

Analyzing the Impact of China's and Japan's Loans on Economic Growth of Sub-Saharan Africa

Ekote Nelson Nnoko

Abstract

This study seeks to examine the impact of Japan and China's loans on the economic growth of Sub-Saharan Africa for five years, starting from the year 2011 to 2016. We also studied the aggregate effect, taking into consideration the total value of the variables for the five years. To cover the full impact of the debts, we considered the one-year lag of debt values against all other variables, including the dependent variable.

The results show that both Japan loans and China loans positively affect GDP growth in Sub-Saharan Africa. However, the impact of China loans is more significant than the impact of Japanese loans on the economic growth of Sub-Saharan Africa.

Keyword: Japan; China; Debts; Economic growth

I Introduction

Both foreign aids and public debts are essential sources of revenue to the government for building the needed infrastructures to stimulate economic growth. The surge in external public debts across countries in Sub-Saharan Africa in recent years has made it a prominent policy issue as to whether high debt levels hurt economic growth, as some literature explains. China and Japan have contributed significantly to this surge of public debts in Sub-Saharan Africa (SSA) in recent years, and China is the leading lender among other top world economic powers.

Japan and China, like many other economic superpowers, have, over the years,

introduced lots of debts and foreign direct investments (FDI) into Sub-Saharan Africa. However, although Japan started long before China, primarily through their Official Development Assistance (ODA) and other Aids, China has overtaken Japan, which was the most significant donor. China since 2000 has covered many more countries in Sub-Saharan Africa with lots of debts and FDI, making them a leading investor in Africa at the moment.

Even though Raposo P.A and potter D.M, 2010 argue that China and Japan aid policies in Sub-Saharan Africa share more similarities than dissimilarities and question the motif and the impact of this aids in Sub-Saharan.

The one big question is why so many nations, including Japan and China, rush to inject loans into Sub-Saharan Africa? Do these loans impact the economic growth of Sub-Saharan Africa? What is the nature and extent of the impact of these loans on economic growth? What is the comparative impact of China and Japan loans on the economic growth of Sub-Saharan Africa, and why?

This surge of debts in Sub-Saharan Africa within the current world economic situation increases the debt crisis in that region. To what extend is this surge of debts sustainable? Many countries in Sub-Saharan Africa are struggling with high levels of indebtedness, budget deficits, and weak growth. What then is the long-run impact of Japan and China loans on the economic growth of Sub-Saharan Africa?

The methodology of this study involves a panel data analysis of 49 countries in Sub-Saharan Africa, carrying out multiple regression analysis of data from the year 2011 to 2016. We also studied the aggregate effect, taking into consideration the total value of the variables for the five years. To cover the full impact of the debts, we considered the one-year lag of debt values against all other variables, including the dependent variable.

This study is very significant in that it adds to the existing literature. Its also educate governments and other stakeholders on debt management towards economic growth. This is also very valuable in solving the debt crisis in Africa and supplementing the work of other authors.

II Brief Literature Review

Modigliani (1961) reiterated the contributions of Buchanan (1958) and Meade (1958), postulating that the national debt is a burden for future generations, coming in the form of reduced flow of income from a lower stock of private capital. He cited the crowding-out effect and negative impact on the long-term interest rate as part of the burden. He cited that the gross burden of national debt could be partially or offset when the debt is employed to finance government expenditure that could contribute to the actual income of future generations (Modigliani, 1961).

Also, Reinhart and Rogoff confirmed that higher levels of government debts correlate negatively with economic growth, that there is no link between debts and growth when the debts are below 90% of GDP. The observations with debts to GDP above 90% have a mean growth rate almost 4 percent lower in advanced countries. (Reinhart and Rogoff, 2010a; Reinhart, Reinhart and Rogoff 2012).

On the other hand, Paul Krugman examined the tradeoff between financing and forgiveness to enable a country with debt overhang to meet its debt service requirement, suggesting that linking new money(debts) and possibly debt relief to measures of economic conditions could be to the mutual benefit of debtors and their creditors. Krugman (1988).

However, Deborah Brautigam and Jyhjong Hwang's estimate suggests that Chinese financiers have provided USD 86.3 billion to African governments and state-owned enterprises between 2000 and 2014 and that China is unlikely to cancel the debts. (Deborah Brautigam and Jyhjong Hwang, 2016).

