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Determinants of Agricultural Gross Domestic Product in Ethiopia

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Abstract: *Ethiopia is the second populous country in the sub Saharan Africa with the substantial share of Gross Domestic Product belongs to agricultural sector. Secondary time series data on different macroeconomic variables for the period 1993 to 2016 was used in this study with the aim of determining the factors influencing the agricultural output in Ethiopia. Descriptive statistics was employed for the computation of maximum and minimum values, means and standard deviation of the continuous variables. The co integration test was done by applying the Augmented Dickey Fuller and Phillips- Peron tests on the residual. The result of the test shows that explanatory variables and agricultural GDP are co integrated. Multiple linear regression model (MLRM) was employed to analyze the impact of explanatory macroeconomic variables on the agricultural output. From the result, agricultural land has a positive significant effect on agricultural output. External debt and annual growth in service and industrial output affects the agricultural GDP negatively and significantly. Even though structural transformation (growth in service and industrial output) is producing efficiency gains by reducing the agriculture's share of GDP, the need of improving agricultural productivity for reducing poverty and creating potential source of raw materials for the manufacturing sector is unquestionable. Hence, policy makers should set policies aimed at increasing agricultural production and the government effort in modernizing and commercializing the agricultural sector is pertinent.*

Keywords: *Determinates, Gross Domestic products, Agriculture*

1. INTRODUCTION

Agriculture is considered as a key sector in Sub Saharan Africa since almost all rural households depend directly or indirectly on agriculture. It plays pivotal roles in countries with a good agro ecological condition, dynamic and growing national economies (Diao, *et al.*, 2010).The economic development is influenced dominantly by the prospects of the agricultural sector in most of sub Saharan African countries. Since it play a significant role through its high share of GDP and employment, the sector prioritized in various development agenda in most of the countries in the region(OECD/FAO, 2016).

Even though agricultural sector is an important sector in terms of employment, supplying food and generating foreign earnings in most of sub Saharan economies, the rural poverty rates remain high(Dercon & Gollin 2014)**.**The total value of agricultural output has grown in sub Saharan Africa over the past decades. However, the region remains under food insecurity in the world with a limited progress towards poverty reduction. This was due to low productivity of agricultural resources, high population growth and political instability(OECD/FAO, 2016).Sub-Saharan Africa Region comprises about 12 percent of the world's population and the rapid population growth including in rural areas, affects the agricultural sector in the region by raising the pressure on the availability of food(Jayne & Ameyaw, 2016, pp.6).

Ethiopia is the second populous country in Sub Saharan Africa in which the performance of the overall economy is highly correlated to the agricultural sector (FAO, 2014b).Substantial share of Gross Domestic Product(GDP) belongs to agricultural sector in Ethiopia(Diao, et al., 2010).The agricultural sector determine the growth of all other sectors and, consequently, whole economy of Ethiopia. Therefore, the sector considered as the building block of the Ethiopian economy. 60 percent

of the sector output is derived from crop production, 27 percent from livestock and 13 percent are from other areas of agricultural production (Gebre-Selassie & Bekele, 2010, pp.10).

Agriculture is the dominant sector of the economy in Ethiopia, since it contributes the lion share of the Gross Domestic product and foreign exchange earnings.

Moreover, 83 percent of the total population sustain their livelihood through the employment opportunity created by the sector (CSA, 2013, pp.1).Growths of overall economy, improvement in food security and reduction in poverty in Ethiopia in recent years are due to the growth in agricultural sector. 44 percent of the Gross Domestic Product derived from the agricultural sector in 2010/11(Woldehanna, 2014, pp.2).The largest share of the agricultural output is due to crop production. Therefore, crop production contributes to the agricultural output in particular and to the national economy as a whole(FAO, 2014a).

The share of agriculture in the national GDP has been declining over the last four decades in Ethiopia. It declined from 76 percent in 1960s to 45 percent in 2003/04. Annual growth rate of agricultural GDP has been fluctuating from time to time. It has been negative in two years and positive in the other three years between 1999/2000 and 2003/2004. It was -3.0 and -12.2 percent in 2001/2002 and 2002/2003 respectively. The fluctuation in annual growth rate of agricultural GDP which has been due to frequent drought was the cause for the fluctuations in national GDP. Therefore, the performance of the whole economy in Ethiopia heavily depends on performance of the agricultural sector(EEA, 2005, pp. 145-147).

