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Original article

Do Trade Liberalisation and Financial Development Affect Macroeconomic Volatility? Evidence from Africa

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Abstract

The study investigates the effect of financial development and trade liberalisation on macroeconomic volatility in Africa between 1960 and 2012. The study employed panel data, de jure and de facto measures of financial openness and three estimation techniques (pooled Ordinary least square method [OLS], fixed effect and dynamic general method of moment [GMM]) to analyse the data. Results show that increased financial openness also leads to increased income volatility for the de jure measure of financial openness while for the de facto measure increased financial openness reduces income volatility. Results also show that financial openness leads to subtle volatility of output growth in Africa. The results contradict the argument that more financial openness leads to lower volatility in consumption in Africa. Furthermore, investment volatility responded to the measures of financial openness in different ways. The study conclude policymakers should focus more on policies that will foster financial system development as it has shown to be very effective in reducing macroeconomic volatility in Africa.

JEL Codes: E32, GMM C33, Fixed Effect C31

Keywords

Trade liberalisation F18, financial development E44, macroeconomic volatility

Introduction

After the reversal of protectionism among the industrialised countries of the world in the 1970s, trade liberalisations was further expanded and consolidated in the 1980s and 1990s across the developing world and to a lesser extent, in Africa and the Middle East. While trade liberalisation brought prosperity, opportunities and economic diversification in some countries, they were reversed in others because trade reforms fell short of expectations. A number of African countries have adopted trade liberalisation

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measures as part of their structural adjustment programmes. The impact of trade liberalisation has been hotly debated in the literature. A huge empirical literature proves the existence of a positive relationship between trade liberalisation and economic growth. It has been found from the extant literature that openness to trade reduces the price of goods and factors, increases their availability and produces incentives for investment and innovation (Pancaro, 2010).

As cited by Ahmed and Suardi (2009), from Long (1991), structural adjustment programme is also accompanied by financial liberalisation. Financial liberalisation, defined as the establishment of higher interest rates that equate the demand for and the supply of savings (McKinnon, 1988; Shaw, 1973), is seen as part of the move towards giving markets a significant position in development. Trade liberalisation that is accompanied by financial liberalisation is believed to benefit countries by moving them closer to the frontier of technology, which the large volume of endogenous growth literature has shown will lead to increased growth (Bencivenga & Smith, 1991). Developed economies have certainly gained from the relationship between trade liberalisation and financial liberalisation in terms of a more efficient allocation of capital and in terms of better risk sharing opportunities. However, evidence for developing and emerging markets is controversial. There is a general perception that developing economies that open up to capital flows has been more vulnerable to macroeconomic fluctuations. Empirical studies have shown that the coefficient of variation of growth among developing countries is over six times (on the average) greater than that of the developed nations. Also, Pritchett (2000) has shown that growth is more volatile and more unstable in poorer countries. Therefore, understanding the role of financial development and trade liberalisation in generating macroeconomic fluctuation is a major challenge for economic literature in Africa.

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Many studies have investigated various sources of macroeconomic variables' volatility with mixed results. Dupasquier and Osakwe (2006) examined the relationship between trade liberalisation and macroeconomic instability in Africa using panel data for 33 African countries spanning the period 1986–2000. Results showed that there is no substantial evidence that trade liberalisation has a systematic impact on instability in the region. The study shows that the volatilities of inflation (INF) and the terms of trade, as well as climatic disasters, the nature of fiscal policy, and the severity of debt are more robust determinants of macroeconomic instability in the region. After controlling for key potential sources of macroeconomic instability, Ahmed and Suardi (2009) examined the effects of both financial and trade liberalisations on real output and consumption growth volatility in Africa. The study demonstrated that the volatility in output and consumption growth, caused by trade liberalisation, is negatively associated with the depth of the financial market. In addition, Rose and Spiegel (2009) introduced another dimension into the macroeconomic volatility literature by examining the proximity to international financial centres as one of the determinants of macroeconomic volatility in some selected countries over the period of 55 years. The study shows that proximity to major international financial centres seems to reduce business cycle volatility. In particular, it was discovered that countries that are farther from major locations of international financial activity systematically experience more volatile growth rates in both output and consumption. Furthermore, Giovanni and Levchenko (2009) examined the mechanisms through which output volatility is related to trade openness using an industry-level panel data set of manufacturing production and trade. Results of the study are in three threefold. First, the study found that sectors that are more open to international trade are more volatile. Second, trade is accompanied by increased specialisation. These two forces imply increased aggregate volatility. Third, sectors that are more open to trade are less correlated with the rest of the economy, an effect that acts to reduce overall volatility. The point estimates indicated that each of the three effects has an appreciable impact on aggregate volatility. However, added together they implied that the relationship between trade openness and overall volatility is positive and economically significant. Tayebi and Torki (2012) explored effects of financial

liberalisation on macroeconomic volatilities (such as economic growth, real exchange rate and exchange rate pass through) in developing countries using data of 43 developing economies between 1996 and 2005. Results showed that financial liberalisation had negative and significant effect on economic growth volatility. However, financial liberalisation had positive and significant effect on real exchange rate and exchange rate pass-through volatilities. In an attempt to examine the intervening role of interest rate in the financial development-macroeconomic volatility nexus, Yang and Liu (2016) employed fixed effect model in estimating the data of 56 emerging and developed economies over the period 1980–2009 in order to examine the relationship among financial development, interest rate liberalisation and macroeconomic volatility. Results showed that financial development plays a significant role in dampening the volatility of macroeconomic growth rate, but up to a limit. The more the interest rate is liberalised, the more likely that financial development can stabilise the economy. In order to investigate the impact of trade openness on economic growth volatility of Ghana, Mireku et al. (2017) employed co-integration and error correction techniques to estimate time series data from 1970 to 2013. Results showed that both the long- and short-run economic growth volatility is positively influenced by changes in trade openness.