Furthermore, Ivar Kolstad and Arne Wing found out that the Chinese foreign direct investments and debts are attracted to countries with enormous natural resources, and more so, the worse the institutional environment of host countries, the greater their interest in the country. That Chinese investment feeds into the institutional dysfunctions of resource-rich countries. (Ivar Kolstad and Arne Wing 2011).

On the other hand, the same as other developed nations, Japan has shown significant interest in Sub-Saharan Africa. However, according to Kweku Ampiah, Japan's initiative towards Africa until 1990 left no landmarks that call for celebration; Japan's foreign policies towards Africa were saddle with immobilized tendencies. (Kweku Ampiah 2010). However, Japan first became aware of Africa due to its vulnerability to the Japanese economy in the face of natural resources. (Makoto Sato 2005).

In respective of who the lender is, be it China, Japan, or others, many recent studies find support for a non-linear impact of external debt on economic growth, with a dexterous effect only after a certain debt-to-GDP ratio threshold. one of these studies is Pattilo et al. 2002 who found out that the impact of external debt on per-capital GDP growth is harmful to the present value of debt above 35-40% of GDP. (Pattillo et al., 2002).

III Empirical Model, hypothesis, data and methodology

1 Empirical model

Economists define and measure economic growth as either an increase in real GDP occurring over some time or an increase in real GDP per capita occurring over some time. (McConnell, Brue and Flynn 2009, p.159).

In this study, we used Real GDP (Gross Domestic Product) to measure economic growth. The gross domestic product (GDP) defines aggregate output as the dollar value of all final goods and services produced within a country's borders during a specific period, typically a year (McConnell, Brue and Flynn 2009, p.138).

Here, we derive the model from the expenditure approach or output approach of determining GDP. This approach looks pretty suitable given that we are analyzing the impact of external debts (China and Japan) on GDP growth.

$$GDP = C + I_g + G + X - M \dots\dots\dots (1)$$

Where, C (Consumption), I_g (Investment), G (Government spending), X (Export) and M (Import).

Also, another aspect of macroeconomic instability like real interest rate and inflation may affect an economy's level of actual output and thus its level of real income based on time and severity. Thus, it could be included in the model as follows.

$$GDP=C+Ig+G+X-M+Interest\ Rate+inflation \dots\dots\dots(2)$$

Given that our study investigates the impact of China and Japan loans on the economic growth of Sub-Saharan Africa, we would add two additional variables to the model. X_1 =Japan's loans to Sub-Saharan Africa.; X_2 =China's loans to Sub-Saharan Africa, Thus

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3C+\beta_4Ig+\beta_5G+\beta_6X-\beta_7M+\beta_8RealInterestrates +\beta_9Inflationrate+\mu. \dots\dots\dots(3)$$

$Y=GDP\ growth\ (current\ USD)=(GDP_n-GDP_{n-1}\ in\ Current\ USD)$, $X_1=Japan's\ loans\ to\ Sub-Saharan\ Africa\ 2011\ to\ 2015$, $X_2=China's\ loans\ to\ Sub-Saharan\ Africa\ 2011\ to\ 2015$, $X_3=General\ government\ final\ consumption\ expenditure\ (GGFCE)\ (current\ US\$)2012\ to\ 2016$, $X_4=Households\ and\ NPISHs\ Final\ consumption\ expenditure\ (HNFCE)\ (current\ US\$)\ 2012\ to\ 2016$, $X_5=Exports\ of\ goods\ and\ services\ (EGS)\ (current\ US\$)\ 2012\ to\ 2016$, $X_6=Imports\ of\ goods\ and\ services\ (IGS)\ (current\ US\$)2012\ to\ 2016$, $X_7=Gross\ capital\ formation\ (GCF)\ (current\ US\$)\ 2012\ to\ 2016$, $X_8=Real\ interest\ rate\ (RIR)\ (\%)\ 2012\ to\ 2016$, $X_9=Inflation,\ consumer\ prices\ (ICP)\ (annual\ \%)\ 2012\ to\ 2016$, $\mu=error\ term$.

The final model used for this study becomes.

