Do Financial and Trade Liberalisation Cause Macroeconomic Volatility in Sub-Saharan Africa?

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Abstract

This paper examines the effects of both financial and trade liberalisations on real output and consumption growth volatility in Africa. Having controlled for economic and financial development, institutional quality and other sources of macroeconomic instability, we find robust evidence that trade liberalisation is associated with higher output and consumption growth volatility. In contrast, financial liberalisation is observed to increase the efficacy of consumption smoothing and stabilise income and consumption growth. We also demonstrate that the volatility in output and consumption growth caused by trade liberalisation is negatively associated with the depth of the financial market. Moreover, there is evidence that good institutions help reduce inflation levels and volatility, which in turn promote lower growth volatility.

Introduction

Over the last 25 to 30 years there is an increasing number of African countries that adopted trade liberalisation measures as part of their structural adjustment programmes. These programmes are often accompanied by financial liberalisation to channel resources from unprofitable activities to profitable ones, made so by devaluations and trade reforms (Long, 1991). The onset of financial liberalisation is believed to benefit countries the frontier of technology, which the large volume of endogenous growth literature has shown will lead to increased growth (Bencivenga and Smith, 1991). Along with financial liberalisation, many of these African countries have also embraced trade liberalisation which purportedly cushions their economies against country-specific shocks (Krebs, Krishna and Maloney, 2005). While there are significant benefits from trade and financial liberalisations, the impact of these reforms has little or no positive effect on growth performance in Africa and the region insofar (Nissanke and Aryeetey, 1998). The effect of trade and financial liberalisations on the region's macroeconomic volatility, however, has never been investigated before even though there are extensive studies that examined sources of macroeconomic volatility based on mixed samples of developed and developing economies.[1]

While, in principle, financial and trade liberalisations should enhance international risk sharing, reduce macroeconomic volatility, and foster economic growth, in practice the empirical effects are less clear-cut. Kose, Prasad and Terrones (2003) document evidence that risk sharing has increased somewhat in advanced countries—consistent with their greater levels of financial openness—but less so or none in emerging market and developing countries. In addition, international financial integration has not increased macroeconomic volatility or crisis frequency in countries with well-developed domestic financial systems and a relatively high degree of institutional quality; it has, however, increased volatility for countries that have failed to meet these preconditions or thresholds. Should the evidence for emerging economies apply to Africa, then the supposedly beneficial market reforms may have detrimental ramifications for the African economies.

One potential implication of increased macroeconomic volatility is a decline in output growth. Studies have shown that a negative correlation exists between output growth volatility and economic growth (Ramey and Ramey, 1995; Kose, Prasad and Terrones,

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[1] Section 2 discusses various sources of macroeconomic volatility identified in the literature.

2005). The rationale is that increased uncertainties on future returns associated with output volatility discourages investment behaviours, and thus lowers economic growth (Pindyck, 1991). In developing countries such as Africa, financing options for long-term investment projects are often hampered by market imperfections associated with credit constraints and limited access to world financial markets; and these would further aggravate the negative impact of short-term volatility on long-term growth (Aghion, Bachetta and Banerjee, 2004). Given the current dismal growth performance in SSA, it is therefore disconcerting if financial and trade reforms were to generate greater macroeconomic volatility to further retard economic growth.

Equally, increased volatility has the effect of increasing the disproportionate distribution of adversity between the poor countries and the more developed and industrialised countries (Laursen and Mahajan, 2005). The poor usually have the least access to financial markets, and may find it harder to diversify the risk associated with their income. They may also not have the set of skills and/or necessary education that enable them to move across sectors during unfavourable economic conditions. These issues are particularly pertinent for the SSA countries (more so than others in the world, less South Asia), given that on average, 45 to 50 per cent of their population live below the poverty line. In light of these considerations, it is therefore important to assess the quantitative significance of the link between trade and financial liberalisations, and macroeconomic volatility. By the same token, it is also crucial to identify the determinants of output and consumption growth volatility for designing appropriate policies to reduce volatility and improve SSA's economic performance.