Agricultural sector is at low performance, even though it takes the lion share in its contribution to GDP, Export trade and earnings, and employment. High levels of food-self-sufficiency gap and food insecurity are the indicators of low performance of the sector and are the challenges the country has been facing for decades (Ibid).

Despite the economic importance of agricultural sector and its contribution in poverty reduction, existing empirical evidence on factors causing the prospects or poor performance of the sector in Ethiopia is inadequate and lacks strength. Therefore, the aim of this paper is to assess the factors influencing the Agricultural GDP in Ethiopia.

2. RESEARCH METHODOLOGY

2.1. Description of the Study Area

The study focused on Ethiopia and carried out based on the data collected by the World Bank in overall regions of the country. Ethiopia has nine regional states and two independent city administration. The region of Ethiopia are namely, Oromia regional state, Amahara regional state, Tigray regional state, Afar regional state, Benishangul Gumuz regional state, Gambella regional state, South Nations, Nationalities and people regional state, Harari and Somali regional states. Addis Ababa and Dire Dawa are the two independent city administrations in Ethiopia. The country is bounded by Sudan, Kenya, Djibouti, Eritrea, and Somalia in West, South, East, North East and South East respectively. According to the revised document of FAO (2014a), the economy of the country is highly dependent on the agricultural production and Agricultural commodities like coffee, oilseeds, dried pulses and skin are the main source of foreign earnings in the country.

2.2. Sources of Data and its Type

The study was conducted by depending highly on the secondary sources of data in which World Bank was the main source of data for this study. Time series data on different macroeconomic variables such as agricultural GDP, External Debt stock, the rate of annual national inflation, Agricultural trade ratio, and annual growth of service and industrial output was obtained from World Bank. In addition to this, the other secondary source of data such as Journals, working papers, student thesis and internet were used in course of conducting this study.

2.3. Data Analysis Methods

The explanatory variables in this study are those variables, which thought to have influence on agricultural GDP. These are agricultural land, rate of annual national inflation, agricultural trade ratio, annual growth of industry and service output and external debt.

2.4. Analytical Techniques for Data Analysis

Descriptive method of analysis and inferential statistics were employed using SPSS (Version 20) and STATA (version 13).

2.5. Descriptive andInferential Statistics for what?

Descriptive statistics was used for the computation of Minimum and maximum values, means, and standard deviation of continuous variables.

Inferential statistics was employed to analyze the impact of independent variables on dependent variable. Multiple linear regression analysis is appropriate for the analysis of data by allowing us to control for many other factors that affect the dependent variable simultaneously. This means to analyze the individual impact of the explanatory variables on dependent variables, multiple linear regression analysis is preferable. Hence, the multiple linear regression model (MLRM) was employed for analyzing the factors influencing agricultural GDP in this study.

2.6. EmpiricalModel Specification

The empirical specification of the model was formulated as follows.

AGDPt= f (AIGDPt,ASGDPt, AGLt,ICPt, EXIMt,and EDSt) Where: AGDPt = agriculture's total value added to GDP or it can be called as Agricultural GDP which expressed as a percentage of total GDP of the country (Data from World Bank).

AIGDPt = Annual growth of Industry's total value added to GDP (annual growth of Industrial GDP) expressed in percentage (Data from World Bank).

ASGDPt= Annual growth of service sector total value added to GDP (annual growth of service GDP)Expressed in percentage (Data from World Bank)

AGLt= Agricultural land expressed as percentage of total land area (Data from World Bank).

ICPt= the rate of national inflation (Data from World Bank).

EXIMt=the ratio of agricultural trade(the ratio of exports to imports of agricultural merchandise in Ethiopia) (Data from World Bank).

EDSt= the total external debt stocks of country (expressed as a percentage of GNI) (Data from World Bank).

