’ as well as ‘with time dummies’ where the latter is intended to consider any common disturbances affecting all countries in the panel. The empirical results indicate that a majority of the tests rejected the null hypothesis of no cointegration in all three sectors i.e. agriculture, manufacturing and mining

respectively. Generally, although not with all tests, we obtained strong evidence of cointegration between these series. Pedroni (1999, 2004) shows that the panel–ADF and group-ADF tests have better small sample properties than other tests; hence, they are more reliable to use. In this empirical study, ADF and group-ADF test results confirmed the existence of a long-run relationship among ratio of exports to imports, real effective exchange rate, own real GDP , and trade-weighted foreign real GDP in all three sectors.

4.5.3. Long Run and Error Correction Empirical Estimation Results

ARDL Model Estimators Short Run Error Correction Empirical Results

Table 4.4 indicates the report for all three models estimation results. The results of these models provided short-run and long-run impacts of the real effective exchange rate and real income on exports to imports ratio in each sector. We emphasized on the interpretation of PMG estimator results because Hausman test confirmed its efficiency and consistency of performance over MG model.

The negative and significant error coefficients (EC)[33] illustrated in Table 4.4 indicates not only the presence of the cointegration among variables but also the adjustments of disequilibrium of the trade balance in agriculture, manufacturing and mining sector in the long-run towards equilibrium. Error correction term allows the long-run behavior of the endogenous variables to converge to their long-run relationship while allowing a wide range of short-run dynamics. In all three sectors, the EC carries the correct sign and statistically significant at 1 percent. This shows that the system is non-explosive and confirmed the existence of stability of the system in long-run equilibrium. The magnitude of the EC value measures the speed of adjustment. For example, in agriculture sector EC value=-0.815 implies that this deviation from long-run agriculture exports to imports ratio during this year

[33] If the error correction sign is positive and statistically significant the system is explosive and long-run equilibrium cannot be attained. This implies due to any disturbance in the system, divergence from the equilibrium will take place and the system will be unstable. For detail regarding to error correction term, refer Robert F. Engle and C. W. J. Granger (1987).

is corrected by about 81 percent in next year; indicates that following a shock, convergence to equilibrium is rapid. In the case of manufacturing sector EC value=-0.44, only about 44 percent of disequilibrium in manufacturing exports to imports ratio is adjusted towards equilibrium from last year's deviation. Finally, the mining sector has EC value=-0.708 which shows that about 71 percent of any last year deviation in actual exports to imports ratio is adjusted towards equilibrium in this year. Low speed of adjustment in manufacturing trade balance might be due to low competitiveness of manufacturing sector trade (Kyophilavong, P. et al., 2013).

The long-run parameter estimated from MG estimator are statistically insignificant for variables in all sectors even at 10 percent level of significance. However, Hausman test proved that the null of long-run homogeneity for each variable cannot be rejected at 5 percent significance level. This evidence justifies the use of PMG estimator which is consistent and efficient under long-run homogeneity. Real effective exchange rate coefficient obtained from MG estimator turned out to be significant when the PMG estimator was used instead, and the DFE result is consistent with PMG estimator results in all three sectors.

As reported in Table 4.4, the sign of long-run coefficients of the real effective exchange rate for agriculture exports to merchandise imports ratio is negative and statistically significant at one percent; implying a devaluation of real effective exchange rate reduces agriculture trade international competitiveness and worsens the agriculture trade balance in long-run for East African countries. As real effective exchange rate increases by one percent, agriculture trade balance declines by about 0.31 percent. The result is not consistent with general theoretical expectation and aggregate trade balance result in this region. However, this result is consistent with previous empirical findings of Cho et al. (2002), Yazici (2006,2012), Kandilov (2008), Caglayan and Di (2008); Byrne et al. (2008), Baek and Koo (2009), Chebbi and Olarreaga (2011). This result is not surprising given the fact that agriculture products are mostly basic and necessities, and therefore, they have low demand elasticities. Moreover, the agriculture sector in this region is dependent on imported agricultural inputs such as machinery, fertilizer, and other chemical inputs. The price response is higher than

volume response for agriculture exports and inputs as real exchange rate increases, indicating that agriculture trade balance is worsening might be because of overweight of price effect over volume effect in agriculture exports and imports in this sector. According to P.-O. Krugman (2003) real depreciation may affect the trade balance negatively or positively. If the price effect dominates the volume effect, then trade balance deteriorates while if the volume effect outweighs the price effect, then trade balance improves. Another possible reason might be a diversion of resources like labor, capital and another resource from tradable to non-tradable goods production because the increase in the real exchange rate would reduce profitability in exportable and import competing products.

In our sampled period, both fixed exchange and managed floating exchange rate regimes are included. During pre-foreign exchange regime periods, these countries were following the protectionist type of policies which restricts imports, imposes taxes on exports that encourage farmers to continue to grow low-value food crops rather than diversifying into high-value nontraditional exports. In many countries, these policies also reduced demand for labor in rural areas, since import substitute crops tended to be less labor intensive than exports, particularly nontraditional exports. During this period, devaluation might offset by domestic inflation, export taxation. This factor might be the final but most important reason that devaluation worked in opposite direction for agriculture trade balance in these countries. This result suggests the need for further analysis by breaking the periods into two as pre-reform and post-reform of foreign exchange regime but the pre-foreign exchange reform period observations are not sufficient so that only post-reform analysis was conducted as indicated in Table 4.7.

Table 4.4: Panel ARDL Long Run and Dynamic Error Correction Estimation Results

	Agriculture			Manufacturing			Mining and Fuel		
	PMG	MG	DFE	PMG	MG	DFE	PMG	MG	DFE
Dep.Var.	Δln(Xa/Ma)			Δln(Xm/Mm)			Δln(Xmi/Mmi)		
				Long -Run					
LnREER	-0.31**	-0.24	-0.59**	0.91***	0.22	0.72**	1.19***	0.017	1.11***
	(0.02)	(0.43)	(0.03)	(0.00)	(0.80)	(0.03)	(0.00)	(0.98)	(0.01)
LnYd	0.35*	-0.19	0.62	1.17**	-0.41	0.40	2.85***	4.82	2.37***
	(0.08)	(0.74)	(0.17)	(0.01)	(0.83)	(0.45)	(0.00)	(0.22)	(0.00)
LnYf	-1.74***	-0.31	-1.48**	-0.74	0.72	0.05	-3.35***	-5.95	-2.90***
	(0.00)	(0.85)	(0.03)	(0.32)	(0.86)	(0.95)	(0.00)	(0.40)	(0.01)
				Short- Run Dynamics					
EC	-0.82***	-1.04***	-0.41***	-0.44***	-0.70***	-0.41***	-0.71***	-0.88***	-0.581***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ΔlnREER-1	-0.45	-0.30	0.32	-0.30	-0.33	-0.42	-1.51	-0.99	-1.02*
	(0.35)	(0.30)	(0.19)	(0.13)	(0.41)	(0.15)	(0.16)	(0.34)	(0.07)
ΔlnYd-1	1.24	1.55	0.81	-2.06	-1.40	-0.011	0.082	-2.94	-2.56*
	(0.66)	(0.50)	(0.21)	(0.42)	(0.65)	(0.99)	(0.98)	(0.22)	(0.06)
ΔlnYf-1	0.68	0.71	-0.31	5.65**	3.39	3.08	0.79	-0.72	-3.13
	(0.66)	(0.56)	(0.867)	(0.03)	(0.16)	(0.15)	(0.90)	(0.87)	(0.44)
Cons	35.20***	-8.42	12.63***	-5.78***	-25.74	-5.44	15.21***	35.39	12.35
	(0.00)	(0.86)	(0.01)	(0.00)	(0.75)	(0.30)	(0.00)	(0.70)	(0.23)
Hausman T.	3.82(0.28)		0.09(0.99)		0.57(0.90)	0.01(0.99)		2.73(0.44)	0.04(1.0)
N	236	236	236	236	236	236	231	231	231

P-values in parentheses; ***, **, * denote 1 percent, 5 percent, and 10 percent level of significance.
Source: Extracted by the author from Regression Output put using E-views version 9, 2015.

In Table 4.4., domestic income is found to be statistically significant in determining agriculture trade balance in the long-run, and it has a positive sign that shows GDP growth improves the trade balance. A. one percent growth in the domestic real gross domestic product increases the ratio of agriculture exports to imports by about 0.39 percent in the long run. The impact of the domestic real income on the exports to merchandise imports ratio is ambiguous[34]. Higher income levels stimulate increased imports to demand as well as increased domestic production of tradable goods leaving the ultimate impact on the trade balance somewhat indeterminate. However, as depicted in Table 4.4, the effect of the rise in the real GDP in the production of agriculture goods dominates increase in the demand of

[34] The impact of the domestic real income variable on trade balance is ambiguous and the expected sign of the effect of real income on trade balance is negative and positive under the absorption and monetary approaches respectively with some assumptions.

agriculture goods. This result shows that the growth in the real GDP in East African countries is supply driven; implying domestic production is more important to improve agriculture trade balance than devaluation.

Similarly to the own real gross domestic product, the impact of an increase in real GDP of the main trading partners is ambiguous as which makes difficult for determination of the sign. Even though it is with uncertainty, it is argued that increase in real GDP of the trading partners increase the demand for exports. However, our empirical results show that the trade-weighted of top partners' real GDP has a negative effect on trade balance and a one percent increase in top trade partners' real income reduces trade balance by about 1.7 percent. This is a fact that average foreign real gross domestic product growth is more of supply-driven than demand-driven. The justification for this is a rise in foreign real GDP is due to an increase in the foreign production of agriculture import substitute goods. Their imports may decline as their income increases. Most of the trade partners of this region like China, India, and Turkey are competitors to African products than complementing . In addition, we need to recognize that outlook for world market trade in primary commodities, which today dominate East African exports of sampled countries (coffee, tea, tobacco, hides and skins, live stocks, copper) is not favorable in that copper is displacing by other metals, demand for coffee and tea in developed countries is saturated. Substitution by synthetics has affected cotton and skins adversely. The health hazard has affected the demand for tobacco. Thus, as their GDP increases, they export more and more to this region and reduce the share of exports to other rest of the world.

As presented in Table 4.4,in the short run, real effective exchange rate worsens agriculture trade balance while both domestic and foreign real GDP has a positive effect on agriculture trade balance but all variables are found statistically insignificant. For estimation of parameters, we were quite restricted by available sample size in each country to derive a conclusion. The small sample size leaves a very little degree of freedom for estimating short-run coefficients.

As reported in Table 4.4., Hausman test confirmed that PMG estimator is efficient and consistent than MG estimator in manufacturing sector trade analysis; therefore, similar to the agriculture sector, we interpreted PMG estimator empirical results. As indicated by PMG estimator, the speed of adjustment for manufacturing to exports ratio (-0.44) is less than both agriculture exports to imports ratio (-0.82) and mining sector exports to imports ratio (-0.71). This estimation shows that manufacturing exports to imports ratio speed of adjustment towards equilibrium is lowest of all sectors. The empirical results obtained from PMG estimator suggests that in long-run manufacturing exports to imports ratio is positively correlated with real effective foreign exchange rate but in short-run real effective exchange rate worsens manufacturing trade balance. This result might reflect the fact that manufacturing firms in short-run remain oriented to the domestic market and imports much of their raw materials from rest of the world which means that the real devaluation may not improve profitability or even adversely affects their profitability and reduces their production to domestic consumption. However, in the long run, most manufacturing firms may expand their market to rest of the world and use domestic raw materials which may make them profitable in the long-run then it increases exports[35]. As result manufacturing trade balance in particular and, total trade balance, in general, may improve. Thus, devaluation as policy instrument increases competitiveness and improves the trade balance. The sign of the coefficient is in line with general theoretical expectations and with some empirical findings by Doroodian et al. (1999) for the USA, Yazici (2006) for Turkey, Chebbi and Olarreaga (2011) for Tunisia, Chiloane (2013) for South Africa.