This paper undertakes a robust analysis on the implications of trade and financial liberalisations on macroeconomic volatility in sub-Saharan Africa (SSA). Specifically, we test whether a more open trade and financial regime increases the volatility in macroeconomic variables in SSA. This paper contributes to the literature in two significant ways. Firstly, contrary to Deaton and Miller (1996) and Hoffmaister et al. (1998), we focus on both growth in output and consumption. As pointed out by Dupasquier and Osakwe (2006), instabilities in output do not imply instabilities in consumption.[2] The reason being consumers can borrow to smooth consumption in the face of a volatile output. In general, welfare in a country is positively associated with consumption growth and negatively linked

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[2] Dupasquier and Osakwe (2006) restricts their analysis on consumption and investment to the case of an open trade regime. Kose and Reizman (2001) also considered consumption and investment although they failed to take account of different trade regimes.

to consumption volatility. A recent study on volatility of consumption over the business cycle has shown that it is associated with large welfare costs up to 8 percent of lifetime consumption, in developed countries (Barlevy, 2004). This figure is estimated to be significantly higher in developing economies where volatility is on average two or three time greater than that in developed countries.[3] Such revelation is not surprising as most developing economies such as the SSA countries are subjected to various highly volatile external and domestic shocks, and they lack developed financial markets and have limited access to international financial markets. All of these factors will invariably magnify the welfare costs of consumption volatility many times more.

Secondly, our analysis controls for the effects of other sources of macroeconomic volatility including, amongst others, changes in fiscal policy, terms of trade shocks, inflation, and natural disasters. In accounting for these factors, our approach is robust to the problem of omitted variable bias and rule out the possibility that other economic mechanisms are driving the results that suggest a more open trade and financial regime gives rise to greater macroeconomic volatility. In addition, we simultaneously control for the depth of the financial market, economic development and the quality of institutions and assess their role in influencing the extent by which trade and financial liberalisations effect macroeconomic volatility. In particular, an important departure from previous studies is in the way we establish the channels by which financial development and institutions promote lower macroeconomic volatility. We test for whether deeper financial development with increased trade openness could lead to income and consumption growth stability as result of greater risk sharing. We also examine whether good institutions through its influence on credible macroeconomic policy and lower inflation levels and volatility help dampen macroeconomic volatility.

The rest of the paper is structured as follows: Section 2 provides a discussion on macroeconomic volatility and its determinants in the SSA region. Section 3 outlines the data and the econometric methodology. Section 4 presents our findings and discusses their implications for the debate on economic reforms and economic volatility. Finally section 5 summarises and concludes.

2. Macroeconomic Volatility and Its Determinants: Theory and Empirics

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[3] Pallage and Robe (2003) report that the welfare cost of volatility in low-income countries is expected to be 10-30 times larger than the estimates for a typical developed economy.

What are the factors that drive output and consumption volatility in SSA? Do factors that cause output volatility necessarily affect consumption volatility too? To address these questions, it is important to understand how these volatilities are related. In a general equilibrium framework with complete markets, where economic agents have recourse to well-developed domestic and international financial and insurance markets, impacts of production shocks that give rise to fluctuations in income are not fully translated to fluctuations in consumption (Arrow and Hahn, 1971). In theory, consumption volatility is driven purely by global shocks which cannot be diversified. But, in reality, such outcome is not observed. One reason is that the markets are incomplete, and there are other impediments that prevent the risk management mechanisms from operating effectively. Thus, a significant portion of production shocks is translated into consumption shocks. This is particularly true for developing economies like the SSA countries, where there is a lack of developed financial markets and little access to international financial markets. Consequently, it is possible that the same factors that influence output volatility will also impact on consumption volatility. There is a dearth of theoretical and empirical literature that identify sources of income and consumption volatility.

(i) Financial Integration

Theoretical studies that investigate the effects of financial integration on business cycle volatility have failed to yield conclusive results. Using a dynamic stochastic business cycle model, Mendoza (1994) finds that welfare improvement in terms of lower volatility in output and consumption is small with increased financial integration. In the face of larger and more persistent shocks, however, there is evidence that output volatility increases with the degree of financial integration. In contrast, Baxter and Crucini (1995) document a negative relationship between financial integration and the volatility of consumption, and the relative volatility of consumption. For them, output volatility is found to increase with greater financial integration. The observed changes in output and consumption volatility are attributed largely to wealth effects and the interaction between these effects and the risk sharing outcomes from different asset market structures.