From the empirical model specification discussedabove, The Multiple Linear regression model which is fitted to the data was formulated as follows:

$AGDPt = \beta 0 + \beta 1AIGDPt+\beta 2ASGDPt +\beta 3AGLt + \beta 4ICPt +\beta 5EXIMt +\beta 6EDSt + Ɛ$

Where Ɛ is an error term

3. Results and Discussion

3.1. Trends of Agricultural, Industrial and Service GDP (1993-2016)

Descriptive analysis the data is presented using mean, standard deviation, figures and charts as follows. The agriculture GDP in the early1990's was high when compared with the GDP of other sectors (service and Industrial GDPdue to the fact that agriculture was the main economic activity in the country. However, it was declined sharply from the beginning of 1990's up to the beginning of 2000"s. It was then reached the minimum level (40.12%) in 2003.

Even though the agricultural GDP was at the minimum level in 2003, it was increased beginning from this period (2003) until the end of 2013. This result is in line with the finding of(WorldBankGroup, 2016) in which the agricultural GDP was increased between 2003 and 2013.

On the other hand, service GDP was stable between 1994 and 1996 after it passed through a sharp increase between 1993 and 1994. It was 35.6 during this period. After this steady state, it declined and reached the minimum level which was 29.24 in 1997.However, it showed a rapid increase between 1997 and 2003. It reached on its maximum level of 46 in 2003 in which the agricultural GDP was reached its minimum level of 40.12 on contrary in this year. Thus, according to this finding, the year 2003 was the year in which agricultural GDP was at its minimum level and service sector reached on its maximum level. The service sector passed through a period of slow decrease between 2003 and 2009. However, it was stable between 2010 and 2011 and increased slowly after it showed a sharp decrease in 2012.

Industrial GDP showed a slow increase between 1993 and 1997 as shown on the figure 1 below. It was almost at steady growth between 1997 and 2007.Then it decreased slowly till 2009 and again stable between 2009 and 2013. However, it increased sharply between 2013 and 2016.

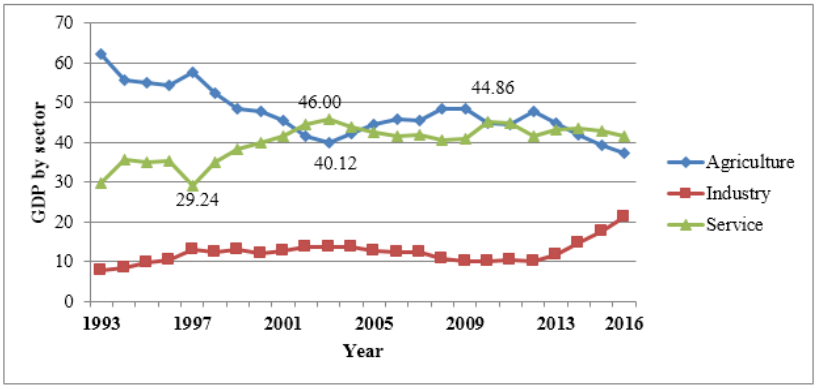

Figure1:*Trends of SectorialGDP over Periods (1993-2016)*

3.2. Mean and Standard Deviation of the Continuous Variables

Before providing a comprehensive econometric analysis, the study gives thebrief interpretation of statistical analysis. Table1 reports the descriptive statistics andthe result shows thatthe average percentage share of agricultural GDP (AGDP) to national real GDP over the last twenty four years period is 47.40%. The average annual growth of the Industrial GDP (AIGDP) and service GDP (ASGDP) are 11.41% and 10.67% with the standard deviation of 6.61 and 4.37 respectively. The mean value of external debt stock is 53.98% of the Gross national income of the country with the standard deviation of 4.97. The mean value of the national inflation rate over the past twenty four years is 8.71% with the standard deviation of 5.39. The average agricultural land (AGL) is 32.89% of the total land area with the standard deviation of 2.34.