Foreign real GDP is found statistically insignificant while the growth of real gross domestic production improves manufacturing trade balance. The justification for this is a rise in the real gross domestic product is due to an increase in the domestic production of a manufacturing import substitute goods. This result shows imports may decline due to domestic production growth and then rise in exportable manufacturing production. As reported in Table 4.4, a one percent rise in own real gross domestic production increases

[35] Refer Bigsten et al. (1999) and Sekkat and Varoudakis (2000)

manufacturing exports to imports ratio by 1.17 percent. This finding shows that emphasizing on domestic production boosting is more pronounced than using foreign exchange rate policy in explaining manufacturing trade balance in East African countries. In the short run, both real effective exchange rate and own real GDP worsen manufacturing trade balance, but both variables are found statistically insignificant while foreign real GDP has a positive effect on manufacturing trade balance. The small sample size leaves a very little degree of freedom for estimating short-run coefficients; therefore, we were restricted to reach the conclusion.

Like agriculture and manufacturing sector, Hausman test confirmed that PMG estimator is more efficient and consistent than MG estimator for estimating mining trade balance elasticities. Table 4.4 indicates that the long-run coefficient of the exports to imports ratio respect to real effective exchange rate is positive. This estimation shows that mining sector trade balance improves as real effective exchange rises. The implication here is that devaluation affects demand side of the mining sector to bring improvement in trade balance and shows that devaluation switches domestic consumers to consume their mining products and foreign consumers from their demand towards East African countries mining sector products. The result is consistent with general theory and some empirical work like Yazici (2006) for the Turkish economy. Price elasticity of trade balance of mining sector is higher than manufacturing and agriculture sectors. Furthermore, real GDP of top ten trade partners and own GDP elasticities are higher than respective elasticities in agriculture and manufacturing sectors and statistically significant. A one percent rise in real domestic (foreign) gross production increases (reduces) mining exports to imports ratio by about 2.85 percent (3.35 percent). In the short run, devaluation of real effective exchange rate worsens mining trade balance while both own and trade partners real GDP has a positive effect on mining trade balance but all parameters are found statistically insignificant.

Finally, when we compared three sectors, the long-run effect of real foreign exchange rate on the trade balance is different in the magnitude of elasticity and even in the sign of

elasticity[36]. This finding is consistent with a study by Bahmani-Oskooee and Ratha (2004) and Baek and Koo (2009). The PMG estimator results reveal that short-run real exchange rate movement effects on the trade balance are not statistically significant. The reason is that PMG estimator does not restrict coefficients to be the same among sampled countries. The small sample size leaves a very little degree of freedom for estimating short-run coefficients.

Estimated short-run and long-run coefficients of the real effective exchange rate were used to test the existence of the J-curve phenomenon that states following a depreciation of a national currency, deterioration of trade balance occurs and an improvement after a while. In this study, manufacturing and mining exports to imports ratios confirmed the existence of this phenomenon, but the short-run coefficients are not statistically significant[37].

Alternative Dynamic Models Estimation Empirical Results

We used two other alternative methods namely panel DOLS (Kao and Chiang, 2000)[38]and panel FMOLS (P Pedroni, 2000; Phillips and Moon, 1999)[39]to check the robustness of the previous results and then to confirm the reliability of our empirical results. Table 4.5 shows the price, real domestic income and foreign income elasticities in the two alternative models. The results are interesting in that the signs of coefficients for all three sectors are consistent with previous PMG estimator. This estimation shows the robustness of our results. A 1 percent increase in real effective exchange rate worsens agriculture trade balance by about

[36] This situation is consistent with Maskus (1986) . As noted by Maskus, the impact of exchange rate volatility may vary across sectors because these can have differing degrees of openness to international trade, different industry concentration levels and make different use of long-term contracts. According to his estimations run over the 1974-1984 period, real exchange rate risk reduces US agricultural trade more than other sectors that he attributes to a greater openness of the agriculture sector, to a low level of industry concentration, and lengthy trade contracts.

[37] It is difficult to test the J-curve effect by using the PMG estimator for all the countries because the estimation procedure does not allow us to include enough lags in the panel.

[38] Panel DOLS model, provided by (Kao and Chiang, 2000) which includes leads and lags of the independent variable. The panel DOLS estimation is fully parametric and offers a computationally convenient to correct endogeneity problems.

[39] Another approach to correct for the endogeneity is panel FMOLS where, in contrast to DOLS, the bias is corrected in a non-parametric way.

0.31 percent (PMG), 0.54 percent (Panel FMOLS), and 0.53 percent (Panel DOLS). In all models, the sign of price (real effective exchange rate) of export to import ratio is positive and significant. This shows that when the real exchange is devaluated by one percent, agriculture trade balance falls between 0.31 to 0.59 percent in the long-run in Eastern Africa. Moreover, the empirical results for both domestic and foreign income elasticities show the robustness of our result that was found by PMG estimator.

Table 4.5: Robustness Check I: Alternative Dynamic Models Estimation Empirical Results

Sector	Agriculture		Manufacturing		Mining	
Variables	Panel FMOLS	Panel DOLS	Panel FMOLS	Panel DOLS	Panel FMOLS	Panel DOLS
Dep. Var.	Δln(Xa/Ma)		Δln(Xm/Mm)		Δln(Xmi/Mmi)	
LnREER	-0.54**	-0.53***	0.65*	0.78**	0.65*	0.31
	(0.01)	(0.01)	(0.05)	(0.00)	(0.07)	(0.35)
LnYd	0.54*	0.33	0.51	0.31	2.35***	2.05***
	(0.09)	(0.32)	(0.18)	(0.45)	(0.00)	(0.00)
LnYf	-1.05**	-0.86*	-0.162	0.30	-2.56***	-2.05**
	(0.03)	(0.09)	(0.79)	(0.61)	(0.01)	(0.02)
Adj. R^2	0.63	0.69	0.79	0.82	0.66	0.72
S.E. reg	0.50	0.46	0.59	0.54	1.01	0.92
Longrun va	0.49	0.32	0.71	0.38	1.70	0.82
Mean dep.va	0.45	0.45	2.30	2.30	2.21	2.22
S.D. dep.	0.82	0.821	1.29)	1.29	1.74	1.74
SSR	59.11	43.128	83.78	56.75	240.25	165.03
N	251	251	251	248	248	246

P-values in parentheses; ***, **, * denote 1 percent, 5 percent, and 10 percent level of significance
Source: Extracted by author from Regression Output put using E-views version 9, 2015

Similarly, foreign exchange rate elasticity of manufacturing exports to imports ratio result robustness is ensured. A one percent devaluation of real effective exchange rate increases manufacturing trade balance by about 0.91 percent (PMG),0.65 percent (panel FMOLS) and 0.78 percent (panel DOLS). Thus, a 1 percent devaluation of real effective exchange rate increases manufacturing trade balance between 0.65 to 0.91 percent in long-run for Eastern Africa.

The mining sector trade balance also followed the same pattern with manufacturing sector and the signs of coefficients are consistent with the PMG estimator results. A one percent

devaluation of the domestic currency increases mining trade balance in East African countries by a 1.19 percent (PMG), 0.65 percent (panel FMOLS) and 0.31percent (panel DOLS) in long-run.

Static Models Estimation Empirical Results

Table 4.6: Robustness Check II: Static Models Estimation Empirical Results

	Agriculture sector		Manufacturing sector		Mining sector	
Variables	(RE)	(FE)	RE)	(FE)	(RE)	FE)
	ln(Xa/Ma)		ln(Xm/Mm)		ln(Xmi/Mmi)	
lnREER	-0.28***	-0.51***	0.41***	0.58***	0.06	0.31
	(0.00)	(0.00)	(0.00)	(0.00)	(0.74)	(0.25)
lnYd	0.49***	0.48**	0.11	0.2	0.69**	2.08***
	(0.00)	(0.03)	(0.58)	(0.30)	(0.02)	(0.00)
lnYf	-1.15***	-1.02***	0.66**	0.37	-0.07	-2.02***
	(0.00)	(0.00)	(0.03)	(0.34)	(0.89)	(0.00)
Cons	22.9***	20.65***	-25.72***	-21.42***	-16.65*	5.94
	(0.00)	(0.00)	(0.00)	(0.00)	(0.07)	(0.59)
Hausman Test	7.06(0.07)*		4.06(0.26)		10.88(0.01)**	
N	256	256	256	256	253	253

P-values in parentheses; ***, **, * denote 1 percent, 5 percent, and 10 percent level of significance
Source: Extracted by author from Regression Output put using E-views version 9, 2015

The static panel models namely fixed and random effects were employed, and the sign of the coefficients are consistent with previous empirical results, but the mining sector is not statistically significant. This finding ensured the robustness of our result in different dynamic models in the above.

Post Foreign Exchange Regime Liberalization Estimation Empirical Results

From the above empirical analysis, we found that real effective exchange rate has a positive effect on manufacturing and mining trade balance while devaluation of real effective exchange rate worsens agriculture trade balance. The above empirical analysis was conducted for the period 1970-2013. During these years, both fixed and floating foreign exchange regimes were practiced in all sampled countries. Therefore, the structural breakdown for the analysis of post-reform and pre-reform gives more reliable results. Many

East African countries undertook comprehensive reforms during late 1980's and early 1990's particularly exchange rate liberalization. Since the size of observation for analysis of pre-foreign exchange rate regime liberalization is not sufficient, we attempted to examine the post-reform effect of real exchange rate on trade balance of each sector as follows.

Table 4.7**:** Robustness Check III: Post Foreign Exchange Reform Estimated Results

Model	PMG	MG	DFE	PMG	MG	DFE	PMG	MG	DFE
Dep. V.	Δln(Xa/Ma)			Δln(Mm/Xm)			Δln(MmI/Xmi)		
				Long -Run					
LnREER	0.37***	-1.19	-0.09	0.55**	-0.30	0.13	1.15**	0.83	1.84***
	(0.00)	(0.34)	(0.59)	(0.02)	(0.81)	(0.74)	(0.02)	(0.35)	(0.01)
LnYd	0.91***	-1.53	0.84***	1.62***	4.21	0.90	2.75***	7.94*	2.97***
	(0.00)	(0.51)	(0.00)	(0.00)	(0.15)	(0.11)	(0.00)	(0.08)	(0.00)
LnYf	-2.33***	3.33	-2.64***	-1.43	-15.27	-0.80	-2.04	-11.02	-4.14**
	(0.00)	(0.64)	(0.00)	(0.14)	(0.21)	(0.43)	(0.14)	(0.17)	(0.02)
				Short-Run Dynamics					
EC	-0.83***	-0.86**	-0.83***	-0.40***	-0.66***	-0.40***	-0.67***	-0.45	0.59***
	(0.00)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.54)	(0.00)
ΔLnREER-1	0.38	0.97	1.00	-0.48	-0.29	-0.05	1.00	3.97	0.56
	(0.73)	(0.50)	(0.67)	(0.49)	(0.82)	(0.85)	(0.36)	(0.20)	(0.42)
ΔLnYd-1	0.06	-2.74	0.28	-1.53	-0.95	-0.46	1.05	-5.851**	-2.52
	(0.97)	(0.50)	(0.640)	(0.49)	(0.74)	(0.55)	(0.81)	(0.03)	(0.16)
ΔLnYf-1	-0.391	-0.52	0.19	7.03**	7.01**	4.96**	-2.37	-1.91	-3.81
	(0.91)	(0.81)	(0.90)	(0.04)	(0.04)	(0.01)	(0.76)	(0.69)	(0.42)
Cons	36.20***	411.5	46.87***	-1.20**	183.2	-0.39	-10.43**	355.80*	23.32
	(0.00)	(0.27)	(0.00)	(0.02)	(0.27)	(0.96)	(0.015)	(0.08)	(0.23)
H.T.	1.34(0.72)		5.41(0.14)	3.60(0.31)		0.69(0.95)	1.42(0.70)		1.41(0.70)
Obs.		166			173			166	
N		10			10			10	

P-values in parentheses; ***, **, * denote 1 percent, 5 percent, and 10 percent level of significance.
Source: Extracted by the author from Regression Output put using E-views version 9, 2016.
H.T. refers Hausman Test

The results obtained from MG estimator shows that except for the coefficient of domestic income for mining trade balance, all coefficients are insignificant even at 10% level of significance. Hausman test confirmed the efficiency and consistency of PMG estimator over MG estimator in all three sectors, therefore, we emphasized on the interpretation of PMG estimator results. In Table 4.8, PMG estimator shows that the effect of real effective exchange rate and domestic income on each sector is positive after foreign exchange

liberalization. However, for the period 1970-2013, agriculture sector trade balance has been worsening because of foreign exchange devaluation. This finding shows that foreign exchange reform is a very important policy action for agriculture trade competitiveness in this region.

