

# Macroeconomic Volatility and Macroeconomic Indicators among Sub-Saharan African Economies

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## Abstract

This study explored how disaggregated macroeconomic volatility parameters impact key macroeconomic indicators in Sub-Saharan Africa. The study employed a number of external and regional macroeconomic volatility parameters derived from macroeconomic data sourced from the IMF in its empirical analysis. Dynamic Panel fixed effect model employed show that regional macroeconomic volatility parameters tend to have more statistically significant impact (positive and negative) on performance indicators in the sub-region than external macroeconomic volatility parameters. This study also finds that among regional macroeconomic volatility parameters shaping growth conditions in the sub-region, investment growth volatility is the dominant condition with statistically significant impact on key macroeconomic indicators in the sub-region. Results further point to evidence of significant moderating effects in how external and regional macroeconomic volatility parameters impact regional macroeconomic indicators.

**Keywords:** Macroeconomic Volatility, international trade, economic performance indicators, sub-Saharan African economies

*JEL Classification:* F1, F3, F4, E1

## 1. Introduction

Growing interactions among economies with varied domestic macroeconomic structures, a feature of evolving trends in international commerce, continues to be a key macroeconomic trend responsible for significant growth in most developed and developing economies. Although Smithian and Ricardian theories, as well as modern adaptive theories of international trade differ somewhat, on how international trade and economic interactions impacts participating economies, the general consensus suggests most participating economies benefits from such interactions. These benefits, according to the literature, stems from access to broader markets, and ensuing exchanges due to differences in resource endowments and technological knowhow. Expansion in cross-national trade necessitated by such fundamental disparities has also been found to be crucial in bridging major economic gaps among participating economies with varied domestic macroeconomic structures. These benefits notwithstanding, present trends in international commerce suggests the drive to major on country specific comparative advantages, a central tenet in international commerce, had led to, and continues to foster economic interdependence especially among developing economies. This drive to gain access to external markets in order to support regional export oriented policies, has also inadvertently exposed most less developed economies to macroeconomic volatilities inherent in the global market place (mostly dominated by advanced and emerging economies). Related literature for instance suggest that, less developed economies (Note 1) who have been mostly insulated from extreme swings in global commerce due to limited interactions and exposure, are now becoming increasingly susceptible to occasional shocks associated with international commerce due to growing interactions. Understanding effects of this growing interaction and exposure to global markets on developing economies is thus crucial; in that, the condition defines how key performance indicators in the sub-region ultimately influence economic growth and living standards. For instance, Addison et al (2007) showed that volatilities inherent in global markets have significant impact on both regional and country specific macroeconomic indicators of participating economies.

Empirical findings however, on the extent to which (external) macroeconomic volatility impact key macroeconomic indicators of participating economies, and how such economies cope with the condition differ significantly. Analysts for instance, differ sharply on what makes some economies more susceptible to external

macroeconomic perturbations than others. Empirical studies nevertheless, suggest that effects of occasional volatility and shocks associated with international commerce might be more severe on less developed economies than their developed counterparts; Kraay and Ventura (2007). Referencing this conclusion, some analysts have argued that SSA economies are more prone to external volatilities resulting from increasing involvement in global commerce due to relatively weak regional economic structures and constrained economic policies needed to manage the condition. Analysis of historical trade dynamics on Sub-Saharan Africa show that until recent decades, the sub region, compared to other economic blocks around the world had minimal interactions and limited access to global markets due to trade barriers and socio-political constraints. Recent trends however, suggest most economies in the sub-region are becoming more and more integrated into the global market economy through expansion in exports, foreign direct investments, networked financial systems etc. Apart from these known traditional means of forging and expanding economic interactions, available evidence further suggest that recent growth in economic interactions for most economies in the region has resulted from mutually beneficial socio-economic and political factors. For instance, trade agreements aimed at promoting export base of economies in the sub-region to support poverty alleviation programs, and access to internet based financial network systems which have made it possible to integrate financial and banking operations into the global financial system are but few of these emerging factors. These evolving conditions coupled with other macroeconomic drivers in the sub-region continue to expose the sub-region to potentially risky macroeconomic conditions associated with global commerce.

The view that most participating economies benefits from international commerce is not in dispute in this study; this study only seeks elicit discussions on whether such benefits outweighs constant risk of exposure to shocks with potential to stall growth or bring about total economic collapse for mostly ill-prepared developing economies. Studies show that external macroeconomic volatility has the potential to exert significant positive or negative influence on performance indicators of participating economies. Further evidence suggest that depending on the nature and trigger of economic volatility or shock, the condition could enhance critical macroeconomic indicators of participating economies bringing about badly needed growth; or suppress them, leading to constrained economic performance. Aghion et al. (2004) for instance, showed that, financial openness (a feature of growing market exposure and interactions) has the potential to destabilize domestic economy of less developed economies by inducing massive swings in capital inflows and outflows during economic booms and downturns. Easterly et al. (2001) additionally showed that increase trade openness (another key feature of growing economic interactions) has significant impact on output volatility among developing economies. Buch et al. (2005) further determined that the link between financial openness (an element of exposure) and business cycle volatility among economies depend on the nature of underlying shocks economies are exposed to.

Additionally, Bekaert, Harvey and Lundblad (2001), who examined effects of financial market liberalization on economic growth, also submitted that the condition has significant positive impact on per capita GDP growth. Focusing on the link between foreign direct investment (FDI) inflows and per capita income among selected SSA economies, Fotso (2003) further concluded that FDI-related technology transfers (due to economic interactions) has positive effects on growth conditions among SSA economies. Delechat et al (2009) also found that net capital flows resulting from economic exchanges correlates positively with growth rate in 44 SSA economies. Edison, Levine, Ricci and Sløk (2002) however, found no significant relationship between financial/economic integration and economic performance. This succinct empirical review to some extent, highlights prevailing views on how financial/trade openness or exposure influence performance indicators among participating economies.

