AN ECONOMETRIC ANALYSIS OF DETERMINANTS OF DEBT SUSTAINABILITY IN ETHIOPIA

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Abstract

Sound and efficient external debt sustainability is an essential instrument to shred the notoriety of indebtedness and to ameliorate economic growth. This study was conducted with an objective to examine the determinants of foreign debt sustainability in Ethiopia using a yearly time series data that lasts from 1980 to 2016. A log-linear regression model was used, and the results demonstrate that debt service to GDP ratio and real effective exchange rate were statistically significant and positively associated with debt sustainability in Ethiopia. Whereas terms of trade and foreign real interest rate were found statistically significant and have a negative relationship with debt sustainability in Ethiopia. The growth rate of foreign GDP and fiscal position of government were statistically insignificant and have opposite signs to impact debt sustainability in Ethiopia. Hence, cautious domestic macroeconomic policies that will avoid overvaluing real effective exchange and deteriorating terms of trade should be designed and implemented.

1. Introduction

Throughout the last decade Ethiopia has moved to broad based and copious economic growth trajectory with an average annual GDP growth rate of around 10 percent (Admasu, 2017). This double digit and colossal economic growth of the country is shining behind the persistently widened fiscal and current account deficits and an onerous burden of external debt. This is why the spurt economic growth

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registered by the country for several years is perceived to be miraculous as the reason behind the curtain is hardly elusive. But, at the rear of miraculous economic growth, there is indeed huge external debt accumulation and indebtedness. The other more debatable issue is the sustainability of the existing rapid economic growth as the country's debt stock is severely mounting year after year. This is because economic growth is hampered by the backwash effect of external debt (Schclarek, 2004; Adepoju et al., 2007; Hameed and Ashraf, 2008; Safdari and Mehrizi, 2011).

Ethiopia is designated as one of the severely indebted low-income countries in the world with unmanageable debt burden (Kebret, 2005; Flynn, 2005). In historical terms, after the downfall of the imperial regime the size of debt has increased significantly and in 1975 the magnitude of the debt was only USD 371 million but after 23 year in 1998 the debt has unprecedentedly risen to USD 9, 812 million. This stood at 150 percent of GDP and 940 percent of export. The scheduled debt service represents 54 percent export earnings (Teklu, 2000). The debt stock to GDP ratio deteriorated to the level of 10.4% in 2007 and grows steadily to 10.5% in 2008. The figure has abruptly increased to 17.8 percent in 2009 (NBE, 2009). Between 2010 and 2015 Ethiopia's debt stock to GDP ratio grew at an average rate of 25.96 percent. In 2016, the country's external debt stock has reached USD 23.5 billion and debt to GDP ratio stood at 30.7 percent (NBE, 2017). Furthermore, according to the report of IMF public debt shares about 54.2 percent of the Ethiopia's GDP in 2016 (IMF, 2016).

For more than a couple of decades, Ethiopia has been having problems of managing her debt service obligations. The debt service lingered somehow away from the average of severely indebted low-income countries (SILICs). The extent of debt burden of the country for instance in 1993 indicates that the ratio of debt service schedule to exports was 47.4 %, slightly greater than the average of 43% for all SILICs. But, the actual debt service to export ratio was only 9 percent which highlights the severity of accumulated arrears of external debt and implies debt overhang. In 1998, the planned debt service to export ratio further augmented to 54 percent (Teklu, 2000). The lowest actual debt service to export ratio was recorded in 2006 by 2.5 percent (NBE, 2007). However, because of 4 billion USD worth debt relief secured in 2007 from the international development community, Ethiopia has made a significant recovery and back on the track of sustainable debt path (Alemu and Zenebe, 2011).

Similarly, over the last three years, the debt service to export ratio has shown a tremendous adjustment from 32.3% and 39.2% in 2014 and 2015, respectively, to 42.2% in 2016 (NBE, 2017). This signifies, currently, Ethiopia has been escaping from the maze of debt overhand but not a guarantee that the indebtedness is being entirely vanished. The external indebtedness may last to deteriorate in the future as long as the debt servicing is persistent and remains high. It is therefore valuable to scrutinize the determinants of the debt sustainability in Ethiopia by establishing causation between debt sustainability and its corresponding key determinants. While there are anecdotal empirical evidences on determinants of debt sustainability in the existing literature (Ajayi, 1991; Mahmood et al., 2009; Kiptoo, 2012; Imimole et al., 2014), the issue remains completely unaddressed in the context of Ethiopia and consequently needs to be addressed abruptly. The current study therefore aims to deal with this and other similar issues in perspective and propose the way forward by offering some possible policy solutions.