Table1. *Descriptive Statistics*

	AGDP	ASGDP	AIGDP	EDS	AGL	ICP
Mean	47.40	10.67	11.41	53.98	32.89	8.71
Max	62.37	21.88	26.90	60.29	36.49	22.77
Min	37.23	4.40	3.68	33.32	30.47	0.662
Std.Dev.	6.20202	4.37	6.61	4.97	2.34	5.39

3.3. Contribution of Agricultural Sector to the National Output

The contribution of agriculture sector to the Ethiopian economy accounted for in terms of real Agriculture Gross Domestic Product (AGDP). The contributions of agricultural sector to national output computed by employing descriptive statistics such as averages, percentages, charts and line graph.The real national output (GDP) is contributed by three sectors of the economy namely: agriculture, Industry and service sector. As the result of this studyshows,the average national GDP share ofagricultural, service and industrial sectoris47.40%, 40.2% and 12.40% respectively over the past twenty four years (from 1993-2016).The GDP share of Service sector was greater in percentage of total national output next to agricultural sector during the last twenty four years period as shown on Figure 2.

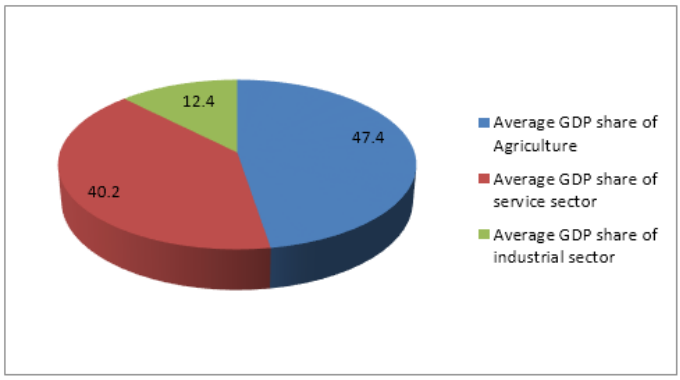

Figure2. *Annual Average GDP Share of Agriculture, Industry and Service from (1993 – 2016)*

3.4. Econometrics Analysis

3.4.1. Unit Root Test and Order of Integration

The variables used in the analysis need to be stationary and/or should be co -integrated in order to have a meaningful relationship from the regression. The unit root test provides the order of integration at which the variables can be stationary.

Therefore, the Dickey Fuller and Phillips-Peron test were applied to test whether the variables are stationery or not. The result of these tests shows that, the variables are integrated of order1 (I (1)) and are difference stationery. The result of the test is presented below in table 2.

Table2. *Result of Unit Root Test at Level Form I (1)*

Variable	ADF		Phillips-Peron(pp)	
	p-value	t statistics	P- value	t statistics
AGDP	0.0003	-4.421***	0.0003	-19.446***
ASGDP	0.0000	-5.201***	0.0000	-23.465***
AIGDP	0.0000	-6.187***	0.0000	-24.747***
AGL	0.0032	-3.773***	0.0032	-18.282***
EDS	0.0001	-4.580***	0.0000	-22.237***
ICP	0.0000	-7.029***	0.0000	-31.283***
EXIM	0.0000	-9.621***	0.0000	-31.283***

****significant at 1% and the critical Values of Mackinnon test for ADF and PP: at 1% = -3.750, 5% = -3.000, 10% = -2.630*

As shown in Table2, the variables are integrated of order one (I (1)) process, since the first differences of the variables are significant at 1% level of significance. This means that the variables are stationery after first differencing.

3.4.2. Test for Co-integration

Test for co integration was employed to the residuals with the purpose of determining whether the explanatory variables and the dependent varaible were co-integrated and there exists a causal long run relationship between them or not. The result of the test is presented below in table 3.

Table3. *Unit Root Test on Residual*

	T- Statistics	P-value
Augmented Dickey-Fuller test statistic	-4.381	0.0003
Phillips-Peron(PP)	-19.602	0.0003

Critical values: at 1%level= -3.750, at 5%level= -3.000, at 10% level= -2.630

As shown above in Table3, the ADF test statistic and Phillips-Peron (PP) in absolute term are greater than the set of critical values at 5%. This means that that the test for unit root on residual is significant.Consequently,the alternate hypothesis of there is no unit root in the series (there is co integration) is accepted. On the other hand, the p-values for both Augmented Dickey fuller Phillips-Peron tests give us the same decision. The P-values for both tests are less than the level of significance (0.005). This implies that the tests are significant at 5% and the alternate hypothesis of

there is co integration is accepted. The presence of co integration shows that there is a long run causal relationship between the explanatory variables and the dependent variable. From this we understand that the explanatory variables considered above in the model are the long run determinants of the agricultural GDP in Ethiopia.