This study evaluates effects of macroeconomic volatility on macroeconomic indicators in SSA using disaggregated volatility approach; this approach derives a number of macroeconomic volatility parameters - both external and regional, and tests how each parameter affects key macroeconomic indicators in SSA. Following Delechat et al (2009), this study subscribe to the view that expansion in international trade, and integration of economies in the sub-region into the global economy has been crucial for growth in the sub-region. Available data further supports this view that the sub-region owes much of its recent economic success to sustained growth in exports and FDI inflows; a direct product of growing interactions and access to global capital flows. However, this study is of the view that unlike most advanced economies that are well equipped with robust macroeconomic structures and strong policy expertise to cope with shocks associated with global commerce, the SSA economy might not be well equipped to deal with economic threats from growing access and exposure to global commerce. This study consequently estimates relationships between disaggregated fundamental volatility parameters and

key performance indicators for SSA; with emphasis on verifying how selected macroeconomic indicators in the sub-region respond to or are shaped by regional and external macroeconomic shocks or volatility.

External macroeconomic volatility in this study defines variability associated with macroeconomic indicators among advanced economies around the world as defined by the IMF. This definition presumes that macroeconomic activities among advanced economies such as the USA, most economies in the European Union etc, to a greater extent, drives much of global commerce and as such, the volatilities involve. This study hypothesizes that macroeconomic volatility and shocks inherent in international commerce dominated by advanced economies could be responsible for depressed growth among exposed less developed economies like those in SSA. Consequently, this study is modeled to estimate how specific volatility parameters – both external and domestic, influence performance indicators in the sub-region. Currently, two views dominate ongoing debate about the relationship between external macroeconomic volatility and performance indicators among economies in the sub-region. The first view surmise that, despite growing integration and purported exposure, financial market operations and economic structures in the sub-region are still less developed and relatively detached from the global financial system to be significantly impacted by external macroeconomic shocks. Proponents of this view for instance, argue that most economies in the sub-region still operates at the subsistence level, with most resources obtained domestically; consequently, external macroeconomic shocks may have little or no significant impact on key regional performance indicators as some have argued. Advocates further argue that compared to most advanced economies, consumption patterns in the sub-region are less credit dependent, a condition which makes economies in the sub-region less susceptible to credit and financial market shocks. Thus, to proponents of this view, external macroeconomic volatility or shocks may have relatively minor impact if any, on key macroeconomic indicators among economies in the sub-region. Opponents however, point out that, growing exposure to external market coupled with weak regional macroeconomic structures and policies capable of absorbing such shocks, constitutes significant threats to long term growth conditions in the sub-region.

This study projects significant relationship between both external and regional macroeconomic volatility parameters and key macroeconomic indicators from the sub-region; it is further anticipated that varied macroeconomic indicators from the sub-region will respond differently to various volatility parameters in this study. To verify these projections, this study provide empirical examination of the nexuses between external and regional macroeconomic volatility parameters generated and selected macroeconomic indicators for SSA. Empirical approach adopted in this study has been motivated in part by lack of empirical study focusing on how disaggregated macroeconomic volatility parameters influence macroeconomic indicators in SSA. This study is also part of evolving literature exploring associations between distortions in macroeconomic condition and growth performance among less developed economies. Macroeconomic performance in the sub-region is modeled using five economic indicators; namely, Gross Domestic Product (GDP) growth, inflation rate, investment growth, gross national savings and current account balance condition. External and regional/domestic Macroeconomic volatility parameters on the other hand are estimated from selected macroeconomic indicators associated with advanced economies as defined by the IMF.

The rest of the study is structured as follows; section two discuss macroeconomic dynamics in Sub-Saharan Africa with specific emphasis on selected performance indicators employed in this study. Section three presents succinct account of empirical literature on the general relationship between fundamental macroeconomic volatility and macroeconomic indicators. Section four estimates external macroeconomic volatility as define in this study and describe sources and data type use in this study. Section five derives and states empirical model as well as auxiliary tests procedures employed in the study. Analysis of test results, possible policy implications of study findings and conclusions are presented in the final section.

## **2. Macroeconomic Conditions among SSA Economies and External Volatility**

The extent to which external macroeconomic volatility parameter impacts performance indicators among economies in the sub-region is projected to depend on two key conditions. Following Watts and Bohle's (1993) and Moser (1998) on the concept of vulnerability; this study projects that, the extent of vulnerability to macroeconomic shocks associated with economies in the sub-region depends on two main conditions:- degree of exposure and relative inbuilt capacity to cope or minimize the condition. According to Watts and Bohle's (1993) and Moser (1998), the degree of exposure to an external threats or shock, and the relative capacity to cope or the resilience of an entity to external threats or shock, are the dominant factors determining vulnerability or how variables responds to or are impacted by an external condition. In order words, this approach suggests that performance of macroeconomic indicators in SSA in the face of external shocks depends on how exposed the region is to the specific shock, and inbuilt regional capacity to cope with the shock or threat. Following this reasoning, this study again projects that modeled macroeconomic volatility parameters will have significant

impact on key macroeconomic indicators from the sub-region due to growing exposure to volatilities in the global market place. This threat from external macroeconomic volatility due to increasing exposure is further expected to be aggravated by weak regional economic policies and structures crucial in coping with potential effects of volatility or shocks. The following section discusses historical trends in key macroeconomic indicators employed in this study.