The effect of Accession to WTO on Sectoral Trade Balance

Table 4.8: Robustness Check IV: The effect of accession to WTO on sectoral trade balance

	PMG	MG	DFE	PMG	MG	DFE	PMG	MG	DFE
		Δln(Xa/Ma)			Δln(Mm/Xm)			Δln(Mmi/Xmi)	
LR									
LnREER	0.58***	1.50	0.08	1.41***	0.73	0.05	1.46***	0.63	1.57**
	(0.00)	(0.33)	(0.64)	(0.00)	(0.45)	(0.91)	(0.0)	(0.63)	(0.02)
LnYd	-0.52**	-2.90	0.65**	2.88***	1.02	1.04	3.04***	9.64*	2.87***
	(0.02)	(0.28)	(0.01)	(0.00)	(0.55)	(0.11)	(0.00)	(0.09)	(0.00)
LnYf	0.23	7.27	-2.39***	-3.88***	-1.54	-0.89	-3.23**	-11.40	-3.89**
	(0.50)	(0.37)	(0.00)	(0.00)	(0.69)	(0.42)	(0.02)	(0.24)	(0.04)
DW	0.28***	0.03	0.00	0.04	-0.10	-0.30	1.64*	0.46	0.88
	(0.00)	(0.65)	(0.10)	(0.96)	(0.14)	(0.54)	(0.06)	(0.17)	(0.27)
SR									
EC	-0.81**	-0.88	-0.81***	-0.4**	-0.75***	-0.38***	-0.66***	-0.01	-0.59***
	(0.02)	(0.11)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.99)	(0.00)
ΔLnREER	0.59	0.90	0.12	-0.44	-1.301*	0.029	0.76	5.03	0.07
-1	(0.66)	(0.61)	(0.61)	(0.64)	(0.06)	(0.92)	(0.26)	(0.22)	(0.92)
ΔLnYd-1	0.02	-3.40	0.12	-2.87	-2.43	-0.74	0.06	-7.88***	-0.79
	(0.99)	(0.49)	(0.85)	(0.38)	(0.47)	(0.37)	(0.98)	(0.009)	(0.70)
ΔLnYf-1	-3.60	-1.39	0.22	7.59*	7.79**	6.38***	-6.80	-5.94	-7.07
	(0.37)	(0.60)	(0.90)	(0.07)	(0.05)	(0.00)	(0.39)	(0.23)	(0.18)
DW	0.14	0.11	0.20**	0.13	0.23	0.05	0.04	0.01	0.24
	(0.16)	(0.51)	(0.04)	(0.58)	(0.277)	(0.667)	(0.58)	(0.93)	(0.345)
Cons	2.78**	461.40	43.58***	12.91**	4.752	-0.572	6.89***	222.6	20.05
	(0.01)	(0.28)	(0.00)	(0.01)	(0.95)	(0.94)	(0.00)	(0.21)	(0.30)
HT	4.27(0.37)		0.00(1.00)	0.69(0.95)		0.14(1.00)	0.12(1.00)		0.34(0.99)
Obs.		144			150			149	
N.		8			8			8	

P-values in parentheses; ***, **, * denote 1 percent, 5 percent, and 10 percent level of significance.
Source: Extracted by the author from Regression Output put using E-views version 9, 2016.

As reported in Table 4.8, the effect of membership to WTO improves trade balance in each sector, but it is found statistically insignificant. Among sampled countries, Ethiopia is not a member of this organization while Seychelles has joined recently in 2015.

4.6. Summary and Conclusion

The objective of this essay in this chapter is to examine and compare the effect of exchange rate on trade balance of agriculture, manufacturing and mining sectors for ten East African countries using annual panel data over the period 1980-2013. Three econometrics procedures were followed to achieve expected objectives. In the first procedure stationarity test was conducted applying standard procedures of panel unit root tests and all tests confirmed the existence of frictional integration of variables in all three sectors at I(0) and I(1). The second procedure is testing cointegration between all variables by using seven Pedroni cointegration tests, and the results indicated that a majority of the tests rejected the null hypothesis of no cointegration in all three sectors. Finally, long run, short run, and error coefficients were estimated by applying PMG and MG estimators.

Hausman test was used to test whether there is a significant difference between the PMG and MG; PMG estimator was found efficient and consistent model than MG under Null Hypothesis for all three sectors. PMG estimator results showed that in the response of devaluation of real effective exchange rate trade balance of all three sectors deteriorates in the short-run even though the response is statistically insignificant except agriculture sector.

Despite exhibiting a similar pattern of reaction to the devaluation of real exchange in the short-run, the long-run response of trade balance differs across sectors. The long-run real effective exchange rate has a positive effect on trade balances of manufacturing sector and mining sector while agriculture sector trade balance worsens because of the devaluation of the domestic real effective exchange rate. However, after foreign exchange regime liberalization, all sectors show a similar pattern and elasticity slightly increases. In the short

run, devaluation worsens trade balance in each sector, this confirmed the existence of J-curve pattern relationship between real exchange rate and sectoral trade balance.

In the long run, both domestic and trade partners foreign real income were found supply driven and improves and worsens all sectors trade balance respectively in East African countries. In the short run, foreign income has a positive effect on trade balance for each sector but it is statistically significant only for manufacturing trade balance. Domestic real GDP improves trade balance for both agriculture and mining trade balances, in contrast, it worsens manufacturing trade balance, but all variables found statistically insignificant.

In all three sectors, error correction model was found negative and statistically significant. This finding shows that in the long-run all three sectors disequilibrium can be adjusted towards equilibrium. The speed of adjustment is highest in the agriculture sector and lowest in the manufacturing sector.

Chapter 5: Summary, Conclusion and Policy Implications

5.1. Summary and Conclusion

This dissertation has investigated the short run and long run effects of real effective foreign exchange rate on aggregate and sectoral trade balance for Burundi, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Tanzania, and Uganda by using dynamic time series model. The empirical studies on this topic for Eastern African countries are very limited and have inconclusive results. Moreover, it has questioned the applicability of cross-country regression, static empirical analysis, the absence of disaggregated studies and using vector error correction methods for small size observations, suggesting that these cannot be extrapolated to individual East African countries for policy prescriptions. Thus, this dissertation contributes to the literature on the effect of real exchange rate on aggregate trade balance by resolving some of the issues by applying the autoregressive distributed lag method framework to analyze the effect of real exchange rate on trade balance for sampled ten countries. The strength of this approach lies in the fact that it can distinguish between long run and short run dynamic effects and analyzing the effects on a sectoral basis. These have important implications for forecasting the effect of real effective exchange rate on the trade balance.

East African countries continue to make progress towards liberalizing their external environment by the progressive liberalizing their exchange rate regimes, lowering of their average tariffs and reducing and avoiding export taxes. Despite high devaluation in terms of nominal value, the translation of nominal devaluation to real devaluation is low. Inability to turn nominal devaluation to real currency devaluation may appear to be one reason why these countries trade balance has been worsening so significantly. As discussed in descriptive part in Chapter two, the extreme variability of openness is quite evident. The very interesting scenario is openness in all countries of the region has been increasing from year to year. Average trade openness in the region rose from 25 percent before foreign exchange regime liberalization to 36 percent after liberalization and Seychelles has

experienced the highest share of trade in GDP (118 percent) after liberalization while landlocked Ethiopia has shown the lowest share of trade in GDP (6 percent) after liberalization. Trade openness increased in six countries out of ten sampled countries in the region. On average, the trade balance has been deteriorated from 59 percent before ten years of foreign exchange liberalization to 55 percent after ten years of foreign exchange regime liberalization.

The empirical essay in Chapter three attempted to examine the short run and long run effects of exchange rate on trade balance for ten East African countries. This essay assumed that countries' heterogeneity in terms of macroeconomic conditions, economic structure, institutional framework matters, and need not be neglected. Most previous empirical studies on the effect of real exchange rate on aggregate trade balance have ignored the short run and long run dynamic effects of real exchange rate on the trade balance, hence failing to capture the full range of the potential consequences. The empirical analysis of the sampled countries presented in this dissertation confirmed this. The effect of real effective exchange rate on the aggregate trade balance is not the same in all countries at least in the magnitude of the effect. This is partly due to the fact that their economic structure, institutional framework, macroeconomic environment, forcing exchange rate policies, the extent of disequilibrium before devaluation. The study followed three econometric procedures. The first procedure is conducting the stationary test, and the test confirmed the existence of mixed integration of variables at the level, I (0) and at first difference, I (1). The second procedure is to test the null hypothesis of no cointegration among variables by using ARDL bound procedures. The computed F-statistic for all countries fall above upper bounds of the critical values at 5 percent and 10 percent except Kenya, Madagascar, and Malawi but the existence of cointegration between variables for these three countries was proved by applying the ECM version of the ARDL model. This indicates that there is a long-run relationship between the variables in all countries. The third procedure is estimating long run, short run and error correction term coefficients by using autoregressive distributed lags model. Individual country ARDL model estimation result has shown that real effective exchange rate is a positive determinant of the trade balance in seven out of ten countries, suggesting that a

depreciation of real effective exchange rate would improve trade balance but it is not statistically significant for Seychelles and Tanzania. In contrast, real effective exchange rate devaluation worsens trade balance in Burundi, Malawi, and Uganda. In Burundi, Madagascar, Mauritius, and Uganda, own real GDP carries a negative sign and statistically significant, implying that an increase in own real income causes domestic consumers to demand more of foreign goods causing the ratio of exports to imports to decline. This leads to worsening of trade balance. In contrast, own real GDP carries a positive sign and statistically significant for Kenya and Rwanda; implying an increase in domestic real GDP improves trade balance in the long-run. In the short run, an increase in domestic real GDP leads to worse trade balance and statistically significant for Kenya, Tanzania and Uganda while in Rwanda, an increase in domestic trade balance leads to increase in the trade balance. Top ten trade partners' real GDP affects trade balance favorably and significantly only in Mauritius, Seychelles and Malawi. In contrast, top ten trade partners' real GDP carries a negative sign and statistically significant in Burundi, Ethiopia, and Kenya, indicating that top ten trade partners' real GDP worsens trade balance in the long run. In the short run, an increase in foreign GDP improves trade balance for Burundi, Madagascar, and Rwanda while it worsens trade balance in Mauritius. Panel ARDL result has indicated that the real effective exchange rate has a positive effect on the trade balance, but it is less elastic as compared to the USA. However, this elasticity slightly increases after foreign exchange regime liberalization. Similarly, real GDP has a positive effect on aggregate trade balance while top partners' real GDP has a negative effect on the aggregate trade balance in the long run. The exports to imports ratio elasticity with respect to the real effective exchange rate is less than the elasticity of exports to imports ratio respect to both own real GDP and trade partners' GDP. This has a policy implication. In the short run, foreign income has relatively elastic and has a positive effect on exports to imports ratio, implying an increase in foreign real GDP improves the aggregate trade balance, but domestic real GDP is statistically insignificant. The error correction term or the speed of adjustment is varied among the sampled countries. This might be because of difference in openness, commercial policies, and exchange rate policies and importantly based on the extent of their exchange rate

disequilibrium before devaluation. The speed of adjustment is very high in agriculture sector but low in the manufacturing sector. Low speed of adjustment in the manufacturing sector will indicate low competitiveness of this sector as compared to other two sectors.