This article, therefore, analyses the effect of financial development and trade liberalisation on macroeconomic volatility in Africa. We investigate whether trade liberalisation and financial development increase or reduce volatility in macroeconomic variables in Africa. This article contributes to knowledge by focusing on the effect of trade liberalisation and financial sector development on investment, output and consumption volatilities, contrary to Deaton and Miller (1985), Hoffmaister et al. (1997) and Ahmed and Suardi (2009). The inclusion of investment volatility enables us to see the role of trade liberalisation and financial sector development on capital accumulation which is a prerequisite for growth as argued by the neoclassical growth theory. This, to the best of our knowledge, is missing in the literature. Similarly, in line with Ahmed and Suardi (2009), the study controls for other causes of macroeconomic volatility like the monetary policy, fiscal policy, terms of trade and INF. Aside the introductory part, section two explains sources of macroeconomic volatility. While section three describes data and methodology, section four deals with empirical analysis. Section five summarises the findings and concludes the article.

Sources of Macroeconomic Volatility

The underlying existence of macroeconomics as a field of study is the phenomena of economy-wide movements in macroeconomic variables. Modern economies undergo significant short-run variations in macroeconomic variables. Expansions and recessions alternate over time and they associated with movements in macroeconomic variables. These fluctuations in macroeconomic variables have been a major bane on growth in many countries (Ramey & Ramey, 1995), especially in Africa. Empirical studies have shown that the coefficient of variation of growth among developing countries is over six times (on the average) greater than that of the developed nations. Also, Pritchett (2000) has shown that growth is more volatile and more unstable in poorer countries.

Measuring economic volatility involves evaluating the deviation between the values of an economic variable and its equilibrium value. Many studies (Ahmed & Suardi, 2009; Blanchard & Simon, 2001; Cariolle, 2012; Cecchetti et al., 2006; Clarida et al., 2000; Olaberria & Rigolini, 2009; Rose & Spiegel, 2009; Yang & Liu, 2016) have investigated various sources of macroeconomic variables' volatility. According to Cariolle (2012), sources of macroeconomic volatility can be put in two forms. The external forms of volatility which include exports, global prices, terms of trade or international interest rates and

the internal forms such as, economic policy, agricultural production and natural or climatic disasters. Ahmed and Suardi (2009) stated that economic, non-economic and institutional factors are crucial in determining the extent of macroeconomic volatility in a country. Some of the domestic economic sources of volatility among macroeconomic variables identified in the literature include monetary policy (Blanchard & Simon, 2001; Cecchetti et al., 2006; Clarida et al., 2000; Olaberria & Rigolini, 2009; Yang & Liu, 2016), fiscal policy (Fatas & Mihov, 2006; Loayza & Raddatz, 2006; Olaberria & Rigolini, 2009; Persson, 2002; Shi & Svensson, 2006), commercial openness (Barrell & Gottschalk, 2004), supply and demand shocks (Ahmed et al., 2002; Stock & Watson, 2002), financial development which can either be through financial innovation and improvements in risk sharing (Dynan et al., 2006), or through deeper financial markets (Bekaert et al., 2006; Denizer et al., 2002; Loayza & Raddatz, 2006). External economic sources like trade liberalisation or trade openness, term of trade shocks, foreign interest rate shocks also influence macroeconomic stability of a country (Calderón & Schmidt-Hebbel, 2008; Calvo, 1998; Cavallo, 2007; Cavallo & Frankel, 2004; Di Giovanni & Levchenko, 2010; Martin & Rey, 2006; Mendoza, 1995; O'Donnell, 2001; Raddatz, 2007; Olaberria & Rigolini, 2009).

Some factors can be categorised as non-economic sources that affect macroeconomic volatility. McConnell and Pérez Quirós (2000), Kahn et al., (2002) and McConnell and Kahn (2005) documented that improved inventory management policies reduce volatility. Rose and Spiegel (2009) added that proximity to international financial centres reduces macroeconomic volatility. Auffret (2003) investigated the effects of natural disasters on consumption volatility in the Caribbean region, and argued that they have direct impact on the stock of human and physical capital, which in turn negatively affects production, consumption, investment and the current account balance of payments. Other studies that documented the impact of natural disaster on macroeconomic volatility include Rasmussen (2004), Fomby et al. (2009), Raddatz (2007), Combes and Ebeke (2013). Other non-economic sources of macroeconomic volatility that have been established in the literature are civil unrest and insurrections or civil war (Auffret, 2003), geographical diversification (Jansen et al., 2009), political instability (Aisen & Veiga, 2006; Alesina et al., 1992; Tang & Leung, 2014), foreign direct investment (Tang & Leung, 2014).

Institutional quality has been documented to have considerable impact on volatility of macroeconomic variables. Duncan (2013) provided evidence linking institutional quality with volatility of output. He argued that in the long run, a lower institutional quality tends to discourage external liabilities. If the institutional quality is low, the economy attracts fewer loans for domestic consumers and shows a lower debt-to-consumption ratio in the steady state. As posited in the literature, a country's vulnerability to macroeconomic volatility is driven by a number of handicaps, which are either structural or depend on the level of economic development (Cariolle, 2012). These factors explain why, in a broader view, developing countries are more vulnerable to macroeconomic volatility. Developing countries are more exposed to shocks and do not always have the mechanisms or internal conditions in place to absorb them. The size of the population, the degree of diversification of the economy and the capacity for operating a countercyclical economic policy, the existence of well-developed financial institutions and institutional quality are therefore determining factors in the impact of volatility on growth.