### 2.1 GDP Growth

Regional GDP growth data indicates growth conditions among economies in the sub-region differ significantly. Specific domestic factors such as differences in natural resource endowment etc. continue to influence regional conditions leading to disparities in economic growth. Oil producing economies in the region for instance, tend to experience relatively higher GDP growth than economies lacking the resource. Aggregate IMF GDP growth data for the sub-region as a whole, further document significant uneven growth conditions over the past decades. The data for instance shows the sub-region has witnessed significant fluctuations in GDP growth over the past two decades. Much of the fluctuations according to analysts have been driven by persistent variability in exports from the region, foreign direct investments inflow, as well as regional socio-political conditions. IMF data on regional economic outlook shows that with the exception of the mid 1980s and the early 1990s when GDP growth in the sub-region trended weakly, GDP growth trajectory for the region after the year 2000 were positive and relatively high until the onset of 2008 global economic slowdown. The data shows GDP growth in the sub-region declined from an average of over 6% per year prior to the recession to a little over 3% in periods just afterwards. From growth rate of 2.82% recorded in 2009 after the economic shock, the data now reports average GDP growth rate of over 5% for the sub-region as a whole. A condition which suggests the sub-region has recovered relatively faster after the global recession compared to the USA. Figure 1 charts regional growth dynamics between 1980 and 2011; as well as projected growth trend until 2016. It also shows the effects of the 2008 global financial crisis on growth conditions in the sub-region.

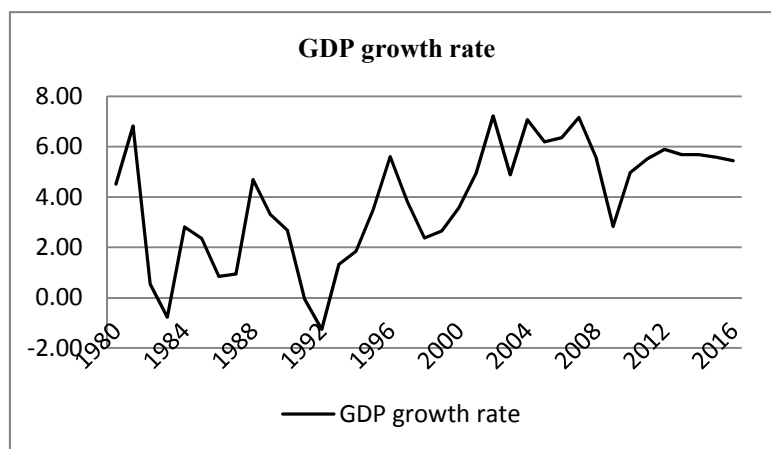


Figure 1. Sub-Saharan GDP growth Conditions (1980-2011) with projections to 2016

Data Source: IMF data

### 2.2 Inflation Rate

Compared to other developing and advanced economies, inflationary conditions in SSA tend to be relatively high with significant negative impact on regional financial system and macroeconomic conditions. IMF regional economic outlook data indicates on the average, inflationary rate for the sub-region hovered around 10% between 1980 and 1988. This relatively high inflation rate rose significantly between 1991 and 1996, with highest rate over the period reaching over 40% on average for the sub-region. Inflationary conditions in the sub-region after 2000 however, have been relatively low by regional standards with the exception of the period leading to 2008 global financial crisis. Recessionary pressures due to the 2008 financial crisis led to minor increase in inflation rate over the period as evidenced by a rise in trend around the recessionary period in figure 2. This condition, coupled with the fact that the highest inflationary condition over the period under study also happened to have coincided with the 1990-1991 global recession, one of the worst on record, suggest that to

some degree, inflationary trends in the sub-region are influenced by external macroeconomic distortions. Figure 2 illustrates inflationary conditions over a 30 year period for the region and shows effects of recessionary pressures on inflation rate.

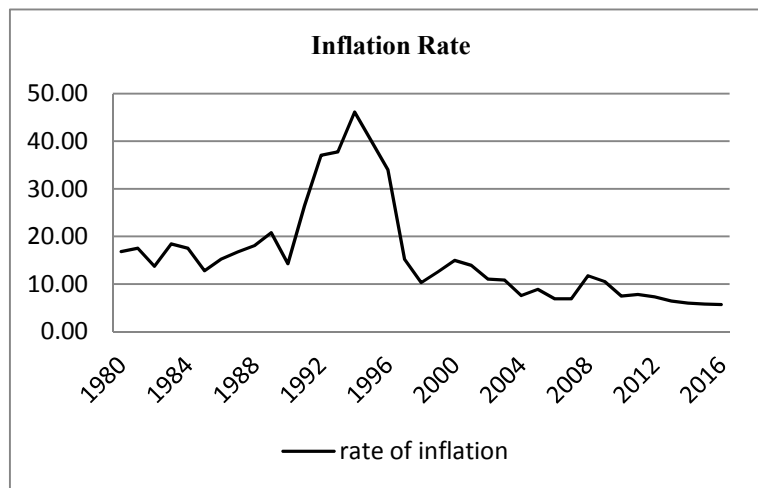


Figure 2. Sub-Saharan Inflation rate Conditions (1980-2011) with projections to 2016

Data Source: IMF data

### 2.3 Investment Growth (% of GDP)

Investment growth conditions in the sub-region over the past two decades have been relatively strong; available data indicates investment growth over the period under study accounts for over 15% of regional GDP growth. According to IMF regional economic outlook, investment growth as a percentage of GDP growth averaged over 20% between 1980 and 1990. The trend however, declined slightly in the early 1990s, and has since ranged between 16% and 21% of GDP growth. Compared to other macroeconomic indicators used in this study, investment growth as a percentage of GDP growth for the sub-region has been fairly stable over the years by regional standards. Although the 2008 economic recession had significant negative impact on individual economies in the sub-region, aggregate data indicates the region as a whole showed little sign of the condition. Figure 3 illustrates sub-regional investment growth as a percentage of GDP between 1980 and 2011.