2. Literature Review

2.1. The Concept of Debt Sustainability

When does a given debt level is said to be sustainable?

Debt sustainability is one of the most vexing issues and escapes any simple definition. This is why there are so many subjective and competing definitions in the existing literature associated with it. Although other imperative policy objectives are able to be objectively defined and measured, it is debt sustainability that neither easy to be defined nor simple to be directly measured (Wyplosz, 2009). Ejaz and Javid (2011) defined debt sustainability as the level of debt that permits a country to continually fulfill its present and forthcoming debt servicing obligations without any further rescheduling or buildup of accruals. In accord with this definition, Kiptoo, (2012) defined debt sustainability as situation where borrowers are able to continually meet their debt servicing obligations without any large balancing adjustment to income and expenditure.

For Mohammadi, Cak and Cak (2007) debt sustainability refers to the ability of the country to meet the required debt obligations and the situation where the inter-temporal budget constraint is fulfilled. To culminate we referred the IMF definition which states debt sustainability as a situation that satisfies the debt solvency of a country

without undertaking a major balancing correction to income and expenditure given the costs of financing (IMF, 2002). Therefore, a given debt is thought to be sustainable when the debtor country is in a position to meet the present and upcoming debt service obligations fully without recourse to additional debt relief or rescheduling and able to avoid buildup of arrears with a minimum acceptable level of economic growth (Muwanga-Zake and Ndhaye, 2001).

2.2. Indicators of Debt Sustainability

In analyzing debt sustainability, both indicator method and empirical approach were used (Hamilton and Flavin, 1986; Trehan and Walsh, 1988; Kebret, 2005). There are basically various indicators that are used by IMF in order to determine the sustainable level of external debt (IMF, 2000). Whereas there is no unanimous consensus between economists as to which indicator is best to be solely used, it is evident that each indicator is peculiar and has its own merits and demerits to deal with particular policy objective. The primary form to specify these indicators are ratios and these indicators thought to be measures of solvency (Muhanji and Ojah, 2011).

According to the IMF (2000) sets of debt sustainability indicators are used and the first set of indictors include debt to GDP ratio, foreign debt to exports ratio, share of foreign debt to total debt stock, government debt to current fiscal revenue ratio, short-term debt to total debt stock, and share of concessional debt to total debt stock. The second set of indictors includes debt service to GDP ratio, government debt service to current fiscal revenue ratio, and external debt service to exports ratio. The second indicators mainly focus on the short-term liquidity requirements of the country in accordance with its debt service obligations and are more useful to sign the early warn of debt service problems and highlight the impacts of inter-temporal trade-offs that arises from past borrowing decisions. The third set of indicators is more dynamic and forward looking as they identify how the debt burden will change over time and includes the ratio of average interest rate on outstanding debt to the growth rate of nominal GDP (Muhanji and Ojah, 2011). From the foregoing debt sustainability measures, in this study we used debt to exports ratio to measure the Ethiopian debt sustainability as Ajayi (1991) and Imimole et al. (2014) did.

2.3. Theoretical Grounds

Theoretically one can find in general that an improvement in terms of trade and a rise in the ratio of debt service to GDP are expected to improve debt to export ratio. Whereas, deterioration of terms of trade and a decrease in the ratio of debt service to GDP are expected to worsen debt to export ratio. While an appreciation of real effective exchange rate leads to worsen the debt to export ratio, depreciation of real effective exchange rate leads to improve the debt to export ratio. A rise in the foreign real interest rate leads to worsen the debt to export ratio. An increase in the growth rate of income in industrialized countries would lead to an improvement in the debt to export ratio. Similarly, a development in the fiscal position of government tends to improve debt to export ratio (Ajayi, 1991).

2.4. Empirical Findings

Greenidge, Drakes, and Craigwell, (2010) analyzed the factors affecting external debt in Caribbean Community using co-integration test and dynamic OLS and the result implies that export and real effective exchange rate (REER) were found to be negatively correlated with external debt. Kiptoo (2012) examined the determinants of Kenya's external debt sustainability and the econometric findings revealed that export and GDP were positively associated with debt sustainability. The study further finds that debt sustainability and external debt have negative and significant associations. Mahmood, Rauf and Ahmad (2009) have used debt to export ratio, among others, to investigate debt sustainability in Pakistan and these authors result imply that fiscal deficit a highly significant while the effect of interest rate was less significant.