Methodology and Data

Data

The data comprise of 51 selected sub-Saharan African countries over the period 1960–2017. The list of the countries is presented in Table A1. Definition, abbreviation and sources of data are presented in Table

A2. The particular selection of countries and the time period employed are dictated by data availability. The Dejure measure of openness (capture by Chinn and Ito index), which is one of the major variables in this, is available up to 2017. For a robust analysis on the effect of trade and financial liberalisations on macroeconomic volatility, we consider different income and consumption growth volatility measures. Following Kose et al. (2003) and Ahmed and Suardi (2009), we employ three proxies for income growth volatility for robustness check. They are the volatility of per capita gross domestic product growth rate (VOLCAP), the volatility of gross national product growth rate (VOLGNP), and the volatility of terms-of-trade adjusted output growth rate (VOLTAD). Volatility of gross domestic product growth rate (VOLGDP) is used, in addition to output, because it accounts for cyclical variations in net factor income flows, which accommodates the effects of international risk sharing on national income arising from market reforms. The terms-of-trade adjusted income factors the terms of trade shocks which are known to be highly persistent and have significant effects on permanent incomes of developing economies. The terms-of-trade adjusted output is computed as:

$$\text{GDP} + \text{EPI} \times \text{EX/GDP} - \text{IPI} \times \text{IM/GDP} \tag{1}$$

where EPI and IPI are export and import price indices respectively, while EX and IM are exports and imports, respectively. Both price indices are obtained from World Development Indicators data base (online version).

Consumption growth volatility is measured using the volatility of private consumption growth rate (VOLPC) and the volatility of total consumption growth rate (VOLTC). Total consumption is computed as the sum of private consumption and government consumption. This is important in the welfare assessment of reform given that the utility of a representative agent in the economy does not solely depend on private consumption. In fact, the cyclical behaviour of government consumption has an immediate effect on the response of private consumption to macroeconomic shocks. More importantly, for developing economies like Africa, the government consumption to gross domestic product ratio is significantly high, thus highlighting the importance of government consumption. It can be seen, therefore, that this volatility measure is effectively the most relevant measure for analysing the welfare effects of reforms on volatility.

Volatility of all the dependent variables is generated using autoregressive conditional heteroscedasticity (ARCH) and generalised autoregressive conditional heteroscedasticity (GARCH) models. ARCH models were introduced by Engle (1982) and generalised as GARCH by Bollerslev (1986). The study adopts the simplest GARCH (1,1) model. The model is specified as:

$$Y_t = X_t'\mathsf{q} + \grave{\mathsf{o}}_t \tag{2}$$

$$\mathsf{s}_t^2 = \mathsf{w} + \mathsf{a}\,\grave{\mathsf{o}}_{t\,1}^2 + \mathsf{b}\mathsf{s}_{t\,1}^2 \tag{3}$$

Equation (2) is the mean equation and it is written as a function of exogenous variables with an error term. Equation (3) is called the conditional variance equation because it is one-period ahead forecast variance that is based on past information. Equation (3) is a function of three terms: a constant term, news about volatility from the previous period measured as the lag of the squared residual from the mean equation (the ARCH term) and the last period's forecast variance (the GARCH term). The (1, 1) in GARCH (1, 1) refers to the presence of a first-order autoregressive GARCH term (the first term in parentheses) and a first-order moving average ARCH term (the second term in parentheses). GARCH model is preferred to the standard deviation method commonly used in the literature because the standard

deviation method wrongly assumed that the empirical distribution of variable is normal and for ignoring the distinction between predictable and unpredictable elements in the variable process (Hook & Boon, 2000; Musonda, 2008). However, for robustness check, the standard deviation method is used in order to compare our results.

The measures of economic reforms involve both trade openness and financial openness. For trade openness, we used a measure of restrictions on current account transactions and a standard trade openness ratio (TRADOP, computed as the ratio of the sum of exports and imports to GDP). Financial openness is measured in two ways: we used an indicator of the restrictions on capital account transactions and the ratio of total foreign investment to total investment. The indicators that measure the restrictiveness of transactions are known as de jure measures of openness (KAOPEN) while the flow measures represent de facto measure of financial openness (FINOPEN). It is important to draw distinction between these measures as many economies that have implemented capital controls during capital flight episodes have found them to be ineffective (Ahmed & Suardi, 2009; Chinn & Ito, 2008). While it is extremely difficult to measure general financial openness (such as the extent of integration into global financial market), it has been suggested that distinction between de facto and de jure measure is important (Ahmed & Suardi, 2009; Chinn & Ito, 2008). Infact, studies have observed robust evidence when using better measures of de jure integration (Ahmed & Suardi, 2009; Kose et al., 2006). All these measures of trade and financial openness are employed separately in our panel regressions for robustness check.

Apart from investigating the effects of trade and financial openness on economic volatility, we also consider a host of other factors including country-specific factors as control variables. These variables that are discussed in the previous section, include terms of trade volatility as a proxy for external risk, volatility of inflation (VOLINF), inflation levels and financial deepening factor (computed as private credit to GDP ratio) as a proxy for the extent of domestic financial market development. Country size and the level of economic development are proxied by the level of GDP per capita.