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6-\beta_7X_7+\beta_8X_8+\beta_9X_9+\mu\dots\dots(4)$$

2 Hypothesis

The null hypotheses (Ho) here claim that Japan's loans and/or China's loans do not affect the economic growth of Sub-Saharan Africa. The alternative hypotheses (H1) claim that Japan's loans and/or China's loans to Sub-Saharan Africa affect the economic growth of Sub-Saharan Africa. If the alternative hypotheses are accurate, we will infer that the changes in the Japan loans and China loans variables

contribute to the changes in GDP growth in Sub-Saharan Africa.

3 Data and Methodology

We employ macroeconomic data set on 49 countries in Sub-Saharan Africa for five years (2011 to 2016).

We employ a primary source, World Development Indicators (WDI) database 2020 of the world bank. Data from International Monetary Fund and International Financial Statistics are also employed. For China loans, the study used the database of www.aiddata.org and Johns Hopkins SAIS China-Africa Research Initiative, and for Japan loans, we used data from www.mofa.go.jp and www.jetro.go.jp.

We used one-year lag of loan data ($n-1$) against n year of other macroeconomic variables in order to capture the full impact of the loans on GDP growth. This cross-sectional analysis also considers data from 2011 to 2016, analyzed annually, and the total of the data for the five years.

Table 1. summary statistics of some key variables of the study.

<i>Japan Loans (X1)</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
Mean	61.96	35.70	53.16	25.54	29.73
Median	24.02	17.86	23.75	11.19	17.2
Standard Deviation	174.81	44.97	78.86	28.97	44.84
Minimum	0	0	0	0	0
Maximum	1216.11	225.87	338.43	113.99	223.55
Count	49	49	49	49	49
<i>China Loans (X2)</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
Mean	190.01	261.14	371.82	246.31	255.68
Median	7.936	48	0	0	0
Standard Deviation	549.59	505.63	1060.83	635.76	553.20
Minimum	0	0	0	0	0
Maximum	3563.14	2088.01	6623.16	3730	2570.12
Count	49	49	49	49	49
<i>GDP G. (Y)</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>
Mean	1.79E+09	2.2E+09	1.7E+09	-3.4E+09	-2.2E+09
Median	1.5E+08	5.82E+08	2.54E+08	-5.6E+08	6.6E+07
Standard Deviation	8.17E+09	9.63E+09	8.47E+09	1.24E+10	1.3E+10
Minimum	-2E+10	-3E+10	-1.6E+10	-7.4E+10	-9E+10
Maximum	4.9E+10	5.56E+10	5.35E+10	1.46E+10	9.7E+09
Count	49	49	49	49	49

Source: Author

Table 1 presents the descriptive statistics of some key variables in which we study to investigate their cause-and-effect relationships. The mean of loans disbursed by China from 2011 to 2015 is higher than the mean of loans disbursed by Japan. The median and standard deviation of China's loans to Sub-Saharan Africa are higher than those of Japan within the same period. Therefore, this means that the volumes of China loans to Sub-Saharan Africa within this period are higher than of Japan. The question here is to what extent does the volume of loans affects GDP growth?

The mean of GDP growth beginning from the years 2012, 2013, and 2014 are positive, while the mean for 2015 and 2016 are negative. Therefore, GDP growth within this region has not been consistent within this period and could be due to the independent variables' impact, including Japan and China's loans to the region

IV Data Analysis

1) 2011 Japan and China's loans together with 2012 other macroeconomic variables including GDP growth. (Model 1, Year 1)

Table 2. Correlation Coefficient of 2011 Japan and China's loans together with 2012 other macroeconomic variables including GDP growth (Model 1)

	(X1)2011	(X2)2011	(X3)2012	(X4)2012	(X5)2012	(X6)2012	(X7)2012	(X8)2012	(X9)2012	(Y)2012
(X1)2011	1.0									
(X2)2011	0.1	1.0								
(X3)2012	-0.0	0.2	1.0							
(X4)2012	-0.0	0.0	0.6	1.0						
(X5)2012	0.1	0.1	0.3	0.9	1.0					
(X6)2012	-0.0	0.0	0.3	0.9	1.0	1.0				
(X7)2012	-0.1	0.1	0.5	1.0	1.0	1.0	1.0			
(X8)2012	-0.1	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	1.0		
(X9)2012	0.1	0.1	0.0	-0.0	-0.1	-0.1	-0.0	-0.1	1.0	
(Y)2012	0.1	0.3	0.1	0.3	0.2	0.0	0.2	-0.1	0.1	1.0

Source: Author

This year's analysis shows a positive correlation between Japan's and China's loans on GDP growth. However, there is a negative correlation between real interest

Table 3. Regression Results of year one analysis. (Model 1, Year 1 Analysis).