Analysing the impact of financial integration on macroeconomic volatility can be complicated by a confluence of other factors. In a related branch of studies that employ dynamic stochastic sticky-price models, Sutherland (1996), Senay (1998) and Buch, Doepke and Pierdzioch (2005) find that the degree of influence on output and consumption volatility depends on the nature of shocks hitting the economy. In the case of monetary and

fiscal policy shocks, the volatilities of output and consumption move in opposite directions with increasing financial integration. Rodrik (1998) argues that with financial integration, open economies have greater exposure to shocks in the world market, and their underlying structure of the economies such as the degree of exports and imports diversification determines their ability to absorb terms of trade and foreign demand shocks. These shocks explain a significant fraction of volatility in developing economies.

(ii) Trade Integration

Research into the relationship between trade integration and macroeconomic volatility has also yielded mixed results attributing to the patterns of trade specialization and nature of shocks. Krugman (1993) argues that output is more likely to be volatile in an increased trade environment, especially when there is a rise in inter-industry specialization across countries, and these industry-specific shocks are crucial in generating business cycles. If these shocks are extremely persistent, they can also increase the volatility of consumption. In contrast, increased trade resulting in increased intra-industry specialization across countries, and larger volume of intermediate inputs trade, can decrease output volatility (Razin and Rose, 1992).

(iii) Country Size and Economic Development

Another relevant factor in determining economic volatility is the country size and the level of development in the economy. These criteria are found to be negatively associated with macroeconomic volatility, as the dynamics of business cycles in small open developing economies tend to be influenced by productivity fluctuations in large industrialized countries (Head, 1995; Crucini, 1997). Small economies often have high trade shares and concentrated export structures that made them very vulnerable to external shocks (Easterly and Kraay, 2000). A low level of economic development also implies that small and open developing economies are unable to diversify risks adequately, and consequently, external shocks tend to exacerbate macroeconomic fluctuations. There are theoretical models that support the notion that volatility is negatively associated with the level of development (Acemoglu and Zilibotti, 1997). Empirical studies that employ GDP per capita as a proxy for country size and development have also found a negative association between volatility and development, as well as country size (Mobarak, 2004).

(iv) Fiscal Volatility

There is extensive literature that documents the effects of changes in fiscal policy on macroeconomic volatility. Based on a large sample of countries, Persson (2001), Shi and Svensson (2006) present evidence in favour of opportunistic political business cycle, that is, discretionary changes in taxes and spending occuring around election times for the purpose of re-election or are motivated by ideological changes in the government. The macroeconomic effects associated with the volatile fiscal policy are large (Blanchard and Perotti, 2002; Fatas and Mihov, 2003). Unanimous findings conclude that discretionary changes in fiscal policy have a significant influence on business cycle fluctuations, and inadvertently, the large economic volatility will lower growth in the long run. Fatas and Mihov (2003) show that the volatility of output caused by discretionary changes in fiscal policy can lower economic growth by more than 0.8 percentage points, for every percentage point increase in volatility.

Another related strand of the literature has delved into the effects of (transitory) procyclical fiscal policy on macroeconomic outcomes (Gavin and Perotti, 1997; Lane, 2003). Procyclical fiscal stance such as spending increases in excess of tax increases during good times does not match the cyclical position of the economy and contravenes the built-in automatic stabilizers. As a result, economic fluctuations are amplified. Furceri (2007) opines that economic uncertainty is prevalent in developing than developed countries. He has also found fiscal policy in the former to be more pro-cyclical. In fact, government expenditure volatility in developing economies exacerbates macroeconomic uncerainties and has larger effects on growth.