The empirical analysis in Chapter four examined and compared the effect of exchange rates on trade balance of agriculture, manufacturing and mining sectors for ten sampled East African countries using annual panel data over the period 1980-2013. In this essay, ARDL panel analysis was conducted to analyze the effect of real effective exchange rate on three sectors trade balances. Panel cointegration tests confirmed the existence of a long-run among variables in all three sectors. To estimate long run, short run and error coefficients PMG estimator was found efficient and consistent by using Hausman test. PMG estimator estimation result has shown that in the response to the devaluation of the real effective exchange rate, the trade balances of all three sectors deteriorate in the short run. In long-run, real effective exchange rate has a positive effect on manufacturing sector and mining sector trade balances, while agriculture sector trade balance worsens as a result of the devaluation of the domestic real effective exchange rate. After foreign exchange liberalization, the effect of real exchange rate on the trade balance is reversed. Unlike aggregate trade balance and foreign exchange relationship, we confirmed the existence J-curve hypothesis relationship between real exchange rate and trade balance in each sector. As real exchange rate value of domestic currency declines, the trade balance of each sector deteriorates at the beginning then starts to improve after a long time. Both domestic and trade partners foreign real income were found supply driven and improve and worsen all sectors trade balances respectively in East African countries in the long run. While in the short run, both foreign income and domestic income has a positive effect on each sector trade balance except manufacturing sector. However, it is statistically insignificant in all sectors except manufacturing sector. In all three sectors, error correction coefficient was found negative and statistically significant; this shows that in the long run all three sectors disequilibrium adjusted towards equilibrium. The speed of adjustment is highest in the agriculture sector and lowest in the manufacturing sector.

5.2. Policy Implications

Based on the empirical investigation results, important policy implications are derived. The elasticity of real effective exchange rate carries a correct sign and statistically significant in panel data analysis, implying the importance of foreign exchange rate policy in improving the region's trade competitiveness. The foreign exchange elasticity is inelastic, but the post foreign exchange liberalization price elasticity is slightly higher than pre-foreign exchange rate liberalization. This result suggests that East African countries need to reduce barriers that make devaluation as policy instrument ineffective. For example, further floating of the exchange regimes are suggested since the liberalization of the exchange rate regimes is not yet completed in this region. In addition, policies aimed at improving trade balance on the country should focus on internal supply side policies that give a conducive environment for the production of exportable goods and import substitute goods. Entirely depending on the external policy (devaluation) only may not bring expected trade balance improvement in the region since countries in this region are price takers on the international market, and would thus not able to influence the external demand sufficiently for their merchandise exports through price incentives that arise from devaluation. However, real effective exchange rate change remains the most important instrument to improve trade balance for many of East African countries.

Finally, after liberalization depreciation has a positive impact on all sectoral trade balances in the long run even though generally a depreciation of the domestic currency has low elasticity in agriculture sector than other sectors. The policy implication based on this result is that extent of exports to imports ratio elasticity is different in each sector. This indicates that East African countries are suggested practicing the systematic type of devaluation supplemented with policy packages that make agriculture sector more responsive to the real effective exchange rate.

5.3. Limitations and Future Study

No one study can be exhaustive, and this is true for this empirical study presented in this dissertation. Several questions and issues have been left unanswered, and these needs further exploration. What is the long-run effect of real effective exchange rate on sectoral trade balance for each East African countries? Why the magnitude and sign of price elasticity among countries in this region varies? is there a difference on the dynamics effect of real effective exchange on sectoral trade balance before and after foreign exchange liberalization for each country in this region? which commodity is mostly affected by devaluation? These are the likely drawbacks of this work, and future works are suggested to divide the sample observed into periods of pegged exchange rate and floating exchange for each country to each sector in order to properly sieve the effects of real effective exchange rate on both aggregated and disaggregated trade balance. In addition, further study is required to address the foreign exchange rate dynamic effect on individual commodity level for each country in the region. Future work with existed few studies together with my work may help policy makers to address the controversy on the use of foreign exchange rate as one of policy instrument to solve ever worsening trade deficit problems in this region.

6 . Appendex

Appendix 1

Table 6.1: Trade Openness

Year	Bur	Eth	Keny	Rwan	Seych	Mad	Tanz	Mal	Uga	Maur
1970	7.69	1.79	18.47	6.41	5.54	9.67	5.97	20.10	15.89	6.32
1971	8.91	1.83	17.68	6.53	6.72	10.66	6.52	19.55	19.44	6.58
1972	10.10	1.99	15.45	6.34	8.67	11.11	6.85	21.41	12.75	9.42
1973	11.45	2.47	17.87	7.61	9.61	12.46	7.90	23.86	11.26	11.82
1974	14.56	3.01	25.53	10.64	11.81	15.81	10.31	28.83	11.66	21.55
1975	18.31	3.17	24.11	16.10	12.31	19.60	9.68	34.71	9.87	20.21
1976	23.48	3.63	26.76	17.05	13.30	17.18	8.53	31.27	8.52	19.82
1977	21.55	4.26	34.41	19.50	16.84	20.51	9.86	34.80	10.22	19.62
1978	33.27	5.10	35.53	23.16	17.85	24.67	12.62	38.18	11.92	20.07
1979	29.78	5.49	32.94	25.52	22.57	29.00	12.07	44.15	29.54	22.40
1980	29.84	6.07	38.56	26.95	26.45	27.82	12.94	51.10	51.27	23.77
1981	33.87	5.77	33.93	26.08	26.56	26.53	12.82	47.19	43.99	22.54
1982	29.78	6.03	28.99	24.88	27.51	22.83	11.55	38.90	33.37	19.77
1983	31.80	6.29	23.62	23.73	26.78	21.24	8.79	37.32	33.46	18.24
1984	32.70	6.63	26.8	27.32	26.79	21.32	6.97	38.37	20.54	18.95
1985	34.83	6.57	24.18	26.62	27.08	20.41	7.55	33.85	9.30	20.77
1986	28.62	7.53	26.51	31.56	26.40	19.72	8.82	31.69	18.93	27.29
1987	30.33	8.11	24.01	27.37	27.74	18.70	7.89	35.39	18.62	34.60
1988	22.68	6.24	25.59	26.86	36.99	18.59	6.83	42.43	17.93	37.96
1989	25.84	6.19	25.01	24.01	34.65	18.84	8.10	45.79	13.21	35.91
1990	28.27	6.04	25	22.79	39.73	25.59	9.70	55.54	10.22	41.80
1991	22.90	3.13	23.04	23.57	35.11	20.84	10.23	60.34	11.91	38.18
1992	19.86	4.32	24.27	19.65	35.40	20.18	10.08	62.87	22.69	39.00
1993	28.37	4.46	23.95	24.14	40.32	19.85	9.78	43.86	24.58	37.81
1994	29.03	6.22	27.25	18.26	36.30	22.67	9.87	47.03	32.16	39.13
1995	15.49	6.55	34.56	26.14	40.49	24.44	11.09	42.53	26.35	40.26
1996	20.97	5.75	34.19	25.40	69.92	25.63	9.78	49.73	29.42	44.89
1997	22.77	5.96	36.17	27.01	54.67	23.04	9.09	57.20	29.85	39.46
1998	16.87	7.51	34.19	22.30	56.33	30.10	8.56	39.53	29.02	36.67
1999	19.56	6.49	29.39	18.81	63.22	30.85	8.40	45.65	30.99	35.67
2000	17.73	5.81	30.84	14.76	57.64	40.44	8.34	36.38	32.27	36.41
2001	15.59	6.92	31.58	17.06	76.44	42.85	8.96	43.56	35.11	30.27
2002	18.17	6.16	32.78	14.10	70.66	26.69	8.60	45.21	24.83	32.10
2003	21.13	9.93	36.45	14.24	79.11	47.20	10.22	51.09	30.58	33.96
2004	32.69	9.52	40.9	15.83	93.61	55.46	12.23	52.84	31.39	35.87
2005	43.77	12.22	50.39	21.51	110.65	50.64	13.46	60.68	34.01	38.21
2006	32.40	13.98	53.95	24.66	113.01	51.48	15.20	62.30	37.66	42.23
2007	36.95	13.99	61.31	30.12	110.08	66.88	17.45	67.86	44.71	41.46
2008	35.82	17.54	75.1	41.61	136.85	91.33	21.53	91.85	50.82	44.96
2009	45.46	15.04	66.46	39.60	112.76	73.70	18.04	85.29	42.67	34.35
2010	62.81	15.72	71.97	43.02	122.29	62.32	21.82	84.97	41.51	38.98
2011	60.90	16.62	80.88	53.99	125.02	65.81	27.60	94.60	37.49	43.45
2012	60.36	20.11	84.5	54.72	124.65	61.44	28.43	85.39	34.11	43.29
2013	56.56	16.46	79.2	67.09	126.36	82.99	28.05	93.14	31.47	43.31
Ave	28.27	7.61	36.688	24.65	53.25	32.93	11.80	49.05	26.31	30.67

Table 6.2: Merchandise exports to Imports Ratio

Year	*Buru*	*Ethiop*	*Kenya*	*Rwan*	*Sey*	*Mad*	*Tanz*	*Mala*	*Ugan*	*Maur*	**Avr.**
1970	62.07	71.29	68.98	85.26	21.28	84.95	79.03	60.18	16.38	91.31	64.07
1971	82.31	66.98	56.11	67.51	12.10	68.85	70.18	66.05	10.42	78.78	57.93
1972	95.36	88.18	67.16	56.39	12.53	80.93	80.22	61.94	17.45	89.06	64.92
1973	71.86	111.55	77.03	99.27	14.56	99.76	73.95	69.65	17.89	81.13	71.67
1974	51.88	94.92	58.76	62.42	25.90	86.86	53.54	64.18	14.78	101.07	61.43
1975	104.59	76.84	64.15	42.04	20.00	80.31	47.90	55.47	12.40	89.81	59.35
1976	120.91	79.58	81.47	75.63	22.14	96.43	68.87	80.32	21.13	73.56	72.00
1977	70.59	89.04	92.01	74.88	24.24	97.10	68.12	85.11	24.35	69.27	69.47
1978	68.22	59.30	59.78	38.04	26.22	80.84	41.62	54.76	13.71	64.96	50.75
1979	38.92	74.40	66.61	61.51	25.89	61.56	45.01	58.33	221.23	66.44	71.99
1980	46.46	58.87	58.61	45.97	21.41	66.96	40.66	67.27	17.61	70.79	59.46
1981	41.23	52.74	58.71	42.57	18.30	58.22	48.28	78.78	70.44	58.94	52.82
1982	44.03	51.52	62.32	37.28	15.49	74.62	39.64	78.42	92.51	78.88	57.47
1983	54.96	45.94	65.17	44.83	23.10	76.86	46.42	73.46	98.64	82.84	61.22
1984	60.31	44.26	73.12	52.02	29.28	90.80	44.84	116.2	115.85	79.06	70.58
1985	76.24	34.17	66.68	44.05	28.09	68.21	29.19	83.51	0.00	83.25	51.34
1986	42.41	42.19	74.36	54.20	17.33	88.87	38.52	95.12	141.86	98.77	69.36
1987	65.01	33.66	55.27	32.05	19.49	111.47	31.15	93.63	37.66	86.91	56.63
1988	41.73	38.81	53.68	29.32	20.01	73.36	33.47	68.65	31.62	77.28	46.79
1989	32.44	47.41	43.75	28.67	20.75	86.50	36.84	52.65	64.60	74.42	48.80
1990	35.56	27.56	46.43	38.02	30.51	49.02	24.27	72.45	52.97	73.78	45.06
1991	32.94	39.98	57.24	30.37	28.40	70.02	22.14	66.75	101.82	76.62	52.63
1992	31.59	29.65	72.74	22.99	25.03	62.11	27.58	53.88	28.37	80.18	43.41
1993	53.82	26.15	77.47	19.68	21.44	55.60	30.06	58.61	29.16	75.71	44.77
1994	45.11	36.16	75.91	23.67	25.16	88.73	34.51	69.62	46.73	69.78	51.54
1995	31.39	36.95	62.81	21.83	22.87	67.94	40.72	85.37	43.63	77.83	49.13
1996	71.28	39.19	70.11	23.54	36.85	87.29	56.49	77.09	49.28	78.72	58.98
1997	40.97	49.61	62.64	29.23	33.28	82.85	56.31	68.71	42.14	72.74	53.85
1998	46.01	38.40	62.81	21.05	31.84	78.10	40.56	83.68	35.53	79.38	51.74
1999	33.82	32.25	61.68	23.93	33.43	78.71	34.89	67.22	38.69	70.67	47.53
2000	27.64	38.18	55.92	24.86	56.32	82.65	43.53	71.25	29.92	82.00	51.23
2001	23.34	23.84	60.90	33.98	45.27	83.02	45.27	79.03	28.65	81.94	50.53
2002	24.06	28.38	65.22	26.42	54.01	77.55	54.35	58.62	45.70	83.43	51.77
2003	26.62	19.38	64.73	24.46	66.26	65.62	53.15	66.27	40.98	80.31	50.78
2004	35.50	21.38	58.95	34.54	58.55	59.02	54.05	51.81	43.74	71.93	48.95
2005	13.56	22.70	53.57	28.99	50.34	49.99	50.97	43.63	49.59	67.74	43.11
2006	19.56	19.68	47.01	26.88	50.16	56.72	40.88	44.87	46.47	64.21	41.64
2007	13.44	22.06	45.39	23.98	41.92	55.61	37.89	51.39	57.18	57.48	40.63
2008	15.42	18.81	44.90	23.56	40.86	43.87	37.76	39.03	59.93	51.25	37.54
2009	19.73	19.63	43.73	15.70	49.84	34.68	37.59	53.42	70.38	51.93	39.66
2010	16.20	26.17	42.66	18.21	40.47	42.33	45.64	52.27	66.13	51.57	40.16
2011	17.57	40.62	38.93	26.14	46.05	47.79	41.04	57.65	52.52	49.82	41.81
2012	12.23	32.02	37.61	23.50	46.24	49.73	45.05	50.68	54.68	49.48	40.12
2013	16.09	25.00	35.80	27.82	52.66	60.94	41.22	42.23	57.78	53.19	41.27
Aver	44.89	44.90	60.20	38.35	31.95	71.89	45.76	66.57	52.56	73.82	53.09

Source: Author's calculation based on WTO data, 2015.