Econometric Methodology

To investigate the link between market reforms (financial and trade openness) and macroeconomic volatility while controlling a host of other sources. We begin with a general regression model

$$y_{it} = \mathsf{a}\ x_{it} + e_{it} \tag{4}$$

where the subscripts i and t denote country and time period, respectively; y_i is the volatility variable for country i, x_{it} is a vector of time- and country-varying explanatory variables which include proxies of trade and financial openness, measures of external shocks and other control variables. The inclusion of the unobserved country effects and the possibility that the model contains endogenous variables are dealt with by differencing and using instrumental variable estimation. Rewriting Equation (4) explicitly, we have:

$$\begin{aligned}\mathrm{Volt}_{it} &= \mathrm{Volt}_{it\ 1} + \mathsf{b}_1\mathrm{KAOPEN}_{it} + \mathsf{b}_2\mathrm{TRADOP}_{it} + \mathsf{b}_3\mathrm{FDVT}_{it} + \mathsf{b}_4\mathrm{GOVEXP}_{it} + \mathsf{b}_5\mathrm{GDPPC}_{it} \\ &+ \mathsf{b}_6\mathrm{INF}_{it} + \mathsf{b}_7\mathrm{VOLINF}_{it} + \mathsf{b}_8\mathrm{VOLTOT}_{it} + e_{it}\end{aligned} \tag{5}$$

b_1, b_2 and b_3 are variables of interest. The lag of the dependent variable explains the dynamism of the model. Equation (5) is estimated with three methods of estimations, namely pool OLS regression, random effect and dynamic generalised method of moment (GMM). The pooled OLS models were

estimated with cross-section effects in order to correct for cross-section correlation, period arbitrary serial correlation, time varying variances in the disturbances and observation specific heteroscedasticity. A serious empirical challenge in the estimation of cross-country regressions is to choose which model to use, whether to use the random or the fixed effect model. The Hausman test was conducted and the result favours random over fixed effect. The random effect takes into consideration different characteristics of countries included in the estimation. We employ a system-GMM estimator, proposed by Arellano and Bover (1995), to estimate our dynamic model. This technique is employed in order to control for omitted variable problem and potential endogeneity issue. More importantly, this approach is appropriate for our unique dataset which has the characteristics of large cross-section and short time series. Our model is analysed by jointly estimating the original level and first-differenced regressions as against two-step differenced GMM of Arellano and Bond (1991). We use the lagged level variables as instruments in the first-differenced regression, and adopt the first-differenced variables as instruments in the level regression. This system-GMM estimator is shown to be more precise and efficient over the first-differenced GMM estimator of Arellano and Bond (1991), Blundell and Bond (1998), Blundell et al. (2000) and Ahmed and Suardi (2009).

Result and Discussion

We analysed the effect of proxies for trade liberalisation, financial liberalisation and financial development on volatility of macroeconomic variables by first examining the stationarity property of all the variables. If the variables are non-stationary, this implies the mean and variance of the variables are not constant over the period. This will give spurious results. To overcome this problem, stationarity test was carried out using five different approaches in order to achieve consistency in the test results. The result is presented in Table 1. Results showed that all the variables are integrated of order zero I(0) except the financial development index which is integrated of order one I(1). These imply while other variables are stationary at levels, financial development index is stationary after first difference. The study rejects the null hypothesis of non-stationarity.

The estimation results of Equation (5) is reported in Tables 2 and 3, which show the growth volatility of income, consumption and investment as determined by financial development, trade openness, financial openness and the host of other economic characteristics stated in the earlier sections. In columns 2 and 3, the dependent variables are two different measures of consumption growth volatility; VOLPC and VOLTC. In columns 4–7, the dependent variables (VOLTAD, VOLGNP, VOLGDP and VOLCAP) are measures of different income growth volatility. The last column (volatility of gross fixed capital formation [VGFC]) is the measure of investment volatility as computed from gross fixed capital formation. We start by concentrating on the effects of financial system development on consumption, income and investment growth volatility. In the de jure measure of financial openness as presented in Table 2, we find that capital account openness measured by KAOPEN index is positively associated to the two measures of consumption growth volatility. KAOPEN index constructed by Chinn and Ito (2008) is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. KAOPEN attempts to measure the intensity of capital controls insofar as the intensity is correlated with the existence of other restrictions on international transactions. By the nature of its construction, the KAOPEN index measures the extensity of capital controls because it may not directly refer to the stringency of restrictions on cross-border transactions, but to the existence of different types of restrictions (Chinn & Ito, 2008). This KAOPEN index takes on higher values the more open the country is to cross-border capital transactions. That is, the higher the value of KAOPEN index the more financially open an economy.

Table 1. Panel Unit Root Test Result

Vrbs	Levin, Lu, Chin		Breitung		Im, Pesaran, Shin		Fisher-ADF		Fisher-PP		RMK
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
FINDEVPT	0.695	−13.63*	2.562	−9.206*	1.180	−17.04*	94.738	483.20*	100.75	2017*	I(1)
	(0.757)	(0.000)	(−0.995)	(0.000)	(0.881)	(0.000)	(0.682)	(0.000)	(0.517)	(0.000)	
FINOPEN	−4.941*		−5.523*		−6.859*		227.664*		432.381		I(0)
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		
INF	−12.71*		−13.03*		−14.65*		406.65		810.61*		I(0)
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		
KAOPEN	−3.654*		−4.779*		−3.533*		155.179*		426.481*		I(0)
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		
TRADOP	−0.632	−15.57*	−2.909*		−2.07**		126.717**		164.705*		I(0)
	(0.264)	(0.000)	(0.002)		(0.019)		(0.027)		(0.000)		
VOLCAP	−5.959		−2.962*		−10.26*		520.766		859.1*		I(0)
	(0.000)		(0.002)		(0.000)		(0.000)		(0.000)		
VOLGDP	−41.00*		−3.200*		−18.16*		513.342*		666.486*		I(0)
	(0.000)		(0.001)		(0.000)		(0.000)		(0.000)		
VOLGFCF	−5.602*		−4.109*		−4.862*		253.865*		553.116*		I(0)
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		
VOLGNP	−4.639*		−8.773*		−7.084*		339.557*		849.703*		I(0)
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		
VOLINF	−5.891*		−2.606*		−8.486*		288.571*		865.889*		I(0)
	(0.000)		(0.005)		(0.000)		(0.000)		(0.000)		
VOLPC	−13.13*		−8.303*		−10.45*		302.005*		549.39*		I(0)
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		
VOLTAD	−1.192	−27.07*	−1.495*		0.067*		245.733*		840.062*		I(0)
	(0.117)	(0.000)	(0.000)		(0.000)		(0.000)		(0.000)		
VOLTC	−12.116*		−9.007*		−13.60*		361.114*		930.871*		I(0)
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		
VOLTOT	−2.515*		−0.842	−11.43*	−5.035*		424.556*		814.945*		I(0)
	(0.006)		(0.199)	(0.000)	(0.000)		(0.000)		(0.000)		

Source: The authors.