3.4.3. The Necessary Diagnostic Tests

All the necessary diagnostic tests were undertaken to know whether the regression model specified correctly or not and it satisfies the assumption of OLS. Therefore, the data was checked for different tests such as test for serial correlation, normality test, test for heteroscedasticity, multicollinearity test, and test for misspecification of the model and omitted variable bias. The Breusch-Pagan test was used to detect the presence of heteroscedasticity. The test is insignificant at 5% level of significance, since the P-value is greater than the level of significance (P=0.8144 > 0.05). This indicates that, the null hypothesis of there is no heteroscedasticity is accepted. Therefore, the Breusch-Pagan test shows that there is no heteroscedasticity problem in the data.

The Breusch- Godfery LM test was applied to check the presence of serial correlation in the data. As the result of this test shows, the P-value (P=0.9233) is greater than the level of significance (0.05). This implies that the test is not significant at 5% level of significance and as a result the null hypothesis of there is no serial correlation is accepted.

The test of multicollinearity was also applied to suggest whether the assumption of the OLS for multicollinearity (there is no high degree of correlation between explanatory variables) is hold or violated. As the result of the test reports, there is small mean value of variance inflating factor (VIF= 1.22) which means that there is no high degree of correlation between the explanatory variables.

Normality test was employed to check whether the error term is distributed normally or not. As the result from Shapiro-Wilk W test indicates, the P-value (0.87306) is greater than the level of significance (0.05). This means the test is not significant at 5% level of significance and null hypothesis of the error term is distributed normally is accepted. Hence, the result of the test shows that there is normal distribution.

To check for the presence of the problem of model misspecification and omitted variable bias, Ramsey Regression Specification Error Test (RESET) was employed. As the result of the test in Table 4 shows, there is no omitted variable bias and model misspecification problem since the test is insignificant at 5% level of significance.

Table4. *Summary of the Diagnostic Tests*

Test statistics	Type of test employed	Statistical Results
Serial correlation	Breusch-Godfery LM test	Prob> F= 0.9233
Functional form	Ramsey RESET test	Prob> F=0.5231
Normality	Shapiro-Wilk W test on residual	(Prob>z) = 0.87306
Heteroskedasticity	Breusch-Pagan test	Prob> chi2= 0.8144
Multicollinearity	Variance Inflating Factor (VIF)	Mean VIF= 1.22

3.4.4. Long Run Model Estimation

As shown from the result presented in table 5 below, the variables ASGDP, AIGDP, AGL and EDS are significant. The three variables; ASGDP, AIGDP AND AGL are significant at 1% level of significance. But, EDS is significant at 10% level of significance. ASGDP, AIGDP and EDS have significant negative effect on the dependent variable (AGDP). However, AGL significantly and positively affect the dependent variable. The Adjusted R square is high which about 86.32 percent. This implies that 86.32 percent of the variation in dependent variable is explained by the independent variables.

Table 5. *Long Run Relationship between Agricultural GDP and Explanatory Variables*

Dependent:AGDP	Coef.	Std. Err.	T	P>t
_cons	-0.72502	0.2247291	-3.23	0.005
ASGDP	-0.982634	0.0954396	-10.30	0.000***

SIGD	-0.5660535	0.1780724	-3.18	0.006***
AGL	0.8372484	0.2616058	3.20	0.006***
EDS	-0.0229328	0.0116888	-1.96	0.067*
ICP	-0.0124214	0.0251453	-0.49	0.628
EXIM	0.0171297	0.0275516	0.62	0.543

****significant at 1% and *significant at 10%. Adj. R squared=0.8632*

3.5. Impact of Agricultural Land (AGL) on Agricultural GDP

As shown in 5 above 1 percent increase in agricultural land resulted in increase of agricultural GDP by 0.837 percent. This result suggests the importance of the expansion of agricultural land to increase the agricultural production and eventually improve the Ethiopian economy through increasing the GDP share of agriculture. This finding is in line with the finding of Odhiambo et al., (2014) which suggested the positive influence of agricultural land on agricultural output growth in Kenya. The finding of Udry (2010) is also consistent with this result. According to this study, Labour productivity on farms and the use of agricultural inputs such as improved seed varieties, fertilizer and irrigation facilities have been limited (low) inSub Saharan Africa. Growth in agricultural output in the region has been due to increase in production through the extension of agriculture onto new land.