Table 6.3: Sectoral Export Share in percentage

	Bur			*Ethio*			*Ken*					*Madag*		*Mala*	
Year	agri	ma	mi	agr	ma	mi	agr	man	mi	agr	man	min	Agr	man	mi
1995	NA	NA	N	NA	NA	N	63	28	9	58	34	8	91	9	0
1996	NA	NA	N	NA	NA	N	64	26	10	43	44	13	89	11	0
1997	NA	NA	N	NA	NA	N	63	25	12	37	58	6	86	13	1
1998	NA	NA	N	NA	NA	N	65	24	11	25	69	6	89	11	0
1999	91	5	4	92	7	2	66	22	11	20	77	3	18	80	2
2000	92	7	1	89	10	1	68	21	11	37	58	5	90	9	0
2001	76	11	13	84	14	2	63	20	16	49	49	2	88	12	0
2002	90	8	2	84	14	2	60	17	23	54	40	5	88	12	0
2003	90	9	1	87	12	1	54	24	22	51	43	6	88	12	0
2004	89	8	3	95	4	1	52	21	27	39	55	6	84	15	1
2005	85	8	7	94	5	1	48	32	20	35	56	9	84	16	0
2006	90	5	5	93	6	1	55	36	10	38	50	12	87	13	0
2007	86	4	10	83	14	3	55	37	7	34	58	8	89	10	0
2008	71	4	15	90	9	1	55	38	7	29	60	11	90	10	0
2009	83	4	13	89	10	1	57	37	6	32	60	8	91	9	1
2010	81	5	14	88	11	1	59	35	6	27	59	14	80	9	11
2011	79	5	16	88	10	2	56	37	7	35	49	16	82	9	9
2012	72	3	15	90	9	1	55	38	7	35	39	26	82	9	9
2013	80	3	17	89	9	2	56	39	6	30	34	36	81	8	11
Av	84	6	10	89	10	1	59	29	12	37	52	10	83	15	3
	Maur			Rwa			Sey			Tanz			Uganda		
Year	agr	ma	mi	agr	man	mi	agr	man	Mi	agr	ma	mi	agri	ma	min
1995	NA	NA	N	NA	NA	N	45	8	47	NA	N	N	94	5	1
1996	32	68	0	76	11	13	30	48	22	NA	N	N	85	15	0
1997	29	71	0	89	2	8	62	3	35	0	94	6	88	10	2
1998	28	72	0	85	6	10	75	3	22	79	19	2	91	5	4
1999	25	75	0	85	4	12	76	2	22	81	18	1	96	3	1
2000	19	81	0	Na	NA	N	64	4	32	83	16	1	81	6	13
2001	26	74	0	40	6	54	94	6	0	75	16	9	84	7	9
2002	27	73	0	11	40	50	76	3	21	71	16	14	84	8	8
2003	26	74	0	61	10	30	77	3	20	72	17	11	91	9	0
2004	29	71	0	57	6	37	63	7	30	61	23	16	78	15	7
2005	29	70	1	34	14	53	57	6	36	64	19	16	76	17	7
2006	30	69	1	57	8	35	53	4	42	60	23	16	71	21	7
2007	32	67	1	39	13	48	55	2	43	52	30	18	65	29	6
2008	33	66	1	39	8	53	58	3	39	43	35	22	60	35	6
2009	35	64	1	48	21	31	58	3	39	50	24	25	57	33	9
2010	38	61	1	53	9	38	58	3	39	34	29	37	61	32	7
2011	35	64	1	41	14	45	58	3	39	39	25	36	62	32	7
2012	37	62	1	48	14	38	58	3	39	37	31	32	56	36	8
2013	40	59	1	43	12	45	58	3	39	56	26	18	61	32	7
Av.	30	69	1	53	12	35	62	6	32	56	27	17	76	18	6

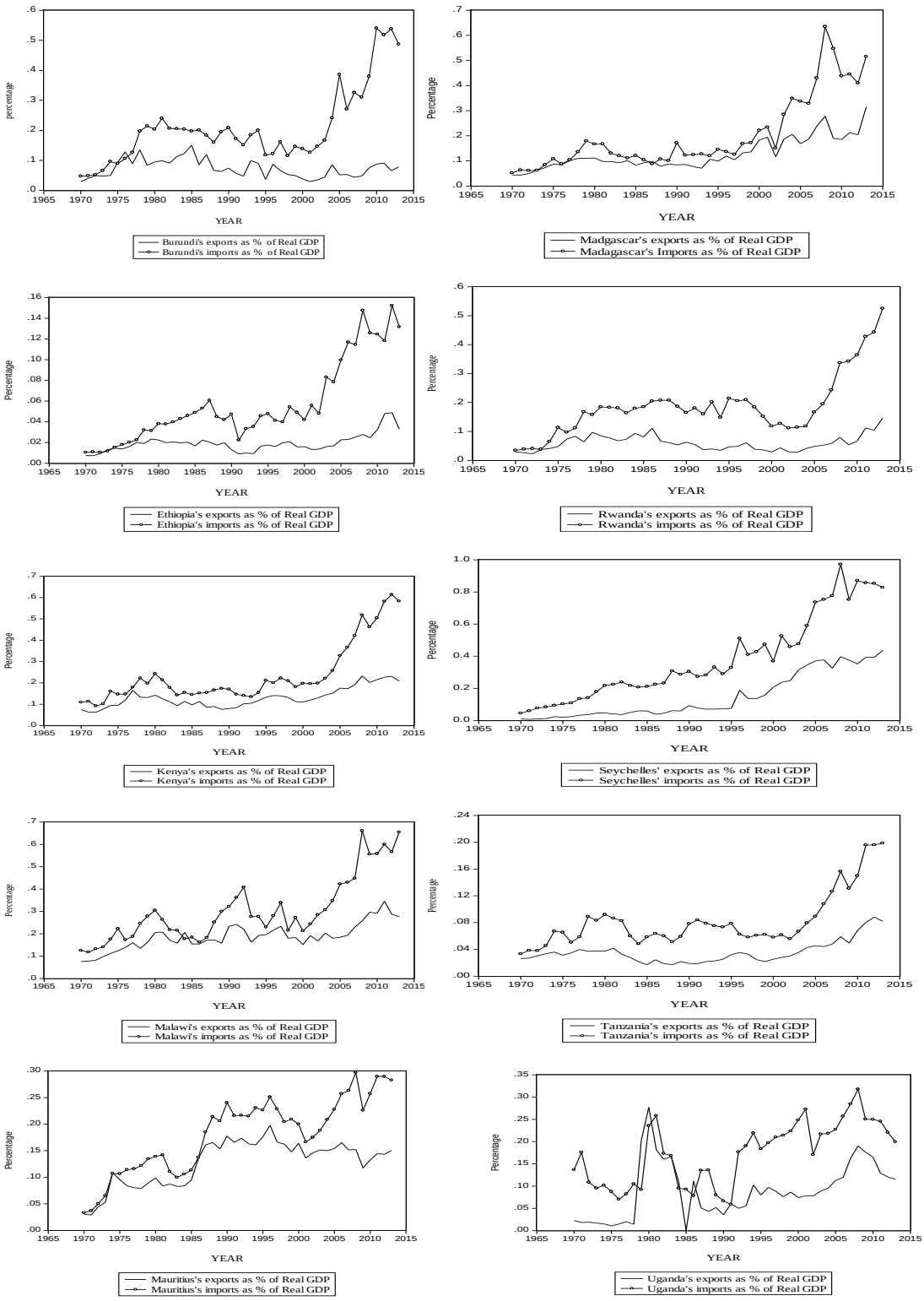
Source: Author's calculation based on WTO data, 2015.

Table 6.4: Sectoral Imports Share in percentage

	Burundi		Ethiop				Ken			Mad			Ma		
Year	agr	ma	mi	agri	ma	mi	ag	ma	mi	ıgr	ma	mi	agr	ma	mi
1995	NA	NA	NA	NA	N	NA	12	71	17	16	71	13	17	71	12
1996	N	N	NA	N	N	N	14	68	18	12	61	27	16	72	12
1997	NA	NA	NA	NA	N	NA	19	63	18	14	68	18	16	72	12
1998	N	N	NA	N	N	N	18	63	20	12	72	15	18	68	13
1999	76	4	20	11	77	12	15	68	18	10	74	17	18	70	12
2000	79	2	19	8	71	21	16	60	24	14	63	23	11	72	16
2001	80	3	17	16	65	19	16	62	22	15	62	23	13	69	17
2002	81	2	17	12	74	14	15	67	18	16	48	35	25	63	12
2003	75	1	24	22	64	13	14	61	25	19	65	17	19	69	12
2004	79	1	19	13	71	16	13	59	28	15	71	14	18	69	13
2005	89	1	10	12	72	16	11	64	24	16	67	17	19	69	12
2006	87	6	7	10	69	21	11	63	26	16	65	19	16	71	12
2007	89	1	10	8	77	15	13	63	24	16	67	17	12	74	15
2008	95	1	4	16	63	21	13	58	29	11	75	14	13	77	10
2009	96	1	3	12	74	14	17	60	23	11	78	11	14	74	11
2010	96	1	3	11	69	20	14	62	24	15	70	16	15	74	11
2011	96	1	3	15	65	19	15	56	29	19	57	24	14	74	12
2012	96	1	3	11	67	22	14	60	27	18	57	25	14	74	12
2013	75	1	25	11	71	18	13	62	25	17	54	29	13	72	16
Av	86	2	12	13	70	17	14	63	23	15	66	20	16	71	13
	Maur		Rwan				Sey			Tanz			Uga		
Year	agr	ma	mi	agr	ma	mi	a	ma	mi	agr	ma	mi	agr	ma	mi
1995	20	72	8	NA	NA	NA	25	55	20	11	84	4	18	78	4
1996	20	71	9	21	64	14	19	68	12	19	72	9	17	69	14
1997	18	74	9	22	64	15	27	57	15	19	66	15	18	68	13
1998	18	74	8	29	55	16	25	65	10	25	63	11	20	67	13
1999	16	76	8	24	57	18	23	66	11	18	73	9	16	69	14
2000	17	70	13	NA	NA	NA	14	58	28	17	63	20	16	65	19
2001	18	69	12	24	60	16	26	74	1	17	69	14	15	67	18
2002	21	67	12	20	61	18	31	53	15	16	71	13	17	65	18
2003	20	68	12	16	66	18	33	50	17	15	65	20	18	67	15
2004	20	66	14	22	60	19	29	44	27	17	66	18	18	68	14
2005	19	64	17	15	70	14	24	51	25	11	66	23	17	65	18
2006	19	63	18	17	70	13	27	44	29	14	59	27	15	63	22
2007	22	59	20	17	73	9	24	50	26	14	51	35	14	65	21
2008	24	54	23	15	76	9	24	60	16	10	55	35	14	66	20
2009	24	59	17	15	76	9	24	60	16	10	66	24	13	68	19
2010	23	56	20	12	78	9	24	60	16	11	60	29	14	65	21
2011	24	53	23	19	72	10	24	60	16	11	54	34	15	61	25
2012	25	51	24	20	73	8	24	60	16	10	55	35	12	63	25
2013	24	53	23	15	78	7	24	60	16	9	50	41	13	62	25
Av.	21	64	15	19	68	13	25	58	18	14	64	22	16	66	18