Notes: *, ** and *** Indicates level of significance at 1%, 5% and 10%, respectively. Panel unit root was conducted with intercept and trend.

Table 2. Regression Results on Determinants of Income, Investment and Consumption Growth Volatility (de jure measure of financial openness)

Variables	VOLPC	VOLTC	VOLTAD	VOLGNP	VOLGDP	VOLCAP	VGFC
LAG OF DEPENDENT	0.950* (0.000)	0.650* (0.000)	0.901* (0.000)	0.149* (0.000)	0.334* (0.000)	0.244* (0.000)	0.908* (0.000)
KAOPEN	0.123** (0.020)	0.222* (0.001)	0.037* (0.000)	8.929* (0.000)	7.449** (0.046)	−0.3,128* (0.004)	0.050* (0.000)
TRADOP	−0.002* (0.000)	0.004*** (0.052)	0.003* (0.000)	0.401* (0.000)	−0.317* (0.000)	−0.119* (0.000)	−0.002* (0.000)
FDVT	−0.139* (0.000)	0.250* (0.000)	−0.105* (0.000)	−9.346* (0.000)	−5.060* (0.000)	−11.354* (0.000)	−0.139* (0.000)
GOVEXP	0.343* (0.000)	0.508* (0.000)	0.247* (0.000)	18.993* (0.000)	−6.418* (0.000)	1.372 (0.502)	0.157* (0.000)
GDPPC	−0.0003** (0.016)	0.0001*** (0.055)	−0.0001* (0.007)	−0.003 (0.340)	0.006* (0.000)	0.004* (0.002)	0.0002* (0.000)
INF	−0.001* (0.000)	−0.0001* (0.000)	0.0002* (0.000)	0.014*** (0.071)	−0.018* (0.005)	−0.001 (0.944)	−0.004* (0.000)
VOLINF	−0.109* (0.000)	0.357* (0.000)	0.02 (0.153)	16.768* (0.000)	−5.782* (0.000)	0.264 (0.431)	0.033* (0.000)
VOLTOT	0.116* (0.000)	0.025 (0.268)	0.064* (0.008)	10.498* (0.000)	1.342 (0.276)	6.838* (0.000)	0.055* (0.000)
AR(1)	−2.54** (0.011)	−2.70* (0.007)	−2.93* (0.003)	−1.22 (0.0224)	−1.02 (0.309)	−1.00 (0.316)	−2.99* (0.003)
AR(2)	2.23 (0.126)	2.5 (0.112)	0.77 (0.440)	−0.30 (0.765)	−1.01 (0.313)	−1.02 (0.309)	2.81 (0.105)
Sargan Test	35.13 (0.999)	35.28 (0.989)	36.39 (0.909)	28.22 (0.997)	338.98 (0.903)	75.07 (0.999)	34.95 (0.999)
Total observations	1,097	1,114	1,113	1,083	1,111	1,112	1,049

Source: The authors.

Notes: Probability values are in parenthesis. *, ** and *** Indicate statistical significance at the 1%, 5% and 10% level, respectively. Lag of independent variables are used as dynamic GMM instruments.

Table 3. Regression Results on Determinants of Income, Investment and Consumption Growth Volatility (de facto measure of financial openness)

Variables	VOLPC	VOLTC	VOLTAD	VOLGNP	VOLGDP	VOLCAP	VGFC
LAG OF DEPENDENT	0.936* (0.000)	0.974* (0.000)	0.943* (0.000)	0.362* (0.000)	0.348* (0.000)	0.535* (0.000)	0.843* (0.000)
FINOPEN	0.034* (0.000)	−0.009* (0.000)	0.021* (0.000)	−1.176* (0.000)	0.175* (0.000)	0.132** (0.038)	0.054* (0.000)
TRADOP	−0.018* (0.000)	0.004* (0.000)	−0.002* (0.000)	−0.907* (0.000)	−2.80* (0.000)	−0.551* (0.000)	−0.004* (0.000)

(Table 3 Continued)

(Table 3 Continued)