(v) Institutional Quality

Poor institutional factors in developing economies have also been blamed for incurring poor macroeconomic performance. An influential viewpoint contributed by Acemoglu, Johnson, Robinson and Thaicharoen (2003) highlight that institutions are a fundamental determinant of long-run development outcomes. They elaborate on a number of reasons as to why institutionally weak economies face risks on higher volatility of output and consumption. Firstly, institutional failures make economic adjustment difficult when dealing with external economic shocks. This is particularly so for developing economies as rising financial integration will imply increased specialization of production along the lines of comparative advantage (Razin and Rose, 1994). Secondly, institutionally-weak societies may encourage coups, revolution and unnecessary civil war cycles, thus disrupting growth patterns and escalating the situation to serious economic crisis (Acemoglu and Robinson,

2001). Thirdly, weak institutions in economies tend to encourage elites and politicians to find various ways to expropriate segments of the society especially in terms of rent-seeking activities. This can proliferate bad policy implementation, leading to poor economic outcomes and greater volatility. There is evidence to suggest that countries with weaker political and/or financial institutions are unable to deal with global crises. Developing countries that were open to capital flows and had weaker institutions were found to be most affected by global shock in the 1990s (Johnson, Boone, Breach and Friedman, 2000).[4]

(vi) Inflation Levels and Volatility

The seminal work of Friedman (1977) presents an informal argument about the effects of inflation on inflation uncertainty and economic growth. An increase in inflation may induce an erratic policy response from the monetary authority and therefore leads to more uncertainty about the future rate of inflation. Increased inflation uncertainty also distorts the effectiveness of the price mechanism in allocating resources efficiently thus causing negative output effects and increasing output volatility. Boyd, Levine and Smith (2001) also suggest that there may be a negative relationship between inflation and financial development in the long run. They believe that should inflation impede financial development then its impact on economic volatility will be even more pronounced. The implications of these findings are particularly relevant for the SSA countries. This is because evidence suggests that inflation rates were generally higher during the 1970s and 1980s in SSA than in other regions, apart from the Western Hemisphere. Statistics from the IMF indicate that the average annual inflation rate (consumer prices) during 1973-1982 was 21.9% for SSA, 11.7% for Asian developing countries, 18.7% for European developing countries, 15.2% for the Middle East and 49.6% for the Western Hemisphere developing countries.

(vii) Financial Sector Development

The resilience of an economy is strongly linked to the development of both its domestic and international financial markets. A more developed financial system is expected to reduce output volatility. Easterly et al. (2001) show that a higher level of development of the domestic financial sector is indeed associated with lower volatility.

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[4] Chinn and Ito (2005) also report that, compared to those with a lower degree of institutional development, financial systems with a higher degree of institutional development on average benefit more from financial openness.

Svaleryd and Vlachos (2002) employ three proxies for financial development, namely the size of the financial sector (measured by the ratio of liquid liabilities to GDP), the financial system's ability to allocate credit (measured by the ratio of credit issued to the private sector to GDP), and the real interest rate. They find that these three proxies are closely associated with the level of openness of a country.

(viii) External Risk Proxies

In a study that examines the relationship between trade openness and government size, Rodrik (1998) highlights the importance of accounting for external risk. In particular, he uses the terms of trade volatility as a proxy for external risk. The results seem to indicate that openness does not influence government size when accounting for the volatility of terms of trade. Instead it appears that the volatility of terms of trade provides a conduit through which openness affects the size of the government. By the same token, the effect of trade openness on output volatility may be nullified once we accommodate for terms of trade volatility.

(ix) Natural Disasters

Auffret (2003) investigates the effects of natural disasters on consumption volatility in the Caribbean region, and argues that they have direct impact on the stock of human and physical capital, which in turn can affect production, consumption, investment and the current account balance of payments. When natural hazards disrupt the production process, exports tend to decline while imports increase, thus leading to a deterioration of the balance of payment. When the damage to the economy is significant, the government will need to implement countercyclical policies even though tax revenues are expected to fall due to a reduction in production. These outcomes can lead to higher fiscal deficits. It is also anticipated that with the disruption in production, distribution processes and money creation to finance the reconstruction effort, inflation would increase.