The study from Uganda by Barungi and Atingi (2000) and Nigeria by Ajayi (2000) analyzed the contribution of external factors on debt accumulation in their respective country. These authors finding show that REER and terms of trade (TOT) were the two key variables that affect external indebtedness in these countries. Loser (2004) investigated indicators of external debt sustainability of low- and middle-income countries and finds that REER, TOT, interest rate and fiscal deficit were among the indicators of external debt sustainability in these countries. Bader and Magableh (2009) in their part analyzed the determinants of external debt accumulation in Jordan and the result indicates that budget deficit, size of external debt, and saving gap were the variables that affect external debt. The finding further indicates that

REER was the most significant variable in terms of affecting external debt.

Awan, Asghar, and Rehman (2011) examined the impacts of fiscal deficit, exchange rate and terms of trade on foreign debt of Pakistan. The study confirms that there is a certain significant long run association between external debt and the aforementioned explanatory variables. Similarly, Awan, Anjum and Rahim (2015) in their recent study found that fiscal deficit, trade openness and nominal exchange rate were the significant determinants of external debt in Pakistan. Pyeman, Noor, Mohamad, Yahya (2014) analysed determinants of external debt in Malaysia and they found that GDP, FDI, and export were the important factors that influence foreign debt. Imimole, Ehikioya, Asin (2014) investigated determinants and sustainability of foreign debt in Nigeria applying co-integration analysis and the result reports that external debt to GDP ratio and TOT are negatively correlated but statistically insignificant.

Ajayi (1991) used regression analysis and finds that falls in the growth rate of income in industrialized countries and a rise in foreign real interest rate have negative effects on the debt to export ratio and government fiscal position found to be positively correlated with this ratio in Nigeria. He also found empirical evidence that a worsening in terms of trade had worsens the Nigerian debt to export ratio.

2.5. Formulation of Research Hypotheses

From the foregoing theoretical grounds and empirical findings, this study has formulated the following six research hypotheses.

- H_1: Debt service to GDP ratio is positively associated with debt sustainability
- H_2: Real effective exchange rate is positively associated with debt sustainability
- H_3: Growth rate of foreign GDP is positively associated with debt sustainability
- H_4: Fiscal position of government is positively associated with debt sustainability
- H_5: Foreign real interest rate is negatively related with debt sustainability
- H_6: Terms of trade is negatively related with debt sustainability

2.6. Conceptual Framework

The conceptual framework of present study has been depicted in figure 1 and illustrates the unidirectional relationship between macroeconomic variables and external debt sustainability.

Figure 1

The conceptual framework of the present study
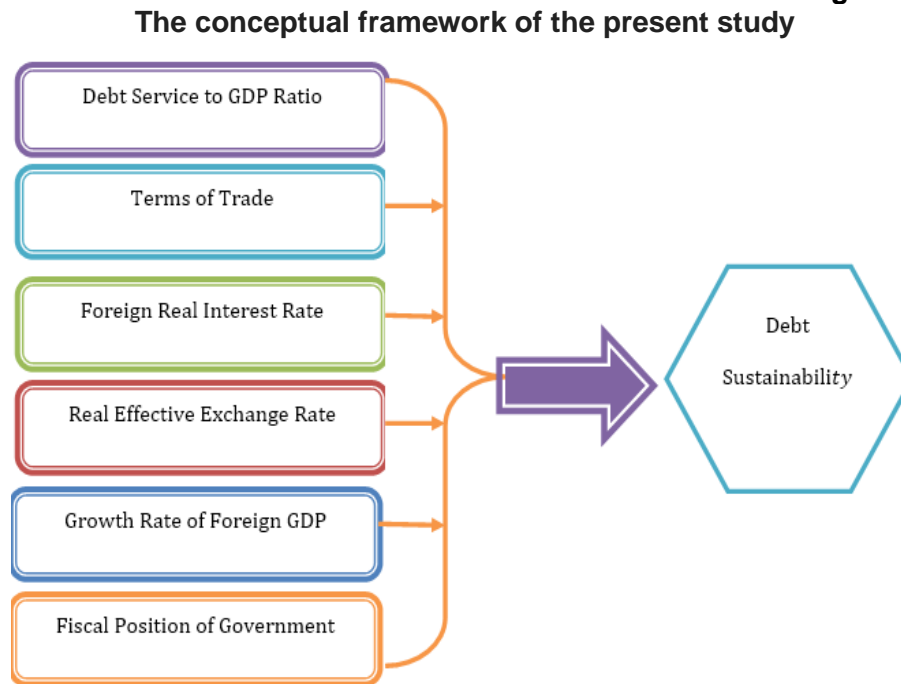
3. Data and Research Methodology