	Coefficients	t -Stat	P-value
(Y)2012	653761375	1.3758	0.1767
(X ₁)2011	1292688.47	0.7228	0.4741*
(X ₂)2011	5779601.39	7.2200	1.071E-08**
(X ₃)2012	-0.64	-9.7515	5.1931E-12**
(X ₄)2012	0.19	5.6588	1.5417E-06**
(X ₅)2012	0.13	2.7745	0.0084*
(X ₆)2012	-0.55	-11.71	2.414E-14**
(X ₇)2012	0.48	3.005	0.0046*
(X ₈)2012	52450406.4	1.574	0.1233
(X ₉)2012	-99189695.87	-2.6862	0.0105*
Observations	49	* = p < 0.05	
R square	0.9519	** = p < 0.1	

Source: Author

rate and GDP growth.

The R square of 0.9519 shows that 95% of independent variables contribute to the dependent variable. In addition to that, the probability of the F test is 6.7902E-23, very close to zero, making the model fitting and very explanatory. The P-value of the t-statistics of Japan's loans is above the critical value of 0.05 given the 95% confidence interval. Thus, we cannot reject the null hypothesis that Japan's loans over this period do not contribute to the economic growth of Sub-Saharan Africa. The P-value of the China loan is less than 0.05, at a 95% confidence interval. Thus, we reject the null hypothesis and accept the alternative hypothesis that China loans affect the economic growth of Sub-Saharan Africa.

2) 2012 Japan and China' loans together with 2013 other macroeconomic variables including GDP growth. (Model 2, Year 2)

In model 2 analysis (2011 vs. 2012), both Japan's 2012 and China's 2012 loans positively correlate with GDP growth in 2013. However, the General government's final consumption expenditure for 2013 and the import of goods and services for 2013 negatively correlated with GDP growth in 2013.

The R square in this regression is 0.8850; thus, 88% of the independent variable does contribute to the dependent variable. Also, Significance F is 1.3141E-15, very

Table 4. Correlation Coefficient of annual values of 2012 Japan and China' loans together with 2013 other macroeconomic variables including GDP growth (Model 2)

	(X ₁)2012	(X ₂)2012	(X ₃)2013	(X ₄)2013	(X ₅)2013	(X ₆)2013	(X ₇)2013	(X ₈)2013	(X ₉)2013	(Y)2013
(X ₁)2012	1									
(X ₂)2012	0.1	1.0								
(X ₃)2013	0.0	0.2	1.0							
(X ₄)2013	0.0	0.1	0.6	1.0						
(X ₅)2013	-0.1	0.0	0.3	0.8	1.0					
(X ₆)2013	-0.1	0.0	0.3	0.8	1.0	1.0				
(X ₇)2013	0.0	0.1	0.5	0.9	0.9	0.9	1.0			
(X ₈)2013	0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	1.0		
(X ₉)2013	0.1	0.1	0.1	0.1	-0.1	-0.1	0.0	0.2	1.0	
(Y)2013	0.1	0.2	-0.0	0.1	0.0	-0.0	0.2	0.1	0.1	1.0

Source: Author

Table 5. Regression Results of year two Analysis. (Model 2)

YEAR 2	Coefficients	t -Stat	P-value
(Y)2013	287745788	0.3424	0.7338
(X ₁)2012	41767279.1	2.3285	0.0251*
(X ₂)2012	1986571.71	1.5825	0.1216
(X ₃)2013	-0.53	-4.0315	0.00024**
(X ₄)2013	0.12	3.80	0.0004**
(X ₅)2013	0.48	3.14	0.0041**
(X ₆)2013	-0.87	-5.43	3.1687E-06**
(X ₇)2013	0.46	1.72	0.092*
(X ₈)2013	92813269.6	1.562	0.1262
(X ₉)2013	-71578610.8	-0.8264	0.4135
Observations	49	* = p < 0.05	
R square	0.8850	** = p < 0.1	

Source: Author

closed to zero, thus making the model very fitting for this analysis. Here the P-value of the t-statistic of Japan's loans to Africa in 2012 is less than 0.05 at a 95% confidence interval, thus rejecting the null hypothesis and accepting the alternative hypothesis that Japan's loans in 2012 contribute to the economic growth of Sub-Saharan Africa. On the other hand, in China's loans in 2012, the P-value of the t-statistics is above 0.05 at a 95% confidence interval, thus do not reject the null hypothesis which says China's loans in 2012 do not contribute to the economic growth of Sub-Saharan Africa.