Variables	VOLPC	VOLTC	VOLTAD	VOLGNP	VOLGDP	VOLCAP	VGFC
FDVT	0.127* (0.00)	−0.055* (0.000)	−0.084* (0.000)	5.381* (0.000)	−12.940* (0.000)	5.197* (0.001)	−0.208* (0.000)
GOVTEXP	−0.041* (0.000)	0.160* (0.000)	0.109* (0.000)	12.929* (0.000)	−4.835* (0.000)	−3.307* (0.000)	0.282* (0.000)
GDPPC	0.0001* (0.000)	−0.00004* (0.000)	−0.00002* (0.000)	0.00003* (0.000)	0.011* (0.000)	0.006** (0.011)	−0.0002* (0.000)
INF	−0.001* (0.000)	−0.0001* (0.000)	0.0003* (0.000)	−0.022* (0.000)	0.019 (0.179)	−0.043* (0.000)	−0.006* (0.000)
VOLINF	0.018* (0.000)	−0.005 (0.365)	0.057* (0.000)	9.585* (0.000)	3.998* (0.000)	−7.849* (0.000)	0.132* (0.000)
VOLTOT	0.112* (0.000)	0.282* (0.000)	−0.152* (0.000)	2.145* (0.000)	9.950* (0.000)	−2.291* (0.009)	0.071 (0.000)
AR(1)	−2.51* (0.012)	−2.74* (0.006)	−2.92* (0.004)	−1.23 (0.218)	−1.03 (0.302)	−1.03 (0.303)	−3.04* (0.002)
AR(2)	2.26 (0.124)	2.65 (0.108)	0.76 (0.450)	0.44 (0.658)	−1.01 (−0.314)	−1.02 (0.310)	2.91 (0.104)
Sargan test	9.43 (0.999)	9.94 (0.998)	15.02 (0.999)	30.88 (0.994)	22.27 (0.999)	124.71 (0.684)	52.27 (0.998)
Obs.	1,114	1,131	1,130	1,100	1,128	1,129	1,058

Source: The authors.

Notes: Probability values are in parenthesis. *, ** and *** Indicate statistical significance at the 1%, 5% and 10% level, respectively. Lags of independent variables are used as dynamic GMM instruments.

The impact of financial integration on business cycle volatility according to Kose et al. (2003) is ambiguous. The main benefit of financial liberalisation proposed by theoretical literature is that it should allow countries to better smooth consumption through international risk sharing. However, recent empirical evidences do not support this prediction. In developing countries for instance, financial liberalisation seems to be associated with an increase in consumption volatility (Levchenko, 2004). In our result, an increase in KAOPEN, a de jure measure of financial openness leads to an increase in consumption volatility, therefore, a reduction in the benefit of consumption smoothing. Capital account openness (KAOPEN) with coefficients (0.123) and (0.222) has a positive and statistically significant effect on VOLPC and VOLTC, respectively (see Table 2). This result was also replicated in the pool OLS and random effect estimation we conducted which shows that KAOPEN has a positive and significant effect on the volatility of total consumption growth (results are available on request). The pool OLS and Random effect estimation were conducted to serve as a robustness check for GMM estimation. The reason behind this result is that developing countries do not benefit from opening up their economies because they do not have the where withal to compete with the developed countries in the international market. This result is consistent with the findings of Bekaert et al. (2002) who argued that capital account openness increases the volatility of output and consumption in emerging market countries. Our result is contrary to Kose et al. (2003) and Ahmed and Suardi (2009) who argue that consumption volatility (smoothing) actually increases (decreases) with greater financial openness.

On the effect of capital account openness on the measures of income growth volatility, the theory is ambiguous about the impact of financial openness and output volatility. Financial openness allows

capital-poor countries to diversify away from their narrow production bases that are often agricultural or natural resource-dependent, thereby reducing macroeconomic volatility. For a more advanced or developed economy however, trade and financial integration could together allow for enhanced specialisation (Kose et al., 2009). This could make middle-income developing countries more vulnerable to industry-specific shocks and thereby lead to higher output volatility (Kose et al., 2004). Some theoretical and empirical works have established that financial openness decreases output volatility (Ahmed & Suardi, 2009; Kose et al., 2006). However, our result shows that capital account openness increases the volatility of VOLGNP, volatility of terms-of-trade adjustment output and GDP growth. The positive effect of capital account openness on VOLGNP, VOLTAD and VOLGDP may be due to the nature of shock that existed in the countries under investigation in which their weak policies might not be able to mitigate for them to reap the benefit of liberalising their economies. According to Buch et al. (2005) and Backus et al. (1992), the link between financial openness and business cycle volatility depends on the nature of the underlying shock.

For the volatility of per capita growth rate (VOLCAP), our result shows that capital account openness has a negative effect on VOLCAP. This implies that more financial openness leads to lower volatility of this measure of income growth volatility, which is consistent with the findings of Ahmed and Suardi (2009) and Kose et al. (2006). Our GMM (in Table 2) and pool OLS (results available on request) estimations show that capital account openness has a significant effect on volatility of investment. In our results, the de facto measure of financial openness shows that financial openness has a positive effect on all the measures of macroeconomic volatility except for total consumption volatility and the volatility of GNP growth rate (see Table 3).

In our result, the effect of financial development index (FDVT, an index we computed measuring financial system development on macroeconomic volatility) manifest varying characteristics. From Table 3, the FDVT has positive effect on private consumption growth volatility while it has a negative effect on total consumption growth volatility. The reason behind this result is the increase in the amount of credit to private sector and access to credit in Africa which is as a result of the development in the financial sector. The theory is also not clear on the effect of financial development on volatility. Many studies have shown that financial development through financial deepening and financial innovation reduces fluctuations in real per capita output, consumption and investment growth (Bekaert et al., 2006; Denizer et al., 2000, 2002; Dynan et al., 2006; Levine, 1997; Loayza & Raddatz, 2006). However, few other studies have established that financial development may actually contribute to increased volatility (Bencivelli & Zaghini, 2012; Jerman & Quadrini, 2009; Tiryaki, 2003). This squares with our result in Table 2 and column 2 where financial development increases volatility of private consumption. FDVT also has positive effect with volatilities of GNP growth and GDP per capita growth. Thus, it implies that financial development increases output per capita growth volatility. Though Cermeño et al. (2012) argued that financial development has no significant effect on output volatility in the USA, they claimed that it tends to reduce it in Mexico. Also, Hirano (2009) finds that the relationship between financial innovation and volatility of the economy is nonlinear: financial innovation first increases instability and then leads to stability. He argued that financial innovation destabilises the economy by accelerating financial amplification. As shown in Table 2, FDVT has a negative relationship with VOLTAD and VOLGDP. This implies that financial development has a reducing effect on GDP and term of trade volatilities. This squares well with tradition and empirical views (Acemoglu & Zilibotti, 1997; Aghion et al., 2005; Ahmed & Suardi, 2009). The result of the pool OLS (available on request) also supports the claim that financial development has a negative effect on the term-of-trade adjusted output growth and a positive effect on volatility of volatility of GNP.