According to a report by the Earth Institute at Columbia University on natural disasters and risks to human populations and economic activity, "drought and combinations of drought and hydo-metereological hazards dominate both mortality and economic losses in sub-Saharan Africa" (Dilley et al., 2005, p.81). The report further notes that in no other

continent does drought appear to be as severe a risk as in Africa.[5] The most concerning aspect of hazards and disasters in Africa is that they are relatively silent and insidious encroachments in life and tend to increase social, economic and environmental vulnerability to even the modest events. A point in case is the recurrent drought, deforestation and progressive land degradation, and the high prevalent rates of HIV/AIDS that resulted in incalculable human, crop, livestock and environmental losses.

An array of factors that can influence the volatility of output and consumption in SSA countries has been highlighted thus far. It is important to recognise that an accurate assessment of the effects of trade and financial liberalisations on macroeconomic volatility should be examined by accommodating a confluence of these factors, failing which the results could be biased.

3. The Data, Econometric Methodology and Instruments

(a) The Data

The data comprise of twenty five selected Sub-Saharan African countries over the period 1971-2005. Our empirical framework draws on the tradition of using data averaged over a number of years which has become a standard approach for analyzing long-term determinants of output growth volatility. To accommodate long-term economic policies and reforms, we use five-year average data as the frequency of observation. Data are thus available for seven time series observations for each country. The particular selection of countries and the time period employed are dictated by data availability.[6] Appendix 1 provides a detailed account of the definitions of the variables, their respective sources and the list of countries in the sample. Where real data are employed, they are expressed in 2000 prices.

Here, we provide a brief description on the data source for natural disasters and a measure of its effects on the economy as they are non-standard. Natural disasters data are obtained from the Emergency Events Database (EM-DAT) developed by the US Office of Foreign Disaster Assistance (OFDA) and the Centre for Research into the Epidemiology of Disasters (CRED) at the Universite Catholique de Louvain. This database nominally covers

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[5] Drought affected countries include Kenya, Magagascar, Rwanda, Somalia, Sudan, Tanzania, Uganda, Ethiopia, and Eritrea.
[6] The use of time series averages in panel data for cross-country studies has become commonplace. Although one could average the data over longer time horizon, say a decade, we prefer the shorter period as it allows for more time variation in the data.

all countries over the entire twentieth century although data on occurrences and effects are sparse for countries and regions prior to about 1970. The database contains entries under a number of different categories for individual natural disasters including its date and location, the number killed, injured, made homeless and otherwise affected. Other categories include economic damage in US Dollars, Euros and local currency. We consider aggregate effects on the proportion of population that are affected by three types of disasters, namely geological, climatic and humanitarian disasters.[7] It is not straightforward to assess the costs of damages caused by disasters in monetary terms. This is made difficult especially in SSA countries where not all assets are registered. Due to the paucity of data, we are not able to proxy natural disasters using damage costs. An alternative method is to measure the effects of a disaster using the proportion of population that is affected. The effects arising from various disasters that occurred in a year are summed together to give an aggregated figure. We then average the sum of these figures across a period of five years to obtain a five-year average measure of the effects of natural disasters.[8]

Data on fiscal policy volatility are categorised into volatility of discretionary fiscal policy (DFP) and fiscal policy procyclicality (FPP). The former is constructed using the method proposed by Fatas and Mihov (2003). We employ annual data for the 25 SSA countries over the period 1971-2005 and estimate the following regression for each country:

$$\Delta G_t = \alpha_1 + \beta_1 \Delta Y_t + \gamma \Delta G_{t-1} + \delta t + \varepsilon_t \tag{1}$$

where G is the logarithm of real government spending and Y is the logarithm of real GDP.[9] The deterministic time trend t is used to capture the observed trend in government spending over time. The country-specific volatility of ε_t is an estimate of discretionary policy. We calculate a 5-year volatility as $\sqrt{\text{var}(\varepsilon_t)}$ for t=1971-75,…,2001-2005 and denote it as the volatility of discretionary fiscal policy. As for fiscal policy volatility, it is constructed using the method of Lane (2003) which involves running a country-by-country regression of

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[7] Geological disasters comprise earthquakes, land slides, volcano eruptions and tidal waves; climatic disasters include floods, droughts, extreme temperatures and wind storms; humanitarian disasters involve famines and epidemics.