3) 2013 Japan and China Debts together with 2014 other macroeconomic variables including GDP growth.

Table 6. Correlation Coefficient of annual values of 2013 Japan and China Debts together with 2014 other macroeconomic variables including GDP growth (Model 3, Year3)

	(X ₁)2013	(X ₂)2013	(X ₃)2014	(X ₄)2014	(X ₅)2014	(X ₆)2001 4	(X ₇)2014	(X ₈)2014	(X ₉)2014	(Y)2014
(X ₁)2013	1.0									
(X ₂)2013	0.2	1.0								
(X ₃)2014	0.0	0.2	1.0							
(X ₄)2014	-0.0	0.2	0.6	1.0						
(X ₅)2014	-0.1	0.0	0.3	0.8	1.0					
(X ₆)2014	-0.1	0.0	0.3	0.8	1.0	1.0				
(X ₇)2014	-0.0	0.2	0.5	0.9	1.0	1.0	1.0			
(X ₈)2014	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	1.0		
(X ₉)2014	0.1	0.1	0.1	0.1	-0.1	-0.0	0.0	0.8	1.0	
(Y)2014	0.1	0.3	0.2	0.5	0.1	0.1	0.3	0.1	0.2	1.0

Source: Author

The year three analysis (2013 vs. 2014) shows that all the independent variables, including Japan's and China's loans of 2013, are positively correlated with the GDP growth of 2014.

Table 7. Regression results Year three analysis. (Model 3, Year 3 Analysis)

YEAR 3	Coefficients	t -Stat	P-value
(Y)2014	237564636	0.4168	0.6790
(X ₁)2013	12162916.9	1.9390	0.0597
(X ₂)2013	793532.23	1.4196	0.1636
(X ₃)2014	-0.26	-3.1173	0.0034**
(X ₄)2014	0.10	3.41	0.0015**
(X ₅)2014	0.36	3.05	0.0040**
(X ₆)2014	-0.70	-5.86	7.9663E-07
(X ₇)2014	0.34	1.56	0.1256
(X ₈)2014	62310474.6	1.246	0.2200
(X ₉)2014	-94092192.1	-0.9707	0.3376
Observations	49	* p < 0.05	
R square	0.9206	**p < 0.1	

Source: Author

R Square is 0.9206 thus about 92% of independent variables actually contribute to the dependent variable. More to that, Significance F is 1.0788E-18 very close to Zero. Thus, making this model good and suitable for the analysis. The P-value of the t-

statistics of China loans and Japan loans to Sub-Saharan Africa are above 0.05 at 95% confidence interval. Thus, we do not reject the null hypothesis, claiming that China and Japan loans to Sub-Saharan Africa in this year 2013 do not contribute to the economic growth of the region.

4) 2014 Japan and China Debts together with 2015 other macroeconomic variables including GDP growth. (Model 4, Year 4)

Table 8. Correlation coefficient of variable values of 2014 Japan and China Debts together with 2015 other macroeconomic variables including GDP growth (Model 4)

	(X ₁)2014	(X ₂)2014	(X ₃)2015	(X ₄)2015	(X ₅)2015	(X ₆)2015	(X ₇)2015	(X ₈)2015	(X ₉)2015	(Y)2015
(X ₁)2014	1.0									
(X ₂)2014	0.4	1.0								
(X ₃)2015	0.1	0.2	1.0							
(X ₄)2015	0.0	0.1	0.6	1.0						
(X ₅)2015	-0.1	-0.0	0.2	0.6	1.0					
(X ₆)2015	-0.1	0.0	0.3	0.8	1.0	1.0				
(X ₇)2015	0.0	0.1	0.5	0.9	0.9	0.9	1.0			
(X ₈)2015	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	1.0		
(X ₉)2015	0.2	-0.1	0.0	-0.0	-0.1	-0.1	-0.1	0.0	1.0	
(Y)2015	0.1	-0.1	-0.8	-0.7	-0.2	-0.2	-0.5	-0.0	0.1	1.0

Source: Author

In the year four analysis (2014 Vs. 2015), Japan's 2014 loans correlate positively while China's 2014 loans are correlated negatively with Sub-Saharan Africa GDP growth of 2015.