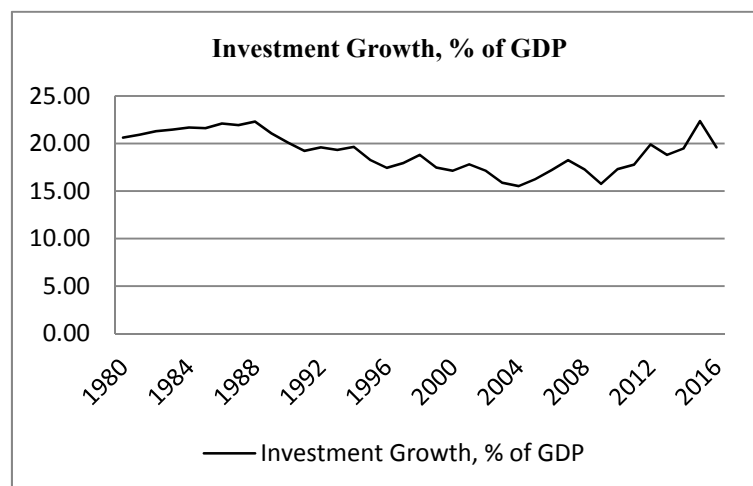


Figure 3. Sub-Saharan Investment growth rate Conditions (1980-2011) with projections to 2016

Data Source: IMF data

#### 2.4 Gross Regional Savings (% of GDP)

According to historical regional economic outlook data, gross regional savings as a percentage of GDP, experienced significant decline in the early 1980s. This decline led to regional savings growth falling sharply below a 20% threshold; growth trend since this decline averaged between 14% and 18% until 2005. Early part 2005 however, witnessed significant growth in gross national savings with average growth rate well over the 20% growth rate for the first time since 1980. A key feature about gross regional savings rate over the period under study is its relatively even growth over the period. Trend analysis based on sub-regional macroeconomic data further show that post 2008 recession regional savings growth has perform better on the average, compared to periods prior to the recession. Figure 4 illustrates sub-regional savings growth as a percentage of GDP growth.

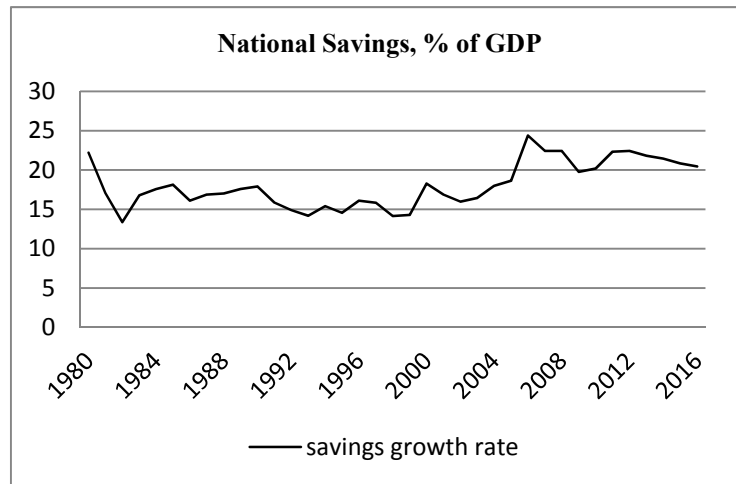


Figure 4. Sub-Saharan National Savings rate Conditions (1980-2011) with projections to 2016

Data Source: IMF data

#### 2.5 Current Account Balance

Among sub-regional macroeconomic indicators explored in this study, regional current account balance as a percentage of GDP growth, like GDP growth trend, also exhibits significant trend volatility. Regional data shows current account balance as a percentage of GDP growth over the past two decades has fluctuated significantly between extremes of - 6% and 4.2%. Further trend analysis indicates early part of 1980s witnessed the worse episode in the sub-region's current account balance condition. Between 1980 and 2005, current account as a percentage of GDP growth hardly recorded positive growth. The best period however in current account condition over the period under study occurred just before the 2008 recession, reaching a peak of 4.2%. As expected, this growth condition was short-lived because of recessionary pressures at the time. Figure 5, illustrates regional current account balance trends as presented by IMF regional economic outlook data.