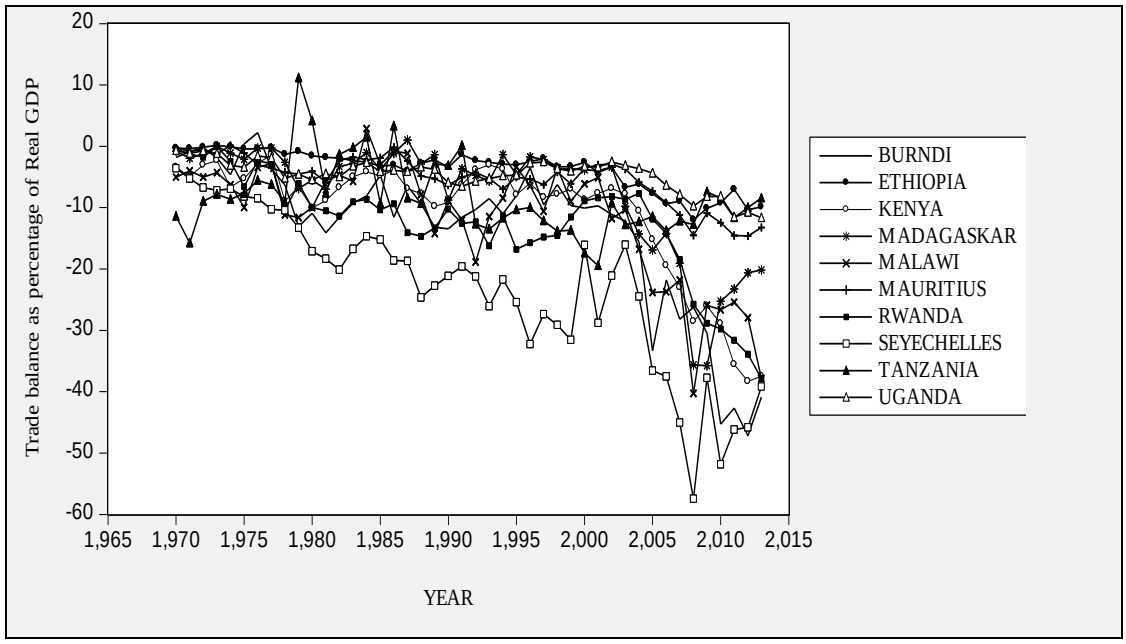
Source: Author's calculation based on WTO data, 2015.

Figure 6.1: Merchandise Exports and Imports as percentage of GDP



Source: Author's calculation based IMF Data, 2015.

Figure 6.2: Trend of percent of Trade Balance to RGDP



Source: Authors calculation based on IMF Data, 2015.

Appendix 2

Table 6.5: Optimum Lag Length

Country	*Lag*	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
Burundi	0	29.74258	NA	3.45E-06	-1.22584	-1.06035	-1.16518
	1	234.1335	360.1174	4.40E-10	-10.1968	-9.369373*	-9.893538*
	2	251.5884	27.42905*	4.20e-10*	-10.26611*	-8.77668	-9.72018
Ethiopia	0	-7.89113	NA	2.07E-05	0.566244	0.731737	0.626904
	1	220.6135	402.6034*	8.38e-10*	-9.553024*	-8.725563*	-9.249727*
	2	235.0438	22.67622	9.24E-10	-9.47828	-7.98885	-8.93234
Kenya	0	77.6707	NA	3.52E-07	-3.50813	-3.34264	-3.44747
	1	310.2806	409.8366*	1.17e-11*	-13.82289*	-12.99543*	-13.51959*
	2	324.6092	22.51636	1.30E-11	-13.7433	-12.2539	-13.1974
Mad	0	64.85955	NA	3.98E-08	-2.85046	-2.64359	-2.77463
	1	264.0259	341.4280*	1.00e-11*	-11.14409*	-9.902896*	-10.68914*
	2	277.5744	20.00025	1.83E-11	-10.5988	-8.32326	-9.76471
Mal	0	77.02047	NA	3.63E-07	-3.477165	-3.31167	-3.41651
	1	246.1496	297.9895*	2.48e-10*	-10.76903*	-9.941568*	-10.46573*
	2	253.0855	10.89918	3.91E-10	-10.3374	-8.84797	-9.79147
Mauri	0	108.0177	NA	8.30E-08	-4.95323	-4.78773	-4.89257
	1	316.4837	367.2972*	8.72e-12*	-14.11827*	-13.29081*	-13.81497*
	2	329.1449	19.89621	1.05E-11	-13.9593	-12.4699	-13.4134
Rwa	0	2.837223	NA	1.24E-05	0.05537	0.220863	0.11603
	1	224.933	391.3115*	6.82e-10*	-9.758712*	-8.931250*	-9.455415*
	2	234.2278	14.60616	9.60E-10	-9.43942	-7.94999	-8.89348
Sey	0	24.00351	NA	4.53E-06	-0.95255	-0.78706	-0.89189
	1	215.2117	336.8906*	1.08e-09*	-9.295796*	-8.468334*	-8.992498*
	2	224.3706	14.39248	1.54E-09	-8.97003	-7.4806	-8.42409
Tan	0	12.01482	NA	8.02E-06	-0.38166	-0.21617	-0.321
	1	274.8401	463.0731	6.34E-11	-12.1352	-11.30778*	-11.832
	2	296.086	33.38638*	5.05e-11*	-12.38505*	-10.8956	-11.83911*
Uga	0	-40.2154	NA	9.65E-05	2.105496	2.270989	2.166156
	1	221.0958	460.4054*	8.19e-10*	-9.575989*	-8.748528*	-9.272692*
	2	230.6417	15.00069	1.14E-09	-9.26865	-7.77922	-8.72272

Source: Extracted by author from Regression Output put using E-views version 9, 2015.
* indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5 percent level).

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

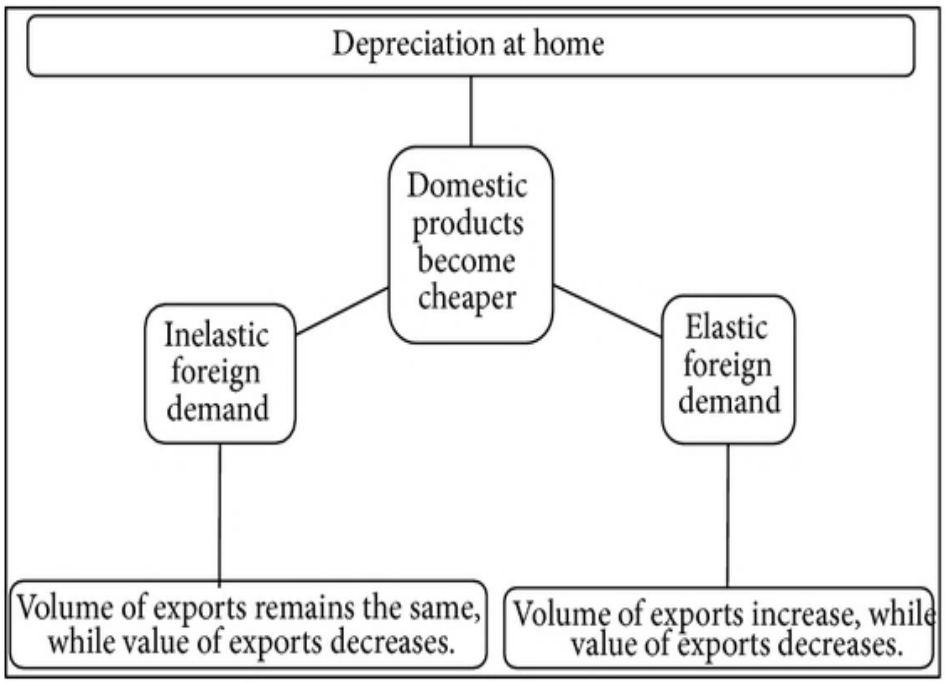
HQ: Hannan-Quinn information criterion

Table 6.6: Estimated Long-run Elasticity Using SBC lag length 2

Long-run		*ARDL*		*FMOLS*		*DOLS*	
country	Variable	Coeffi	Prob.	Coeffi	Prob.	Coeffi	Prob.
Burundi	LNREER	0.38	0.48	0.45**	0.04	0.39	0.32
	LNYd	0.06	0.94	0.51*	0.09	0.42	0.40
	LNYf	1.84*	0.09	0.74**	0.04	0.97	0.12
	C	-55.21***	0.00	-33.88***	0.00	-37.7***8	0.00
Ethiopia	LNREER	-0.56***	0.00	-0.59***	0.00	-0.57***	0.00
	LNYd	-0.03	0.88	-0.03	0.78	-0.03	0.85
	LNYf	0.92***	0.00	0.92***	0.00	0.91***	0.00
	C	-23.70***	0.00	-23.77***	0.00	-23.60***	0.00
Kenya	LNREER	-0.22	0.25	-0.39***	0.00	-0.49**	0.04
	LNYd	0.92*	0.10	0.37	0.35	0.69	0.12
	LNYf	-0.64	0.32	-0.17	0.72	-0.36	0.49
	C	-3.06	0.57	-2.10	0.57	-4.29	0.34
Madagascar	LNREER	-0.43	0.20	-0.10	0.64	-0.51*	0.08
	LNYd	0.31	0.69	1.23**	0.02	0.13	0.84
	LNYf	0.91	0.30	-0.07	0.89	1.16	0.14
	C	-29.96**	0.03	-25.76***	0.01	-32.45***	0.01
Malawi	LNREER	0.67	0.15	0.46***	0.01	0.58**	0.05
	LNYd	-0.14	0.91	-0.97*	0.09	-0.54	0.63
	LNYf	0.30	0.89	1.65*	0.10	0.95	0.62
	C	-7.59	0.83	-25.77*	0.10	-16.23	0.58
Mauritius	LNREER	-0.21	0.52	-0.30**	0.04	-0.40*	0.06
	LNYd	0.90**	0.05	1.09***	0.00	1.13***	0.00
	LNYf	-0.58	0.31	-0.81**	0.00	-0.78**	0.05
	C	-3.28	0.62	-0.67	0.82	-1.91	0.63
Rwanda	LNREER	-1.07***	0.00	-1.10**	0.00	-1.20	0.00
	LNYd	-0.10	0.46	-0.23**	0.03	-0.11	0.24
	LNYf	-0.32**	0.06	-0.09	0.48	-0.23*	0.08
	C	17.98***	0.00	14.75	0.00	16.46***	0.00
Seychelles	LNREER	-0.12	0.82	-0.35	0.27	-0.13	0.87
	LNYD	0.80	0.41	1.32**	0.03	1.87**	0.03
	LNYd	-2.63	0.15	-3.44**	0.00	-4.45***	0.01
	C	59.60*	0.07	72.08***	0.00	89.26***	0.00
Tanzania	LNREER	-0.15	0.60	0.05	0.81	0.14	0.61
	LNYd	-1.23	0.14	-1.26**	0.05	-0.17	0.82
	LNYf	1.69*	0.09	1.60**	0.05	0.55	0.54
	C	-15.95*	0.10	-14.14*	0.09	-10.61	0.19
Uganda	LNREER	0.41	0.27	0.43**	0.03	0.55*	0.07
	LNYd	1.37**	0.05	0.77*	0.07	1.23**	0.04
	LNYf	-3.84***	0.01	-2.43***	0.00	-3.71***	0.00
	C	73.17***	0.00	48.29***	0.00	72.04***	0.00
Panel	Variable	ARDL		FMOLS		DOLS	
	LNREER	-0.47***	0.00	-0.32	0.17	-0.43***	0.00
	LNYd	-0.08	0.47	-0.35	0.39	-0.27*	0.08
	LNYf	0.85***	0.00	0.25	0.66	0.31	0.17