The R Square is 0.8740; thus, the independent variable explains about 87% of the dependent variable. Also, the Significance F is 7.4248E-15, very close to zero, thus explaining the model's suitability. The P-value of the t-statistics of China's loans and Japan's loans to Sub-Saharan Africa is above 0.05 at a 95% confidence interval. Thus, we do not reject the null hypothesis, claiming that China's and Japan's loans to Sub-Saharan Africa in this year 2014 do not contribute to the economic growth of the region.

Table 9. Regression results of Year 4 analysis. (Model 4, Year 4 Analysis)

	Coefficients	t -Stat	P-value
(Y)2015	-2020446308	-1.7012	0.0968
(X ₁)2014	54271357.7	1.590	0.1198
(X ₂)2014	-256790.58	-0.19	0.8484
(X ₃)2015	-0.61	-3.934	0.0003**
(X ₄)2015	-0.07	-1.88	0.0669
(X ₅)2015	-0.83	-2.54	0.0151*
(X ₆)2015	1.41	3.18	0.0028**
(X ₇)2015	-0.65	-2.38	0.022*
(X ₈)2015	-108745961	-1.38	0.1743
(X ₉)2015	154752513	1.77	0.0831
Observations	49	* p < 0.05	
R square	0.8740	**p < 0.01	

Source: Author

5) 2015 Japan and China Debts together with 2016 other macroeconomic variables including GDP growth. (Model 5, year 5)

Table 10. Correlation Coefficient variables values of 2015 Japan and China Debts together with 2016 other macroeconomic variables including GDP growth. (Model 5)

	(X ₁)2015	(X ₂)2015	(X ₃)2016	(X ₄)2016	(X ₅)2016	(X ₆)2016	(X ₇)2016	(X ₈)2016	(X ₉)2016	(Y)2016
(X ₁)2015	1.0									
(X ₂)2015	0.7	1.0								
(X ₃)2016	0.2	0.1	1.0							
(X ₄)2016	0.2	0.0	0.5	1.0						
(X ₅)2016	-0.1	-0.1	0.2	0.8	1.0					
(X ₆)2016	-0.0	-0.0	0.2	0.8	1.0	1.0				
(X ₇)2016	0.1	0.0	0.4	0.9	0.9	1.0	1.0			
(X ₈)2016	-0.1	0.0	-0.2	-0.1	-0.1	-0.1	-0.2	1.0		
(X ₉)2016	0.3	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1	1.0	
(Y)2016	-0.2	0.1	-0.5	-0.7	-0.1	-0.1	-0.4	0.0	-0.0	1.0

Source: Author

In year five (2015 vs. 2016) analysis, Japan's 2015 loans correlate negatively while China's 2015 loans correlate positively with the Sub-Saharan Africa GDP growth for 2016.

The R Square is 0.9228; thus, the independent variable explains about 92% of the dependent variable. Also, the Significance F is 6.35052E-19, very close to zero, thus explaining the model's suitability.

Table 11. Regression Results of year Five analysis. (Model 5, Year 5 Analysis)

	Coefficients	t -Stat	P-value
(Y)2016	19784169.5	0.020	0.9839
(X ₁)2015	-6954300.66	-0.28	0.777
(X ₂)2015	2019113.84	1.18	0.2450
(X ₃)2016	-0.11	-1.23	0.2258
(X ₄)2016	-0.38	-10.89	2.131E-13**
(X ₅)2016	-0.81	-3.25	0.0023**
(X ₆)2016	1.25	3.56	0.0009**
(X ₇)2016	0.25	1.05	0.2963
(X ₈)2016	-24117279.4	-0.32	0.7492
(X ₉)2016	84842.40	0.0067	0.9946
Observations	49	* p < 0.05	
R square	0.9228	**p < 0.1	

Source: Author

The P-value of the t-statistics of China's loans and Japan's loans to Sub-Saharan Africa is above 0.05 at a 95% confidence interval. Thus, we do not reject the null hypothesis, claiming that China's and/or Japan's loans to Sub-Saharan Africa in this year 2014 do not contribute to the region's economic growth.