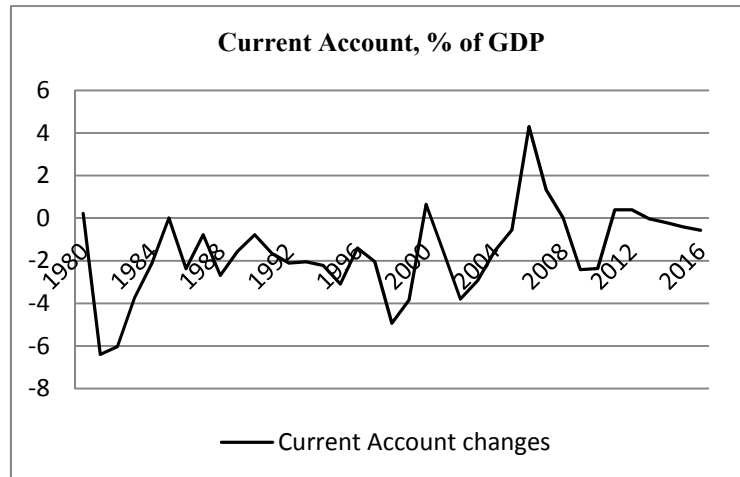


Figure 5. Sub-Saharan Current Account Conditions (1980-2011) with projections to 2016

Data Source: IMF data

### 2.6 Export Growth

Regional time series data on trends in export growth shows extensive growth between 1993 and 1996. This positive growth trend however fluctuated significantly until a major decline just after the 2008 economic downturn. Since this decline following the 2008 recession, exports from the sub-region have experienced significant growth to date; it is projected that the current trend could be sustained as foreign direct investments into the region grows with substantial portion of these investments augmenting domestic export base. Export growth trend over the period under study to some extent, further support the condition that global macroeconomic condition such as the 2008 recession, tend to have significant impact on key macroeconomic indicators in the sub-region. Figure 6 illustrates export growth dynamics for the region between 1990 and 2011 as documented by IMF regional economic outlook data (Note 2).

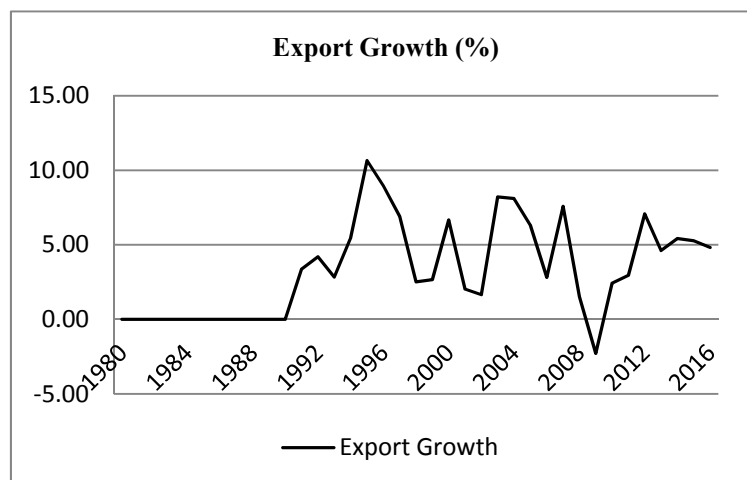


Figure 6. Sub-Saharan Export Growth rate Conditions (1990-2011) with projections to 2016

Data Source: IMF data

### 3. Overview of Empirical Literature: *Macroeconomic Volatility and Macroeconomic Indicators*

The fundamental view that volatility exerts significant influence on macroeconomic indicators in both developed and developing economies is highly supported by existing literature focusing on the relationship. Empirical studies reviewed so far, largely supports the view that macroeconomic volatility has significant negative impact on macroeconomic indicators all things being equal. Studies focusing on the relationship between fundamental

volatility and economic performance such as Bernanke (1983), Pindyck (1991) and Ramey and Ramey (1991) have all arrive at similar conclusions; providing evidence in support of negative relationship between volatility and economic growth. Additionally, Henry and Olekalns (2002) also found negative relationship between economic volatility and real GDP growth for the U.S economy. Again, using panel data for 59 industrialized and developing economies, Asteriou and Price (2005) further showed that output volatility due to uncertainty reduces both investment and economic growth; further supporting negative relationship between macroeconomic volatility/uncertainty and economic growth. Furthermore, employing a sample of 128 countries, Badinger (2010) also found evidence of negative effect of volatility on economic growth. Giovanni and Levchenko (2006) additionally documented that, countries whose economies are more open to trade tend to experience more volatility; and are more susceptible to inimical external macroeconomic conditions with the potential to negatively impact domestic economic indicators.

Aizenman and Marion (1999) also found evidence in support of negative relationship between volatility and economic performance indicators among developing countries; for instance, the study showed that volatility negatively affects private investment growth in developing economies. Kharroubi (2007) additionally provided empirical evidence in support of inverse relationship between economic growth and volatility; Kharroubi further surmised that negative relationship between growth and volatility observed in developing countries could be traced to shortcomings or weakness associated with domestic financial system. Using a sample of 79 developed and developing economies, Hnatkovska and Loayza (2005) studied the growth-volatility relationship over the period 1960–2000, and found volatility to be inimical to economic growth. However, contrary to conclusions from most studies reviewed, Kose, Prasad, and Terrones (2005) found positive relationship between growth and volatility among industrialized economies; the case among developing economies in the same study was however, found to be negative. If these findings on the relationship between volatility and economic growth among developing economies especially are indication of a general trend, then all things being equal, findings of the current study might mimic this trend despite the use of disaggregated volatility parameters.

#### **4. Estimating Macroeconomic Volatility**

External macroeconomic volatility in this study defines volatilities inherent in specific macroeconomic indicators associated with advanced economies around the world as classified by the IMF. This study employs aggregate data on real GDP growth, investment growth as wells as output gap conditions for advanced economies in estimating external macroeconomic volatility parameters. In all, GDP growth, Investment growth and output gap data for 34 advanced economies are use in estimating this study's external volatility parameters. External volatility in this study is measured as the standard deviation of stated macroeconomic indicators. Regional macroeconomic volatility parameters for SSA are also derived using similar procedure.