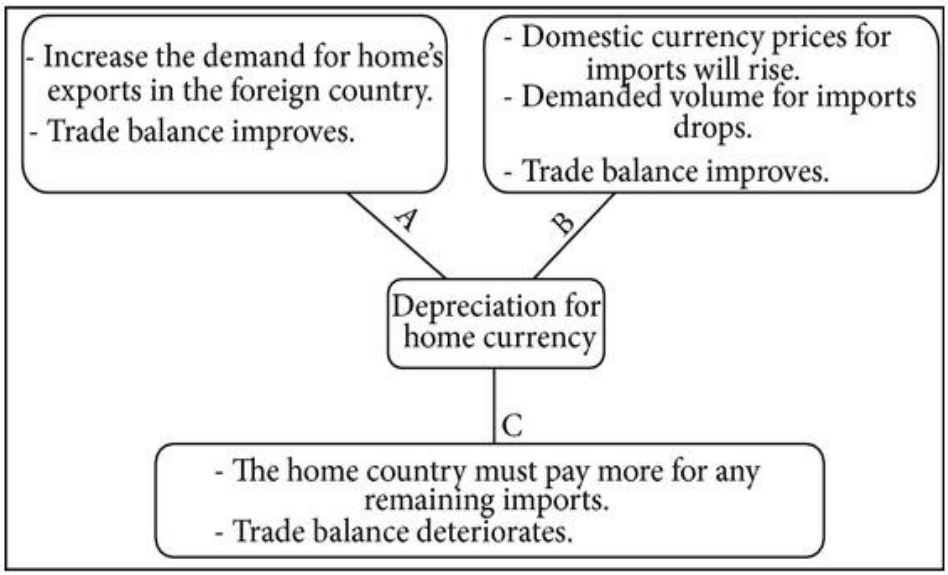
***, **, * denote 1 percent, 5 percent, and 10 percent level of significance.
Source: Extracted by author from Regression Output put using E-views version 9, 2015.

Figure 6.3: Elasticity Approach the case of Foreign Good



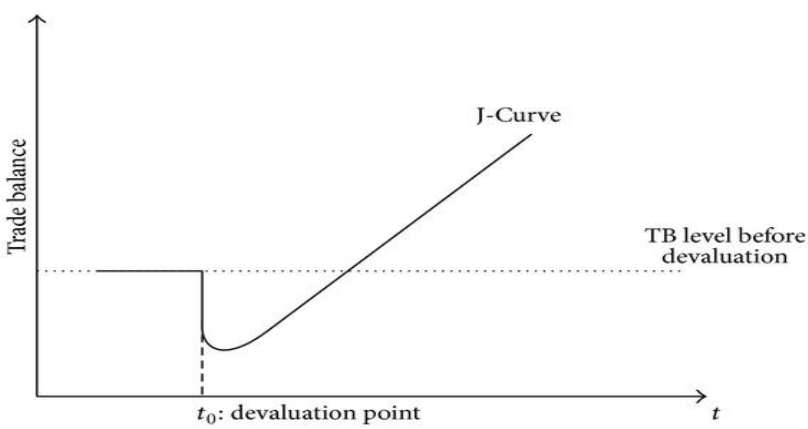
Source**:** Taken from . Abbas Ali et al. (2014)).

Figure 6.4 : Marshall-Lerner Condition.



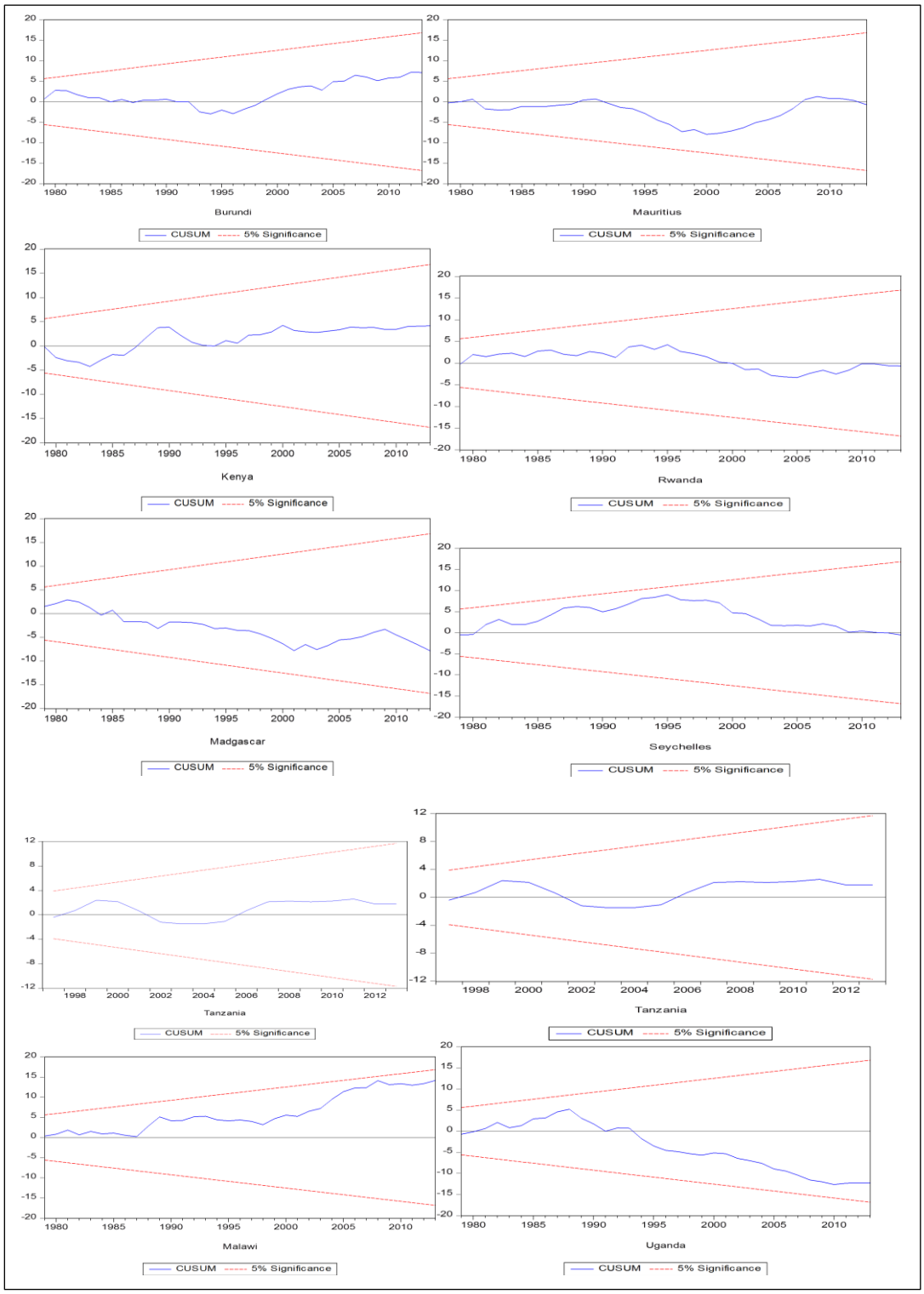
Source: Taken from. Abbas Ali et al. (2014).

Figure 6.5: J-Curve



Source: Taken from. Abbas Ali et al. (2014).

Figure 6.6: CUSUM Stability Test Result



Source: Extracted by author from CUSUM stability test output put using E-views version 9, 2016.

Appendix 3

Table 6.7: Lag (2 2 2 2) Based on SBC Alternative Dynamic Models Results

	Panel FMOLS Δln(Xa/Ma)	Panel DOLS	Panel FMOLS Δln(Xm/Mm)	Panel DOLS	Panel FMOLS Δln(Xmi/Mmi)	Panel DOLS
EC						
LnREER	0.63**	0.56***	-.71***	-1.07***	-.28	--0.35
	(0.03)	(0.00)	(0.00)	(0.00)	(0.45)	(0.54)
LnYd	-0.54	-0.35	-0.59	-0.15	-2.20***	-0.74
	(0.33)	(0.30)	(0.14)	(0.78)	(0.00)	(0.59)
LnYf	0.54	0.85*	0.20	-0.31	0.24**	0.80
	(0.44)	(0.09)	(0.75)	(0.62)	(0.01)	(0.63)
N	211	211	213	213	213	213

p-values in parentheses; ***, ** ,* denote 1 percent , 5 percent, and 10 percent level of significance.
Source: Extracted by author from Regression Output put using E-views version 9, 2015.

Table 6.8: ARDL (2 2 2 2) Based on SBC Dynamic Models Results

	Agri			Man			Min		
	PMG	MG	DFE	PMG	MG	DFE	PMG	MG	DFE
	Δln(Xa/Ma)			Δln(Xm/Mm)			Δln(Xmi/Mmi)		
EC									
LnREER	0.39*** (0.00)	0.88 (0.11)	0.49 (0.16)	-1.21*** (0.00)	-0.58** (0.05)	-1.19 (0.15)	-0.49 (0.19)	0.56 (0.26)	-0.92* (0.07)
LnYd	-0.55*** (0.003)	0.32 (0.68)	-0.76 (0.21)	-1.12*** (0.00)	-0.15 (0.77)	0.67 (0.65)	-0.76 (0.24)	-5.59 (0.30)	-2.24*** (0.0)
LnYf	1.85*** (0.00)	0.15 (0.92)	1.69* (0.06)	0.17 (0.69)	-0.36 (0.63)	-2.83 (0.18)	1.33 (0.12)	7.805 (0.44)	2.52* (0.06)
SR									
EC	-0.796*** (0.00)	-1.138*** (0.000)	-0.294*** (0.00)	-0.63*** (0.00)	-0.48*** (0.00)	-0.88*** (0.00)	-0.69*** (0.00)	-0.92*** (0.00)	-0.54*** (0.00)
Δln(Xa/Ma)-1	-0.045 (0.32)	-0.03 (0.62)	-0.03 (0.56)						
ΔLnREER-2	-0.24 (0.71)	-0.381 (0.72)	-0.30 (0.17)	2.11 (0.18)	0.43 (0.16)	0.87 (0.53)	0.38 (0.72)	-0.19 (0.87)	-0.14 (0.81)
ΔLnYd-2	0.079 (0.97)	0.84 (0.71)	0.15 (0.78)	6.12* (0.05)	0.61 (0.42)	2.04 (0.53)	-4.27 (0.39)	-5.07 (0.36)	-0.08 (0.96)
ΔLnYf-2	-1.17 (0.53)	0.90 (0.77)	-1.65 (0.27)	-4.92 (0.19)	-0.69 (0.74)	-4.87 (0.18)	0.96 (0.77)	0.05 (0.99)	1.58 (0.70)
Δln(Xm/Mm)-2				0.01 (0.96)	0.03 (0.57)	0.04 (0.74)			
ln(Xmi/Mmi)-2							-0.04 (0.66)	-0.03 (0.739)	0.02 (0.71)
cons	-33.73*** (0.00)	-12.96 (0.67)	-9.70** (0.02)	18.56*** (0.00)	8.83 (0.12)	48.35 (0.16)	-10.86*** (0.00)	-28.44 (0.786)	-7.56 (0.51)
N	213	213		213		213	206	206	

P-values in parentheses; *** , ** , * denote 1 percent , 5 percent and 10 percent level of significance.

Source: Extracted by author from Regression Output put using E-views version 9, 2015.