3.1. Data and Variables Description

To achieve the foregoing stated objective of this study, we have basically used different economic data and macro-econometric model. The data used in the analysis were obtained from National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MoFED), Central Statistical Agency (CSA), International Monetary Fund (IMF) and World Bank (WB). Annual time series data spanning from 1980 to 2016 were used. Since this study focuses on the macroeconomic determinants of debt sustainability in Ethiopia, the following explanatory variables were adapted from Ajayi (1991) and Imimole et al. (2014). These are debt service to GDP ratio (DGDPR),

terms of trade (TOT), growth rate of foreign GDP (GFGDP), foreign real interest rate (FRRI), real effective exchange rate (REER) and fiscal position of government (FPY).

To estimate the effects of external economy on debt sustainability of Ethiopia, we have used the GDP growth rates of 7 industrialized countries (USA, Germany, Japan, United Kingdom, France, China and Italy). In this study, we have defined the fiscal position of government as revenue minus expenditure divided by GDP. The explained variable of our model, external debt to export ratio, was adopted from Ajayi (1991) and used to measure debt sustainability.

3.2. Empirical Model Specification

In order to examine the macroeconomic determinants of debt sustainability, the present study has used econometric model that takes the following functional form.

$$\text{DER}_t = f(\text{DGDPR}, \text{TOT}, \text{GFGDP}, \text{FRRI}, \text{REER}, \text{FPY})$$

Where:
DER=Debt to Export Ratio,
DGDPR=Debt Service to GDP Ratio,
TOT=Terms of Trade,
GFGDP=Growth Rate of Foreign GDP,
FRRI=Foreign Real Interest Rate,
REER=Real Effective Exchange Rate,
FPY=Fiscal Position of Government.

Rewriting the above general functional form into a more particular form gives the following estimation equation.

$$\text{DER}_t = \beta_0 + \beta_1 \, \text{DGDPR} + \beta_2 \, \text{TOT} + \beta_3 \, \text{GFGDP} + \beta_4 \, \text{FRRI} + \beta_5 \, \text{REER} + \beta_6 \, \text{FPY} + \mu_t$$

Transforming the above variables into logarithm form yields the following empirical estimating model.

$$\text{LnDER}_t = \beta_0 + \beta_1 \, \text{LnDGDPR} + \beta_2 \, \text{LnTOT} + \beta_3 \, \text{LnGFGDP} + \beta_4 \, \text{LnFRRI} + \beta_5 \, \text{LnREER} + \beta_6 \, \text{FPY} + \mu_t$$

Where:
LnDER - Log of Debt to Export Ratio,
LnDGDPR - Log of Debt Service to GDP Ratio,
LnTOT - Log of Terms of Trade,
LnGFGDP - Log of Growth Rate of Foreign GDP,

LnFRRI - Log of Foreign Real Interest Rate,
LnREER - Log of Real Effective Exchange Rate,
FPY - Fiscal Position of Government,
μ_t - error term.

4. Regression Result and Discussions

4.1. Statistical and Econometric Tests

Prior to interpret and discuss the regression coefficients of variables, the time series properties of data for all variables must be first checked for stationarity so as to avoid spurious and misleading regression results (Granger, 1986). Thus, to ensure the stationarity of the variables in use, we have used the conventional method of testing for stationarity of the series, Augmented Dickey Fuller (ADF) test. The results of ADF test that compares the calculated and McKinnon critical values with different level of significance are presented in Table 1.