##### *4.1 Data and Variables*

Empirical analysis verifying effects of external and regional macroeconomic volatility on selected sub-regional macroeconomic indicators such as investment and GDP growth are estimated using a panel of 39 sub-Saharan African economies; the data sets span the period 1980 to 2011. Key macroeconomic variables from the sub-region employed in this study include, GDP growth, investment growth, inflation rate, current account balance conditions, and gross regional savings conditions. External macroeconomic volatility parameters are estimated from variables already stated. All data sets are sourced from the IMF regional economic outlook database.

#### **5. Econometric Specification**

This study adopts empirical estimation approach which relies heavily on empirical methodology used extensively in the macroeconomic volatility-growth nexus literature. This study however examines specific dynamic relationships at the micro-level using disaggregated regional and external volatility parameters via panel fixed effects regression instead of a single volatility variable often found in the literature. This study projects that, holding all else constant, (i.e. all growth augmenting conditions, technology, socio-political conditions etc.) growth conditions associated with macroeconomic indicator  $y_t$ , in a sub-region made up of  $t$  varied economies, could be modeled as a function of the degree to which such variable cope with regional and external macroeconomic volatilities. In other words, growth conditions characterizing key macroeconomic variables in SSA are projected to depend on how the variables fair in the face of volatile regional and external macroeconomic conditions. In this line of argument, growth conditions associated with key macroeconomic indicators in SSA are said to be defined by occasional macroeconomic volatilities; both regional and external. To this end, this study models performance of key macroeconomic indicators among economies in the sub-region as a function of regional and external macroeconomic volatility as follows:



$$y_t = f\left[\sum_{i=1}^t dom\sigma^2 + \sum_{i=1}^t \sum_{i=1}^t Ext\sigma^2\right] \quad (1)$$

Where  $y_t$  estimates overall growth performance associated with specific sub-regional macroeconomic indicator;  $dom\sigma^2$  captures portion of overall macroeconomic volatility experienced from the regional (domestic) economy, and  $Ext\sigma^2$  estimates external volatility in the global market place. Equation 1 suggests that all things being equal, performance of key macroeconomic indicators in the sub-region depend on how the sub-region manages regional and external macroeconomic volatilities or shocks. In other words, this estimation process holds constant other known factors influencing key economic indicators in the sub-region, in order to assess how macroeconomic volatilities or shocks influence regional economic indicators. The following section determines appropriate empirical approach to adopt in verifying the relationship between disaggregated volatility parameters and selected macroeconomic indicators from SSA modeled in equation 1.

Hausman test determining appropriate model for this study based on type of data employed, supports fixed effects approach for this study; consequently, fixed effect model estimating effects of domestic/regional and external macroeconomic volatility on key macroeconomic indicators in SSA is formulated. Fixed effects method used in this study is modeled to correct for parameter endogeneity which could skew test results. Fixed effect model estimating effects of macroeconomic volatility parameters on key economic indicators is specified as follows (Note 3):

### 5.1 The Fixed Effect Model

$$y_{it} = \delta_0 + \delta_1 EOutpv_{it} + \delta_2 EInvestv_{it} + \delta_3 EGDPgv_{it} + \delta_4 Dgdvpv_{it} + \delta_5 Dinvestv_{it} + \delta_6 Dinflv_{it} + q_i + q_t + e_{it} \quad (2)$$

where

–  $y_{it}$  captures dependent variables (macroeconomic indicators) of sub-region  $i$ , at time  $t$ .

–  $\delta_0$  ( $i=1 \dots n$ ) is the unknown intercept.

–  $E-Ouptv$ ,  $E-Investv$ ,  $E-GDPgv$ ,  $D-gdvpv$ ,  $D-investv$ ,  $D-inflv$ ,  $D-cablv$  etc captures independent variables ( $E$ -external and  $D$ -domestic (regional) volatility as measured by standard deviations of selected variables)

–  $\delta_1 \dots \delta_6$  are the coefficients for independent variables tested

–  $q_i$  Controls for unobserved country heterogeneity

–  $q_t$  Time (year) fixed effects

–  $e_{it}$  The error term

Equation 2 models effects of domestic/regional and external macroeconomic volatility on selected regional macroeconomic indicators from SSA using data from 1980 to 2011. As defined earlier,  $q_i$  and  $q_t$  from equation 2 defines vectors of country and time fixed effects and  $e_{it}$  the error term. Country fixed effects in this instance controls for unobserved country specific heterogeneity while time fixed effects controls for variations in time periods. Table 1, 2 and 3 report fixed effects estimates (coefficients and standard errors) of relationships between macroeconomic volatility parameters and selected regional macroeconomic indicators. Table 1 estimates highly plausible scenario where both regional and external macroeconomic volatility parameters concurrently influence key performance indicators among economies in the sub-region. Tables 2 and 3 on the other hand, verify how macroeconomic volatility (domestic/regional or external) independently influence regional macroeconomic indicators. Separate tests results presented in tables 2 and 3, are meant to highlight how key regional macroeconomic indicators relates to specific volatility parameters in the absence of others. These highly unlikely scenarios (the presence of only domestic/regional or external macroeconomic volatility), are meant to afford this study a means of weighing the case for, and against orienting regional policies towards reducing specific form of macroeconomic volatility. For instance, if specific sources of volatility are determined to have significant constraining effects on regional economic performance, such information could help policy makers design policies specifically geared towards minimizing such sources of volatility. Outcome of such analysis could further help utilize resources efficiently by focusing on specific sources of volatility projected to have significant negative impact on key regional macroeconomic variables. Table 1 present results of a combined scenario; i.e. how both regional and external macroeconomic volatility parameters impact key macroeconomic variables in the sub-region.