6) Total sum of 2011 to 2015 Japan's and China's loans and the total sum of 2012 to 2016 other macroeconomic variables including GDP growth. (Aggregate model)

Table 12. Correlation Coefficient of summation of variable values of total sum of 2011 to 2015 Japan and China loans together with total sum of 2012 to 2016 other macroeconomic variables including GDP growth. (Aggregate model)

	(X1)2011-2015	(X2) 2011-2015	(X3)2012- 2016	(X4)2012-2016	(X5)2012-2016	(X6) I2012-2016	(X7)2012- 2016	(X8)2012-2016	(X9)012-2016	(Y)2012-2016
(X1)2011-2015	1.0									
(X2)2011-2015	0.4	1.0								
(X3)2012-2016	0.0	0.2	1.0							
(X4)2012-2016	0.0	0.1	0.6	1.0						
(X5)2012-2016	-0.1	0.0	0.2	0.8	1.0					
(X6)2012-2016	-0.1	0.0	0.3	0.8	1.0	1.0				
(X7)2012-2016	0.0	0.2	0.5	1.0	1.0	1.0	1.0			
(X8)2012-2016	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	1.0		
(X9)2012-2016	0.1	0.0	0.1	0.0	-0.1	-0.1	-0.0	0.1	1.0	
(Y)2012-2016	0.3	0.3	-0.8	-0.3	-0.2	-0.2	-0.3	0.1	0.1	1.0

Source: Author

The aggregate correlation analysis shows that Japan's and China's loans correlate positively with the GDP growth of Sub-Saharan Africa within the said study period. therefore, it means that its falls with the thresholds of public debt to GDP ratio in which debts do positively impact and enhance economic growth.

Table 13. Regression Results of combined or aggregate model.

	Coefficients	t -Stat	P-value
(Y)2012 -2016	-1032890931	-0.9247	0.3607
(X1)2011-2015	5272608.1	1.73	0.0912
(X2)2011-2015	2559881.2	5.90	7.0576E-07**
(X3)2012-2016	-0.52	-18.20	1.1532E-20**
(X4)2012-2016	0.04	3.39	0.0015**
(X5)2012-2016	-0.22	-5.20	6.5063E-06**
(X6)2012-2016	0.17	3.49	0.0012**
(X7)2012-2016	0.13	1.72	0.0916
(X8)2012-2016	-1061344.65	-0.0622	0.9507
(X9)2012-2016	13778476.8	1.4003	0.1693
Observations	49	* p < 0.05	
R square	0.9538	**p < 0.1	

Source: Author

The regression equation of the sum total of Japan and China loan from 2011 to 2015 together with the sum total of others macroeconomics variable from 2012 to 2016.

The R square of the aggregate model is 0.9538; thus, about 95% of the dependent variable is explained or contributed by independents variables. Therefore, it shows the model is goods and appropriate for this study. The significance F is 3.117E-23, very closed to zero. On the t-statistics, the P-value of aggregate Japan loans is above 0.05 at a 95% confidence interval. Thus, we do not reject the null hypotheses claiming that Japanese loans do not affect the economic growth of Sub-Saharan Africa. On the other hand, the P-value of aggregate China loans is below 0.05 at a 95% confidence interval; thus, we reject the null hypotheses and accept the alternative hypothesis, which says China loans affect the economic growth of Sub-Saharan Africa.