The results of ADF test indicates that variables such as LnDER, LnDGDPR, LnGFGDP, LnFRRI, and FPY are stationary at level form but LnTOT and LnREER are stationary in their first difference. To illustrate, LnGFGDP, LnFRRI, and FPY are stationary in level, since the ADF calculated values of these variables at level is greater than the McKinnon 1% critical values. LnDER is stationary at level at 5% level of significance and LnDGDPR is stationary at level at 10% level of significance. LnTOT and LnREER are stationary at first difference, since the ADF calculated values of these variables at first difference is greater than the McKinnon 1% critical values.

As shown in Table 2 the value of R- squared is 0.7688 and is the coefficient of determination. It indicates that about 76.9% of the total variations in debt to export ratio of Ethiopia are explained by the variations in debt service to GDP, terms of trade, growth rate of foreign, foreign real interest rate, real effective exchange rate, and fiscal position of government. This implies that the model we have used explains large proportion of variations in debt sustainability in Ethiopia. The rest of the variation is accounted for excluded determinants of debt sustainability. Looking at the F-statistics, Table 2 shows the overall significance level of the estimated parameters with a probability value of 0.000. This indicates that all explanatory variables included in our model are jointly significant at 1% level of significance. Therefore, we have rejected the null hypothesis that all independent variables are zero jointly and simultaneously.

A diagnostic test of autocorrelation is conducted to look the troubles of serial autocorrelation and detect the existence of relationship between successive values of the same variable (usually, the error term). Durbin Watson test of autocorrelation is estimated as shown in Table 2 and the calculated value of the Durbin Watson test is 1.74. This statistic falls in the region of no serial autocorrelation and concludes that there is absence of serial autocorrelation in our model. To test the existence of Multicollinearity we carried out variance inflation factor (VIF) and the mean VIF is 1.94, which shows the absence of severe Multicollinearity among explanatory variables.

Table 1

Results of Unit Root Test

	ADF-Test		
Variables	**ADF Calculated Value at Level**	**ADF Calculated Value at First Difference**	**McKinnon Critical Value**
LnDER	-2.219		-1.691**
LnDGDPR	-1.426		-1.307***
LnGFGDP	-4.539		-3.675*
LnTOT	-1.035	-4.132	-3.687*
LnREER	-1.345	-4.106	-3.689*
LnFRRI	-2.848		-2.441*
FPY	-4.080		-3.675*

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

4.2. Regression Results

Table 2

OLS Regression results

Variables	**Coefficient**	**Standard Error**	**T-Ratio**	**Prob. (p-value)**
Debt service to GDP ratio	1.015234	0.1330117	7.63	0.000*
Terms of trade	-1.984226	0.4022054	-4.93	0.000*
Growth rate of foreign GDP	-0.0221809	0.0546203	-0.41	0.668
Foreign real interest rate	-0.3035358	0.162091	-1.87	0.071***
Real effective exchange rate	1.18892	0.2169126	5.48	0.000*
Fiscal position of government	2.975425	5.700675	0.52	0.606
Constant	-1.909858	0.966922	-1.98	0.058

R-Squared	0.7688
Adj R-Squared	0.7225
F- Statistics	16.62
Prob (F -Statistics)	0.0000
DW Statistics	1.7394
Mean VIF	1.94

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

The empirical result reported in Table 2 indicated that debt service to GDP ratio is vital determinant of debt sustainability in Ethiopia. This ratio has the second most substantial positive effect on debt sustainability in Ethiopia next to real effective exchange rate. The positive coefficient in Table 2 confirms that 1 percent increase in debt service to GDP ratio leads to 1.015 percent increase in debt to export ratio. This relationship was found to be statistically significant at 1 percent level of significance. The positive coefficient of the ratio is consistent with what we have hypothesized and implies that improvement in debt service to GDP ratio has played a significant role in improving the external debt sustainability of Ethiopia which was measured by debt to export ratio. The result further implies that a positive GDP growth leads to augment the debt financing ability of the county and eventually maintains the sustainability of debt in Ethiopia.

The finding reported in Table 2 indicated that real effective exchange rate has positive effect on debt to export ratio or debt sustainability of Ethiopia. The size of the coefficient is much stronger than any other significant variables do in our model and is one of the major determinants of debt sustainability in Ethiopia. From hypothesis 2 we deduced that appreciation of real effective exchange rate leads to worsen debt to export ratio just as depreciation in contrary would improve. As the government of Ethiopia has been undertaking substantial devaluation in real effective exchange rate for many years, in our estimation, we find positive association between real effective exchange and debt to export ratio and verify the hypothesis that depreciation of real effective exchange rate improves debt to export ratio. This is why the result reported in Table 2 confirms that 1 percent increase in real effective exchange rate leads to 1.189 percent increase in debt to export ratio. This association was statistically significant at 1 percent level of significance. This finding generally implies that devaluation of real effective exchange rate improves debt

sustainability in Ethiopia when using debt to export ratio as measures of debt sustainability throughout the period of the study.