Table 1. Fixed Effect Estimates: Effects of Volatility on Macroeconomic Indicators

Volatility Parameter	(1) GDP Growth	(2) Investment Growth	(3) Gross National Savings	(4) Inflationary Conditions	(5) Current Account Balances
<i>E-Outputv</i>	1.5581* (0.70)	0.4327 (0.29)	-0.200 (0.41)	-0.2776 (23.54)	-0.560 (0.36)
<i>E-Invstv</i>	-1.131 (0.71)	0.924** (0.29)	0.146 (0.41)	-11.006 (23.63)	-0.740* (0.36)
<i>E-GDPv</i>	-1.389* (0.66)	-0.641* (0.27)	0.623 (0.38)	-116.93*** (22.00)	1.047** (0.33)
<i>D-GDPv</i>	0.299*** (0.04)	0.0030 (0.02)	-0.008 (0.02)	0.234 (1.42)	-0.003 (0.02)
<i>D-Invstv</i>	-0.770*** (0.16)	0.731*** (0.06)	-0.499*** (0.09)	-1.707 (5.34)	-0.973*** (0.08)
<i>D.Infv</i>	-0.0001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.545*** (0.03)	-0.000 (0.00)
_cons	13.00*** (1.82)	16.34*** (0.74)	15.03*** (1.07)	171.71** (61.07)	-1.819* (0.92)
Obs	1239	1239	1239	1239	1239
r2	.0303481	.0738676	.0073496	.1893524	.0869733

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## 6. Empirical Results

### 6.1 External Volatility and Performance of Sub-regional Macroeconomic Indicators

Fixed effects coefficients reported in table 1 demonstrate that external macroeconomic volatility has statistically significant effect on key sub-regional macroeconomic indicators. Coefficients estimates for instance, indicate external GDP growth volatility has significant negative effect on GDP growth in the sub-region. A review of related time series data suggest that this negative association may reflect export oriented nature of most economies in the sub-region. Analysts for instance, are of the view that being predominantly export dependent increases the likelihood for anemic regional growth during periods of global economic shocks or volatility (external GDP growth volatility). This study also finds that external GDP growth volatility (*E-GDPv*) negatively impacts regional investment growth among economies in the sub-region. The same condition, (*E-GDPv*) is further found to have significant negative impact on inflationary conditions in the sub-region; but a positive impact on regional current account balance conditions. These findings to a large extent suggest that, volatility associated with external economic growth (GDP growth) has significant negative impact on key performance indicators among SSA economies. Apart from these relationships (between external GDP growth volatility and key indicators in the sub-region), this study also finds positive association between external investment growth volatility and investment growth in SSA. To verify underlying factors responsible for this positive association, the literature on foreign direct investment and regional economic growth nexus is reviewed for clues. The evidence suggests this positive link between external investment growth volatility and regional investment growth could be explained by two key factors. The first factor revolves around relatively lower cost of production in most economies in the sub-region which makes it possible to attract specific investments even during periods of declining or constrained investment conditions in most external economies. Some analyst also suggest that highly inelastic demand for resources from most parts of the sub-region helps to attract and sustain investments growth even during periods of general global investment decline. These conditions according to the literature explain to some degree why external investment growth volatility rather induces investment growth in the sub-region.

This study further finds that external investment growth volatility has significant negative effects on regional current account balance; a condition which suggests persistent external investment growth volatility constrains current account balance conditions in SSA. External output gap volatility (*E-Outputv*) in this study measures fluctuations in productivity level in the global market place. This study surmised that extreme volatility in this indicator will be beneficial to economies in the sub-region; in that, the condition has the potential to increase

demand for exports from the sub-region to compensate for short falls in global market productivity. Coefficients estimates accordingly show that external output gap volatility correlates positively with GDP growth in the sub-region. Reported results however suggest external macroeconomic volatility parameters moderated by domestic/regional conditions have no statistically significant impact on gross regional savings.

### 6.2 Regional/Domestic Volatility and Performance of Macroeconomic Indicators

Results featured in Table 1 further shows that in an environment characterized by some form of external macroeconomic volatility, regional investment growth volatility is the dominant macroeconomic condition with significant impact on key regional macroeconomic indicators. Although regional GDP growth and inflation rate volatility also have significant impact on some regional macroeconomic variables, effects of regional investment growth volatility on regional macroeconomic indicators tend to be pervasive; impacting almost all regional macroeconomic indicators tested in this study. Regional investment growth volatility in this case is found to have negative effects on gross regional savings, current account balance conditions and GDP growth; this study however finds that regional investment growth volatility has positive effects on regional investment growth all things being equal. In other words, regional investment growth volatility ultimately promotes investment growth in the sub-region. This positive relationship between regional investment growth volatility and investment growth is thought to reflect a long run investment drive phenomenon; where short run investment growth volatility due to unique regional factors ultimately necessitates and generates the needed impetus for sustained regional investment growth in the long run.

Table 2 report effects of external macroeconomic volatility parameters on selected regional macroeconomic indicators holding regional/domestic volatility parameters constant.