V Conclusion

In this study, we explore the impact of Japan's and China's loans on the economic growth of Sub-Saharan Africa, for five years, from the year 2011 to 2016. We also studied the aggregate effect, taking into consideration the total value of the variables for the five years. To cover the full impact of the debts, we considered the one-year lag of debt values against all other variables, including the dependent variable (GDP growth). All values were in current values in USD and not percentages. In year one analysis (model 1), China's loans P-value $1.071\text{E-}08 < 0.05$, thus rejecting null hypotheses and accepting alternative hypotheses that claim China's loans affect Sub-Saharan Africa's economic or GDP growth. In contrast, the P-value of Japan loans in the same year is $0.474107 > 0.05$; this accepting the null hypothesis, which claimed that Japan's loans do not affect the GDP growth of Sub-Saharan Africa. Furthermore, in year two (model 2), the P-value of Japan's loans is $0.0251607 < 0.05$; thus, we reject the null hypotheses and accept the alternative hypotheses, which claim that Japan's loans affect the economic growth of Sub-Saharan Africa. In the same year model, the P-value of China's loans is $0.12160125 > 0.05$; thus, do not reject the null hypotheses claiming that China's loans affect economic growth. On the subsequent models (model 3, model 4, model 5) of year 3, 4, 5, the P-values of both Japan's and China's loans is more significant than 0.05; thus, we do not reject the null hypotheses claiming that they do not affect the economic growth of sub-Saharan Africa. On the same scale, the correlation between these two loan variables and GDP growth alternated positively and negatively at different times. Thus, confirming the non-linear relationship between public debt and economic growth as cited by Pattillo et al. 2002.

Although the P-value of China's loans in the aggregate model is $7.0576\text{E-}07 < 0.05$, Rejecting the null hypotheses and that of Japan's loan $0.09122067 >$, 0.05 do not reject the null hypotheses.

We would conclude that both Japan and China loans have a positive effect on

economic growth, although the impact of China seems to be greater than that of Japan. However, this study does not analyze the extent and nature of their impact.

It is also essential to understand that China's and Japan's loans are just a portion of public debts in Sub-Saharan Africa and may not cover the complete causality of public debt on economic growth within the region. Also, the political situations, governance, and management of public investments affect public debt on economic growth, and This study does not cover this aspect.

Finally, most countries in Sub-Saharan Africa have huge inherited debts called debt overhang, requiring high debt servicing cost and making debt sustainability and maximization a problematic task. Lenders like China and Japan needs to consider linking new loans and possibly debt reliefs to measure economic conditions for the mutual benefit of the debtors and their creditors, as suggested by Paul Krugman (1988).

References

- Brautigam, Deborah, and Jyhjong Hwang 2016 Eastern Promises: New Data on Chinese Loans in Africa, *Working Paper* No. 2016/4. China-Africa Research Initiative, School of Advanced International Studies, Johns Hopkins University, Washington, DC. Retrieved from <http://www.sais-cari.org/publications> (accessed 2021-5-25).
- Kweku Ampiah (2010), Japan and Commonwealth Africa, *The Round Table*, 99:409, 413-428, DOI: 10.1080/00358533.2010.498978.
- Meade J. E. (1858), Is the National Debt a Burden? *Oxford Economics papers, New series*, Vol. 10 No. 2, 163-183.
- Merton H. Miller and Franco Modigliani (1961), Dividend Policy, Growth, and the valuation of shares, *the Journal of Business*, Vol. 34 No. 4, 411-433.
- Milton A. Iyoha (1999), External Debt and Economic growth in Sub-Saharan African countries: An Econometric Study, *African Economic Research consortium*, RP90, 10-32.
- Modigliani, F. (1961), Long-Run Implications of Alternative Fiscal Policies and the Burden of the National Debt. *The Economic Journal*, 71(284), 730-755. doi:10.2307/2228247.
- Paul Krugman (1988), Financing Vs. Forgiving a debt overhang, *National Bureau of Economic Research, NBER working paper #2486*, January 1988.
- Pedro Amakasu Raposo and David M. Potter (2010), Chinese and Japanese development co-operation: south-south, North-South, or what? *Journal of Contemporary African Studies*, 28:2, 177-202, DOI.10.1080/02589001003736819.

- Raphael Kaplinsky (2013), What Contribution Can China Make to Inclusive Growth in Sub-Saharan Africa? *Development and Change* 44(6): 1295-1316.DOI:10.1111/dech. 12059.
- Reinhart, C. M., Rogoff, K. S. (2010), Growth in Time of Debt, *American Economic Review*, 73-578.
- Sanjeev Gupta, Catherine Pattillo and Smita Wagh (2006), Are Donors Countries Giving More or Less Aid, *Review of Development Economics*, 10(3), 535-552.
- Sato Makoto (2005), Japanese Aid Diplomacy in Africa: An Historical Analysis, *Ritsumeikan Annual Review of International Studies*, 2005.ISSN 1347-8214. Vol. 4 66-85.