Looking into terms of trade, the finding of the study indicates that terms of trade has negative and significant effect on debt to export ratio. 1 percent increase in terms of trade leads to about 1.984 percent decreases in Ethiopian debt to export ratio. This association was statistically significant at 1 percent level of significance. From hypothesis 6 we inferred that an improvement in terms of trade leads to improve debt to export ratio just as deterioration in reverse would worsen. As reported in Table 2 we find a sturdy negative association between terms of trade and debt to export ratio. This finding confirms the hypothesis that deterioration in terms of trade leads to worsen the debt to export ratio. The rationale is that the Ethiopian terms of trade has been deteriorating as the demand for Ethiopian export goods are price inelastic and the prices of these commodities in the world market are steadily decreasing over the last many years. These sharp fluctuations had been deteriorating the terms of trade of Ethiopia overtime and ultimately worsened the debt to export ratio. Our finding is consistent with the earlier findings by Ajayi (1991) and Imimole et al. (2014).

As it is indicated in Table 2, the coefficient of foreign real interest rate is negatively correlated with the debt to export ratio of the country, which is in consistent to theoretical expectation and the finding by Ajayi, 1991. The reported estimate appears to be statistically significant at 10% level of significance. The coefficient of this variable implies averagely that 1 percent increase in foreign real interest rate leads to about 0.304 percent decrease in debt to export ratio, holding other variables constant. The reason behind this result has to do with theoretical argument that increases in foreign interest rate mean that developed countries are more willing to grant loan to these countries and high level of debt and hence, rise in the debt to export ratio. The result reported in Table 2 lend credence to this theoretical expectation and implies that rise in foreign real interest rate has lead to slightly worsened the debt to export ratio of Ethiopia compared to other significant variables included in our model. Looking into the size of the estimated coefficient of the variable, our result is in accordance with the finding of Mahmood, Rauf and Ahmad (2009) who found foreign interest rate has less significant effect on debt to export ratio.

The estimated results regarding growth rate of foreign GDP and fiscal position of government are reported in Table 2. The coefficient of

growth rate of foreign GDP was found to be negative being statistically insignificant. This result conflicts to theoretical expectation, hypothesis 3 and the empirical finding of Ajayi (1991). The coefficient of fiscal position of government has a positive sign and supports hypothesis 4, but it is statistically insignificant.

5. Conclusion and Recommendations

This paper has investigated the macroeconomic determinants of external debt sustainability in the Ethiopian economy using annual time series data that spanned from 1980 to 2016. A log-linear regression model was used to find the macroeconomic factors that determine external debt sustainability and the results of our estimation show that debt service to GDP ratio and real effective exchange rate have statistically significant estimates and are positively associated with external debt sustainability of Ethiopia which was measured by debt to export ratio. These imply that the improvements in debt service to GDP ratio and devaluation of real effective exchange rate significantly ameliorate and maintain the sustainability of debt in Ethiopia during the period of the study. Whereas terms of trade and foreign real interest rate were found statistically significant and have a negative relationship with external debt sustainability of Ethiopia which was measured by debt to export ratio. These imply that a further intervention through deteriorating the terms of trade at any time in the future would detrimentally worsen the external debt sustainability of Ethiopia just as a rise in the foreign real interest rate would do. The growth rate of foreign GDP was negatively associated to external debt sustainability being statistically insignificant. On the contrary, the fiscal position of government was positively associated to external debt sustainability but statistically insignificant.

The positive association that was found between debt service to GDP ratio and debt to export ratio is an indication that government must work hard in enhancing the debt servicing capacity without hamstringing the current copious economic growth and a due consideration should be paid to the issues of debt reduction, debt forgiveness and interest rate reduction to front the country on the path of sustainable external debt. Since devaluation of real effective exchange rate and improvement in terms of trade promote external debt sustainability in Ethiopia, cautious domestic macroeconomic

policies that will avoid overvaluing real effective exchange and deteriorating terms of trade should be designed and implemented.

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