### 6.3 Effects of External Macroeconomic Volatility on Regional Macroeconomic Indicators

Table 2. Fixed Effect Estimates for External Macroeconomic Volatility

Volatility Parameter	(1) GDP Growth	(2) Investment Growth	(3) Gross National Savings	(4) Inflationary Conditions	(5) Current Account Balances
E-Outpv	1.9845** (0.72)	0.1596 (0.30)	-0.0421 (0.41)	-16.7039 (26.28)	-0.2148 (0.37)
E-Invstv	-1.0568 (0.72)	0.7842** (0.30)	0.1619 (0.41)	-65.128* (26.27)	-0.6129 (0.37)
E-GDPv	-1.1859 (0.66)	-0.6735* (0.28)	0.7360 (0.38)	-52.8176* (24.31)	1.1597*** (0.35)
_cons	9.794*** (1.70)	19.914*** (0.71)	12.664*** (0.98)	224.434*** (62.16)	-6.515*** (0.89)
r2_a	.021168	.025654	.029988	.019677	.023981
Obs	1,239	1,239	1,239	1,239	1,239

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 2 presents coefficients and standard error estimates of a scenario where regional macroeconomic indicators are only influenced by external macroeconomic volatility parameters. Although regional macroeconomic environment devoid of any domestic economic influence is farfetched, this approach allows this study to verify the extent to which effects of external macroeconomic volatility on key growth indicators are moderated or otherwise; by comparing results with those reported in table 1. Table 2 results show that, holding effects of domestic macroeconomic volatility parameters constant significantly influence the extent to which external volatility influence key macroeconomic indicators in the sub-region. For instance, coefficient estimates, show that in the absence of domestic/regional macroeconomic volatility, external GDP growth volatility fails to have significant impact on GDP growth in SSA. A similar condition is also found in the relationship between external investment growth volatility and regional/domestic current account balance. This study further finds that external investment growth volatility has statistically significant negative impact on domestic/regional inflation rate although results in table 1 suggested otherwise. These results (Table 2) suggest that in an environment of minimal or no regional macroeconomic volatility threats, external macroeconomic volatility (as measure by

various parameters already stated) tend to influenced regional economic indicators differently; a condition which suggests some moderating effects from regional macroeconomic volatility in table 1. For instance, external GDP growth volatility in this scenario is found to have relatively weaker negative impact on inflationary conditions compared to condition reported in table 1.

Results presented in table 3 focuses on a reverse condition where regional macroeconomic indicators are modeled as a function of only domestic/regional macroeconomic volatility parameters.

#### 6.4 Effects of Domestic Macroeconomic Volatility on Regional Macroeconomic Indicators

Table 3. Fixed Effects Estimate for Domestic Macroeconomic Volatility

Volatility Parameter	(1) GDP Growth	(2) Investment Growth	(3) Gross National Savings	(4) Inflationary Conditions	(5) Current Account Balances
D-GDPv	0.2996*** (0.04)	0.0031 (0.02)	-0.0072 (0.02)	-0.0276 (1.44)	-0.0023 (0.02)
D-Invv	-0.769*** (0.16)	0.721*** (0.06)	-0.504*** (0.09)	-0.060 (5.38)	-0.968*** (0.08)
D-Inflv	-0.0004 (0.00)	0.0002 (0.00)	0.0006 (0.00)	0.5231*** (0.03)	0.0003 (0.00)
_cons	12.870*** (0.80)	17.654*** (0.33)	15.561*** (0.47)	20.289 (27.12)	-2.665*** (0.41)
r2_a	.020303	.064494	.008060	.167966	.078579
Obs	1,239	1,239	1,239	1,239	1,239

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Coefficient estimates in this case verifies how domestic/regional macroeconomic volatility parameters independently influence critical regional macroeconomic indicators. These estimates presume a relatively closed regional economic enclave devoid of any major external macroeconomic influence. Coefficients estimates in this case show that key macroeconomic indicators in the sub-region are influenced predominantly by volatility associated with regional investment growth. The results further show that the relationship between regional investment growth volatility and the various regional economic indicators are statistically identical to those reported in table 1. This outcome suggest that regional investment growth volatility constitutes a dominant feature influencing key macroeconomic variables in the region with or without moderating effects of other volatility parameters. It also suggest that apart from socio-cultural and geo-political conditions which often perturbs growth dynamics in the region, regional investment growth volatility should be a variable of interest for policy makers in the sub-region. These results further imply that all things being equal, effects of domestic/regional macroeconomic volatility parameters on key macroeconomic indicators are hardly moderated or influenced by external macroeconomic conditions; since coefficients of various indicators barely changes in the two cases tested; ( comparing table 1 and 3 estimates for domestic investment volatility).

#### 7. Concluding Remarks

This study verified the dynamic interactions between disaggregated macroeconomic volatility parameters and key macroeconomic indicators for the SSA region. I find that on average, macroeconomic volatility parameters have statistically significant negative impact on selected macroeconomic indicators for the sub-region. Estimated coefficients also show that in a hypothetical scenario where regional macroeconomic indicators are only exposed to either external or domestic/regional macroeconomic volatility parameters, external macroeconomic volatility parameters tends to have more influence on macroeconomic indicators in the sub-region than domestic/regional macroeconomic volatility parameters. Finally, this study also finds that effect of domestic/regional macroeconomic volatility on performance indicators in the region is mostly dominated by volatility associated with domestic/regional investment growth. These findings suggests that, in order to ensure sustained regional growth, policies geared towards fostering macroeconomic stability should target minimizing effects associated with specific external macroeconomic volatility parameters and instability in regional investment growth. Successful implementation of such policies could help the sub-region manage effects of such macroeconomic

conditions; and augment efforts aimed at creating the necessary environment critical for sustained economic growth.

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#### **Notes**

Note 1. Especially those in Sub-Saharan Africa (SSA)

Note 2. Data from 1980 to 1989 were unavailable for the sub-region as a whole

Note 3. Export growth is omitted from the model due to missing data for the first ten years of the period under study