Result in Table 2 shows that FDVT is negatively related to VGFC (see last column of Table 2). This implies that financial development has a decreasing effect on investment volatility. The result is consistent with the findings of Okoli (2012) who asserted that financial deepening reduces the level of risk (volatility) in the stock market. This is also corroborated in the pool OLS estimation results (available on request).

Looking at the coefficient of trade openness variable TRADOP, we only focus on the de facto measure
AQ: 4 of trade openness (3). The TRADOP coefficient is mix-signed in the two measures of consumption growth volatility models. On private consumption volatility, trade openness has a decreasing effect while on total consumption volatility trade openness has an increasing effect. However, contrary to Ahmed and Suardi (2009) who claimed that there is no evidence that trade liberalisation in Sub-Saharan Africa (SSA) improves the efficacy of consumption smoothing, our study confirms the existence of such relationship. Moore and Walkes (2007) on the other hand reported that more diversified countries tend to have lower rates of output, consumption and investment volatility. In our result, trade openness decreases volatility of GNP, GDP per capita growth (VOLCAP), the volatility of term-of-trade adjusted output growth, GDP growth rate and investment volatility. (see Table 3). This result was replicated for GDP growth rate in our pool OLS estimation, it shows that trade openness negatively affects volatility of term-of-trade adjusted output growth and volatility of GNP (results are available on request). While some theoretical and empirical works have shown that trade liberalisation leads to greater output volatility (Ahmed & Suardi, 2009; Drion, 2011; Easterly et al., 2001; Krugman, 1993; Razin & Rose, 1992), due to the facts that it exposes the economy to external risks, other works by (Calderón & Schmidt-Hebbel, 2008; Hegerty, 2014; Kim, 2007; Moore & Walkes, 2007) argued that trade openness may enable a country to expand and diversify its export sector and by varying its export industry, a country reduces its dependency on a small number of products or trading partners and also reduce a country's exposure to domestic risk, which may however leads to a lower growth volatility.

On investment volatility, our result is consistent with the findings of Moore and Walkes (2007). From Tables 2 and 3, the coefficients of trade openness variable show that trade liberalisation have a negative effect on investment volatility (see the last columns of Table 2 and 3). By implication, trade liberalisation reduces investment volatility in Africa. Though Mujahid et al. (2015) argued that trade liberalisation have a significant effect on investment volatility, they however did not say the direction of the effect. While the findings of the study of Moore and Walkes (2007) squares well with our findings, they claim that trade liberalisation leads to decreasing investment volatility in Middle East and North African countries particularly in a more diversified economy. They also found on the other hand that in South Asian countries, trade liberalisation kindles investment volatility.

Aside the trio of financial development, trade openness and financial openness, there are other economic variables that influence macroeconomic volatility. Some of these variables include INF (both level and volatility) which we used in capturing the effect of monetary policy and government expenditure which stand as a proxy for fiscal policy. Others are the term-of-trade volatility which measures the effect of term of trade shocks on volatility and the level of development in the economy proxied by GDP per capita growth. Some empirical evidences have suggested that the level of development in an economy is negatively related to output growth volatility (Ahmed & Suardi, 2009; Easterly et al., 2001). However, the result in Tables 2 and 3 show GDP per capita growth has a negative effect on volatility of terms of trade adjusted growth rate and positive effect on GDP growth rate and per capital GDP growth rate volatilities. This result is consistent with the findings of Hira and Shaista (2014). There are also evidences in the literature that monetary policy has significant effect on macroeconomic volatility (Blanchard & Simon, 2001; Cecchetti et al., 2006; Clarida et al., 2000; Olaberria & Rigolini, 2009). Also term of trade shock has been found to have significant effect on volatility Africa (Ahmed & Suardi, 2009), and

elsewhere in the world (Ahmed & Suardi, 2009; Easterly et al., 2001; Hira & Shaista, 2014; Mendoza, 1995; Moore & Walkes, 2007).

Finally, as shown in Tables 2 and 3, government expenditure has an increasing effect on macroeconomic volatility except for volatility of GDP growth rate in Table 2 and private consumption volatility, GDP growth rate volatility and per capita growth rate volatility in Table 3. We used government expenditure to capture the fiscal policy effect on macroeconomic volatility. There are also evidences that suggest a statistically significant effect of fiscal policy on macroeconomic volatility (Fatas & Mihov, 2006; Loayza & Raddatz, 2006; Olaberria & Rigolini, 2009).

For diagnostic check, different variables have been used to measure macroeconomic volatility in the literature (see Ahmed & Suardi, 2009; Rose & Spiegel, 2009; Yang & Liu, 2016). The contribution of our study is to examine additional variable that is missing in the existing literature. Our study added investment volatility that is measured using gross fixed capital formation. For other macroeconomic variables such as consumption and income volatilities, we used additional proxies to capture the realities in Africa. For consumption volatility, the study used private consumption and total consumption as justified in the body of the work. The study found that the results are the same for our variable of interest such as trade openness and financial openness. In addition, four proxies were used to capture income volatility namely: per capita income, GNP growth rate, terms of trade adjustment growth rate and GDP growth rate. Our results also showed no significant difference. Another important source of variation in the results of studies in the extant literature is the measurement of financial openness. While many studies used de jure measure of financial openness, others used de facto measure. The study followed the approach of Ahmed and Suardi (2009) by using both measures and discovered no significant difference in the results of our variables of interest. For financial development, two variables are used to construct financial development index using Principal Component Analysis. We use credit to private sector as a percentage of GDP and M_2 as a percentage of GDP. We later used the variables differently. Our results show that there is no significant difference from when the index was used and when the variables were used differently. Finally, the study used three estimation techniques so as to correct for like problem that may arise during estimation. Results from the estimation techniques shows that dynamic GMM result performs better and it is presented. Results from the other techniques are not significantly different from GMM results even though some are not statistically significant. We discovered that our results are reasonably insensitive to some assumptions that underline our baseline result.