Table 6.9: Agriculture Trade Balance PMG estimator Empirical Results

Country	EC	ΔLnREER -1	ΔLnYd-1	ΔLnYf -1	Cons
Burundi	-0.84***	-2.35*	0.84	9.84	-37.34***
	(0.00)	(0.06)	(0.83)	(0.39)	(0.00)
Ethiopia	-3.28***	0.28	-4.06***	-4.46	-54.09***
	(0.00)	(0.75)	(0.00)	(0.53)	(0.00)
Kenya	-0.48***	0.60	0.64	-3.33	-20.57***
	(0.00)	(0.35)	(0.73)	(0.66)	(0.00)
Mad	-0.38***	0.28	-3.33	-3.42	-36.85***
	(0.00)	(0.28)	(0.26)	(0.33)	(0.00)
Malawi	-0.78***	-0.074	0.31	-4.33	-34.33***
	(0.00)	(0.85)	(0.97)	(0.27)	(0.00)
Mauritius	-0.40***	-0.24	0.037	0.63	-37.26***
	(0.00)	(0.44)	(0.94)	(0.65)	(0.00)
Rwanda	-3.34**	3.78	33.40	-5.10	-57.99**
	(0.03)	(0.31)	(0.34)	(0.68)	(0.02)
Seychelles	-0.06	3.01	-0.87	3.98	-2.56
	(0.39)	(0.50)	(0.53)	(0.43)	(0.370)
Tanzania	-3.58***	0.96	-22.74***	3.66	-67.38***
	(0.00)	(0.37)	(0.00)	(0.59)	(0.00)
Uganda	-0.37	3.27	3.73	-7.78	5.79
	(0.33)	(0.41)	(0.79)	(0.39)	(0.27)
N			243		

p-values in parentheses; *** , ** , * denote 1 percent , 5 percent and 10 percent level of significance.

Source: Extracted by author from Regression Output put using E-views version 9, 2015.

Table 6.10: Manufacturing Trade Balance PMG estimator Empirical Results

Country	EC	ΔLnREER -1	ΔLnYd-1	ΔLnYf -1	Cons
Burundi	-0.39***	0.48	-9.74**	-38.67**	6.25
	(0.00)	(0.73)	(0.03)	(0.03)	(0.21)
Ethiopia	0.09	3.37	-5.75***	-0.34	-0.65
	(0.65)	(0.24)	(0.00)	(0.98)	(0.80)
Kenya	-0.44***	0.083	3.54	5.63	5.53
	(0.00)	(0.89)	(0.53)	(0.30)	(0.33)
Mad	-0.38*	0.03	-0.63	2.33	2.34
	(0.06)	(0.90)	(0.55)	(0.53)	(0.38)
Malawi	-0.08	0.25	0.58	-4.67	3.38
	(0.26)	(0.39)	(0.79)	(0.34)	(0.37)
Mauritius	-0.06	-0.32	0.53**	-2.34**	0.54
	(0.23)	(0.33)	(0.04)	(0.04)	(0.50)
Rwanda	-0.90***	-0.42	6.30	-6.94	32.06
	(0.00)	(0.80)	(0.38)	(0.44)	(0.25)
Seychelles	-0.84***	-0.38	5.75**	-20.28**	6.83
	(0.00)	(0.88)	(0.03)	(0.04)	(0.53)
Tanzania	-3.24***	0.86	20.33***	-3.61	37.94
	(0.00)	(0.23)	(0.00)	(0.30)	(0.38)
Uganda	-0.37	3.27	3.73	-7.78	5.79
	(0.33)	(0.41)	(0.79)	(0.39)	(0.27)
N		236			

p-values in parentheses; *** , ** , * denote 1 percent , 5 percent and 10 percent level of significance.

Source: Extracted by author from Regression Output put using E-views version 9, 2015.

Table 6.11: Mining Trade Balance PMG estimator Empirical Results

Country	EC	ΔLnREER -1	ΔLnYd-1	ΔLnYf -1	Cons
Burundi	-0.83***	8.25***	-5.76	-34.37	-38.06
	(0.00)	(0.00)	(0.48)	(0.37)	(0.34)
Ethiopia	-0.65***	6.49***	33.46***	-23.86*	-33.27
	(0.00)	(0.00)	(0.00)	(0.05)	(0.30)
Kenya	-0.51***	-0.39	2.48	4.43	-30.32
	(0.00)	(0.43)	(0.37)	(0.48)	(0.37)
Mad	-0.51***	-0.39	2.48	4.43	-30.32
	(0.00)	(0.43)	(0.37)	(0.48)	(0.37)
Malawi	-0.23*	0.70	0.79	33.30***	-5.28
	(0.07)	(0.44)	(0.90)	(0.00)	(0.33)
Mauritius	-0.36*	-2.03	-4.43**	-8.34	-8.53
	(0.05)	(0.36)	(0.04)	(0.39)	(0.38)
Rwanda	-0.36*	-2.03	-4.43*	-8.34	-8.53
	(0.05)	(0.36)	(0.04)	(0.39)	(0.38)
Seychelles	-0.70***	0.249	8.99***	-33.88***	-36.83*
	(0.00)	(0.78)	(0.00)	(0.00)	(0.06)
Tanzania	-3.36***	-2.35	-23.79	33.09**	-23.99
	(0.00)	(0.39)	(0.37)	(0.05)	(0.36)
Uganda	-3.36***	2.44	3.59	-23.30	-37.74
	(0.00)	(0.38)	(0.90)	(0.25)	(0.39)
N			233		

P-values in parentheses; ***, **, * denote 1 percent, 5 percent and 10 percent level of significance.

Source: Extracted by author from Regression Output put using E-views version 9, 2015.

Table 6.12: Top Trade Partners based on Average Total Trade from 1970-2013

	Burundi			**Ethiopia**		
No.	Partner	TotalTrade in $	Share	Partner	TotalTrade in $	Share
1	Belgium	3E+07	0.18	China, Mainland	3E+08	0.19
2	Germany	2.3E+07	0.14	Saudi Ar.	3E+08	0.17
3	France	1.7E+07	0.10	USA	2E+08	0.15
4	Saudi Ar.	1.7E+07	0.10	Germany	2E+08	0.11
5	Kenya	1.6E+07	0.09	Italy	2E+08	0.11
6	USA	1.5E+07	0.09	Japan	1E+08	0.08
7	Japan	1.3E+07	0.08	India	1E+08	0.08
8	China, Mainland	1.3E+07	0.08	UK	8E+07	0.05
9	UK	1.2E+07	0.07	Belgium	7E+07	0.04
10	**Tanzania**	1E+07	0.06	France	7E+07	0.04
	Kenya			**Madagascar**		
1	UK	5.4E+08	0.17	France	4E+08	0.37
2	UAE	5E+08	0.15	China, Mainland	1E+08	0.15
3	India	3.7E+08	0.11	USA	1E+08	0.13
4	USA	3.2E+08	0.10	Germany	7E+07	0.07
5	Uganda	2.9E+08	0.09	South Afr.	6E+07	0.06
6	Japan	2.8E+08	0.09	Bahrain	6E+07	0.06
7	Germany	2.8E+08	0.09	Japan	5E+07	0.05
8	China, Mainland	2.8E+08	0.09	India	4E+07	0.04
9	Netherlands	2.1E+08	0.06	Mauritius	4E+07	0.04
10	South Afr.	2.1E+08	0.06	Italy	3E+07	0.04
	Malawi			**Mauritius**		
1	South Africa	2.5E+08	0.37	UK	5E+08	0.22
2	UK	8.7E+07	0.13	France	4E+08	0.20
3	USA	6.8E+07	0.10	India	2E+08	0.12
4	Germany	6.3E+07	0.09	South Africa	2E+08	0.10
5	Zimbabwe	5.3E+07		USA	2E+08	0.09
6	Japan	4.5E+07	0.07	China, Mainland	2E+08	0.08
7	Zambia	4.3E+07	0.06	Germany	1E+08	0.06
8	India	3.6E+07	0.05	Italy	1E+08	0.05
9	Netherlands	3.4E+07	0.05	Japan	8E+07	0.04
10	China, Mainland	2.8E+07	0.04	Spain	7E+07	0.03
11	France	2.4E+07	0.04			
	Rwanda			**Seychelles**		
1	Kenya	3.2E+08	0.21	France	3E+08	0.17
2	Belgium	3.2E+08	0.15	UK	3E+08	0.16
3	Germany	3.2E+08	0.13	Saudi Arabia	3E+08	0.16
4	Uganda	3.2E+08	0.11	Spain	3E+08	0.10
5	USA	3.2E+08	0.10	South Africa	3E+08	0.09
6	China, Mainland	3.2E+08	0.09	Italy	3E+08	0.09
7	France	3.2E+08	0.06	Singapore	3E+08	0.08
8	Japan	3.2E+08	0.06	Germany	3E+08	0.05
9	UAE	3.2E+08	0.05	Japan	3E+08	0.05
10	Netherlands	3.2E+08	0.05	USA	3E+08	0.05
	Tanzania			**Uganda**		
1	India	2E+09	0.20	Kenya	3E+08	0.27
2	China, Mainland	2E+09	0.19	UAE	1E+08	0.13
3	UK	2E+09	0.10	UK	1E+08	0.10
4	Kenya	2E+09	0.09	India	1E+08	0.09
5	Japan	2E+09	0.09	USA	9E+07	0.08
6	South Africa	2E+09	0.08	China, Mainland	8E+07	0.07
7	Germany	2E+09	0.08	Germany	8E+07	0.07
8	UAE	2E+09	0.07	Japan	8E+07	0.07
9	USA	2E+09	0.06	South Africa	6E+07	0.06
10	Netherlands	2E+09	0.05	Netherlands	6E+07	0.06

7. 요약

환율 동학과 무역수지:

동아프리카 국가에 대한 실증분석

서울대학교 대학원 경제학부

본 논문은 실질실효환율이 무역수지에 미치는 영향을 동아프리카 10 개 국가들에 대해 살펴본다. 동아프리카 국가들을 대상으로 한 기존 실증 연구들은 동일 시점의 국가간 비교에 초점을 맞추는 정태적 분석에 머무르고 있기 때문에 환율의 시간적 변화가 무역수지에 미치는 장·단기적 영향을 확인할 수 없었다. 본 연구에서는 동아프리카 국가들을 대상으로 ARDL(Autoregressive Distributed Lag)모형을 통해 동적분석을 수행한다는 점에서 기존 연구들과의 차별성을 가진다.

실증분석 결과 총량 및 산업별로 살펴본 무역수지는 모두 공적분 관계가 존재했다. 개별국가에 대한 ARDL 모형 추정 결과 실질실효환율의 증가는 10 개 국가 중 5 개 국가에서 무역수지를 개선하는 것으로 나타났으며 이는 통계적으로 유의하였다. 패널분석 결과에서도 유사하게 실질실효환율의 탄력성은 예상된 부호를 나타내며 통계적으로도 유의하였다. 이는 무역경쟁력을 개선하는데 있어서 환율정책이 매우 중요함을 의미한다. 동아프리카 국가들의 실질실효환율의 탄력성은 미국과 비교하면 매우 낮은 수준이지만 환율자유화 이후로 다소 증가하였다.

산업별 실증분석을 수행한 결과, 실질실효환율의 상승은 단기적으로 모든 부분에서 무역수지를 악화시킨다. 하지만 장기적으로는 산업별로 차이가 존재한다. 장기적으로 환율의 상승은 제조업과 광업부문의 무역수지에는 양의 효과가 있지만 농업 부문의 무역수지는 악화시키는 것으로 나타났다. 그러나 환율자유화 이후에는 각 산업의 무역수지에 양의 효과를 미치는 것으로 나타났다. 농업부문의 탄력성은 매우 낮으며 이는 무역수지 총량에 반영되어 나타났다. 마지막으로 총량 및 산업별 분석결과 모두에서 환율보다 실질소득의 영향이 더욱 두드러지게 나타났다.

본 연구를 통한 정책적 함의는 다음과 같다. 동아프리카국가들은 (특히 농업분야에서) 무역수지를 더욱 탄력적으로 하는 환율자유화정책과 더불어 체계적인 방식으로 통화의 평가절하를 실행하는 것이 필요하다. 나아가 무역수지 개선을 위한 정책들은 기존의 생산시설을 최대한 활용하여 제품의 다각화 등을 통해 수출품에 대한 의존을 점차 줄이며 내부생산에 초점을 맞추어야 한다.

키워드: ARDL모델, 동아프리카, 환율, 무역수지

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