3.6. Impact of External Debt Stock (EDS) on Agricultural GDP

As the result of this study implies, external debt stock which expressed as a percentage of Gross National Income negatively affects the agricultural GDP at 10% level of significance. For 1 percent increase in external debt stock, the agricultural GDP decreases by 0.023 percent. Moreover, this finding is consistent was the finding ofGebru, (2015, PP.77) in which for each percent increase in external debt stock the Real GDP decreases by 0.042 percent.

3.7. Impact of Annual Growth in Industrial GDP (AIGDP) and Service GDP (ASGDP)

From the result it is shown that annual growth of both service and industrial GDP have a negative and significant impact on the agricultural GDP. One percent increase in annual growth of service and industrial output decreases the agricultural output by 0.983 and 0.566 percent respectively. This implies that the structural change towards service and industrial sector causes the agriculture's share of GDP to decline. Furthermore, this result is consistent with the finding of research report on Ethiopia's Great Run by the World Bank Group (2016, PP. 42). According to this report, service sector contributed to half of output growth on average between 1999 and 2013, while the average contribution of the agricultural sector was only one third of the output in the period. There was a decline in agriculture's share of total output from 57 percent in 1999 to 42 percent in 2013. However, service output increased from 33 to 45 percent and output share industrial sector was also increased from 10 to 13 percent in the same period.

4. Conclusion and Recommendations

This chapter provides the conclusion of the study and some policy recommendations, whichneed to be applied in order to improve the contribution of agricultural GDP to the national economy.

Agricultural share of GDP trends in Ethiopia have shown decreasing patterns from early 1990s to the beginning of 2000s. It was high in the early 1990s. However, it has been declined sharply between early 1990s and beginning of 2000s. It reached a minimum level of 40.12% in 2003. Even though agricultural GDP was reached a minimum level in 2003, it showed an upward trend between 2003 and 2013. This result is consistent with the finding of World Bank (2016, PP.43) in which agricultural output showed an increasing pattern between 2003 and 2013.

The result of the long run relationship shows a positive and significant association between agricultural land and GDP share of agriculture. One present increase in agricultural land caused agricultural GDP to increase by 0.837 percent at 5 % level. Effect of annual growth in industrial and service GDP on agricultural GDP is negative and significant at 5% level. One percent increase in annual growth of industrial and service sector caused the agricultural GDP to decrease by 0.566 and 0.982 percent respectively. The relationship between external debt and agricultural GDP is also negative and significant at 10% level. One percent increase in external debt caused the agricultural GDP to decrease by 0.0229 percent. However, the rate of national inflation and agricultural trade ratio are not significant. Hence, they have no significant long run effect on agricultural GDP.

5. Future Measures and Policy Recommendations

Even though expansion of agricultural land increase the agricultural production, cultivation into forest areas and steep slope causes an adverse environmental problems such as extreme soil erosion(loss of fertile soil) and rainfall fluctuations. These problems decrease the agricultural production in the long run. Therefore, the government should set the policy options that bring improvements in agricultural production in environmentally friendly way.

Although structural transformation produces efficiency gains through reducing the agricultural GDP, and increasing the service and industrial GDP, Agricultural sector is still playing a central role in poverty reduction and employment. Therefore the need of improving the productivity of agricultural sector is unquestionable. This requires the Government and other stakeholder's effort to modernize and commercialize the agricultural production, promoting foreign investments on the sector and improving access to input output market and agricultural credit at small holder level.

To tackle the negative impact of external debt stock on agricultural output, allocating resources on productive investment areas is the necessary measure or action that the government and other responsible stakeholders should take.

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