Conclusion

This article seeks to further our understanding of the macroeconomic instabilities of African countries. Using the GMM estimation, this article focuses on the role of financial development, trade and financial liberalisation on macroeconomic instability in Africa. We used both the de jure and de facto measures of financial openness and our results contradict the argument that more financial openness leads to lower volatility in consumption in Africa. Though, for the de facto measure of openness, financial openness shows the capacity of reducing macroeconomic volatility. Our results also show that increased financial openness also leads to increased income volatility for the de jure measure of financial openness. This is consistent for the de facto measure also as increased financial openness increases income volatility on the average. Results also show that financial openness leads to subtle volatility of output growth in Africa. The volatility of investment also responded to the measures of financial openness in the same ways. Our results also show that a more developed financial market has a reducing effect on the volatility of total consumption, term-of-trade adjusted output growth, investment and income growth in Africa

(Table 3). On the contrary, a more developed financial market tends to increase volatility of private consumption and output in Africa. Also, in Africa trade openness reduces the volatility of private consumption, income and investment growth (Table 3). Our results also accounted for other determinants of macroeconomic volatility, including terms of trade volatility, economic development, INF levels and volatility and fiscal policy.

Therefore, the important policy implications that can be drawn from these results are that policymakers in Africa should focus more on policies that will foster financial system development as it has shown to be a very effective in reducing macroeconomic volatility in Africa. Financial development has been argued to play a critical role in igniting industrialisation by facilitating mobilisation of capital for immense works (Bagehot, 1873; Hicks, 1969, cited in Ross, 1997). It is also a said that a well-functioning financial system spurs technological innovation by identifying and funding those entrepreneurs with the best chances of successfully implementing innovative products and production processes (Schumpeter, 1912, cited in Ross, 1997). By a way of policy, an improved regulatory framework of a domestic banking industry should be ensured to diminish government influence and heighten the quality of loans in the financial sector. Policymaker in Africa should also consider the policy option of opening up the economy to trade as this is also seen to reduce the cardinal macroeconomic variables in Africa. Trade openness has argued by neoclassical trade theory drives countries to specialising according to the area of their comparative advantage. As trade barriers are removed, the specialisation effect will lead to more concentrated production structures. The reason trade openness may have been increasing the volatility of some macroeconomic variables (i.e., terms-of-trade adjusted output and GDP) may be due to the fact that most African countries are dependent on exports for primary goods, and their prices of these primary goods are often subjected to instabilities in the world market. That is to say, openness to trade that promotes exports in traditional sectors may have result in greater output growth volatility experienced in Africa.

Appendix A

Table A1. List of 51 African Countries Used in this Study

Algeria, Angola, Benin, Botswana, Burkina Faso
Burundi, Cameroon, Cape Verde, CAR–DR Congo
Congo, Republic Cote d'Ivoire, Egypt, Ethiopia, Gabon
Gambia, Ghana, Guinea, Bissau, Kenya
Lesotho, Liberia, Libya, Madagascar, Malawi
Mali, Mauritania, Mauritius, Morocco, Mozambique
Namibia, Niger, Nigeria, Rwanda, Senegal
Seychelles, Sierra Leone, South Africa, Tanzania, Togo
Tunisia, Uganda, Zambia, Zimbabwe, Chad
Comoros, Djibouti, Equatorial Guinea, Eritrea, Sudan
Swaziland

AQ: 5 **Source:**

Table A2. Data, Abbreviations and Source

Data/Abbreviation	Definition	Source
VOLCAP	Volatility of per capita GDP growth rate	Data from World Development Indicators, volatility was conducted using GARCH method.
VOLGNP	Volatility of GNP growth rate	„
VOLTAD	Volatility of terms-of-trade adjusted output growth rate	„
VOLPC	Volatility of private consumption growth rate	„
VOLTC	Volatility of total consumption growth rate	„
VOLGDP	Volatility of GDP growth rate	„
VGFC	Volatility of gross fixed capital formation, proxy for investment	„
VOLINF	Volatility of inflation	„
VOLTOT	Volatility of term of trade	„
INF	Inflation	Data sourced from World Development Indicators.
GDPPC	Per capital GDP	„
GOVEXP	Government expenditure	„
FDVT	Financial development index	Data sourced from World Development Indicators: financial development index computed by authors from two indicators (domestic credit to private sector [% of GDP] and M2 [% of GDP]), using the principal component analysis (PCA).
TRADOP	Trade openness	Data sourced from World Development Indicators: trade openness was computed by author from the sum of imports of goods and services (% of GDP) and export of goods and services (% of GDP).
KAOPEN	De jure measure of financial openness	KAOPEN is an index constructed by Chinn and Ito (2008).
FINOPEN	De facto measure of financial openness	Data sourced from World Development Indicators: foreign direct investment, net inflows (% of GDP) used as a proxy for financial openness.
OLS	Ordinary least square method	
GMM	General method of moment	
SSA	Sub-Saharan Africa	

Source:

AQ: 6

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