[8] An alternative way of measuring the effects of disasters is to measure the incidence of disasters by counting the number of events in a given year that classify as large disasters according to the criteria set by the International Monetary Fund (IMF) which are the event that affects at least half a percent of a country's population, or causes damages of at least half a percent of national GDP, or results in more than one fatality every 10,000 people (see Skidmore and Toya, 2002). We employ this measure in our regression analysis as a check for robustness, but the results are qualitatively unchanged.

[9] Real government spending data are obtained from World Economics Indicators in 2000 prices.

$$\Delta CG_t = \alpha_2 + \beta_2 \Delta CGDP_t + e_t \tag{2}$$

using annual data where CG is the logarithm of the cyclical component of real government expenditure and CGDP is the logarithm of the cyclical component of real GDP. The logarithm of the cyclical component of a series is obtained by taking the log deviation of the series from its Hodrick-Prescott trend. β_2 measures the elasticity of government expenditure with respect to output growth. A positive value indicates a procyclical fiscal stance, and values above unity indicate a more than proportionate response of fiscal policy to output fluctuations. The estimated cyclicality coefficient $\hat{\beta}_2$ is the measure of fiscal policy procyclicality.

For a more comprehensive analysis on the effects of trade and financial liberealisations on macroeconomic volatility, we consider different income and consumption growth volatility measures. Following Kose et al. (2003), we employ three proxies for income growth volatility. They are the volatility of per capita GDP growth rate (Vy), the volatility of GNP growth rate (Vq), and the volatility of terms-of-trade adjusted output growth rate (Vy*). GNP is used, in addition to output (GDP), 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 $GDP + EPI * EX / GDP + IPI * IM / GDP$ 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 database.

Consumption growth volatility is measured using the volatility of private consumption growth rate (Vc), the volatility of total consumption growth rate (Vcg) and the ratio of the volatility of total consumption growth rate to that of income growth rate (Vr). 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 SSA, the government consumption to GDP ratio is significantly high which highlights the importance of government consumption. Vr is considered as a measure of the efficacy of consumption smoothing relative to income volatility. A lower value for Vr indicates greater consumption smoothing and this can emanate from lower consumption growth volatility, higher income growth volatility or both. It can be seen, therefore, that this volatility measure is effectively the most relevant measure for analysing the welfare effects of reforms on volatility.

The measures of economic reforms involve both trade openness and financial openness. For trade openness, we use a measure of restrictions on current account transactions and a standard trade openness ratio (computed as the ratio of the sum of exports and imports to GDP).[10] Financial openness is measured in two ways: we use an indicator of the restrictions on capital account transactions and the ratio of gross capital flows to GDP. The indicators that measure the restrictiveness of transactions are known as *de jure* measures of openness while the flow measures represent *de facto* openness.[11] 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. 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 (Chinn and Ito, 2005; Eichengreen, 2002). In fact, studies have observed robust evidence when using finer measures of *de jure* integration (Kose, Prasad, Rogoff and Wei, 2006).

Apart from investigating the effects of trade and financial openness on economic volatility, we also consider a host of other factors and measures of foreign shocks variables as control variables. These variables that are discussed in the previous section, include the terms of trade volatility (TOTV) as a proxy for external risk premium, inflation levels (INF) and inflation volatility (VINF) measured as the standard deviation of the five-year inflation rates, financial deepening factor (computed as M2/GDP) as a proxy for the extent of domestic financial market development, and volatility in changes of this ratio (M2V). Country size and the level of economic development are proxied by the level of GDP per capita (YPC).

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[10] Another measure of the degree of restrictiveness of trade policy is based on tariffs and non-tariff barriers. While we do not use this incidence based measure of openness, this measure of trade restrictions is taken into account in the current account transaction restrictions index.

[11] Restrictiveness indicators are dummy variables with 1 indicating the presence of restrictions and zero otherwise. In the panel regressions, these indicators are averaged across a period of 5 years, hence it can take values between 0 and 1.

(b) Preliminary Data Analysis

In this section we provide a brief description of our dependent and explanatory variables. This will not only help us depict main trends but highlight the response of output and consumption growth volatilities to various macroeconomic developments. We will also review the specific roles of financial and trade integration, given their increasing importance in the pursuit of economic stability. More specifically, we look at whether financial and trade integration has dampened or magnified fluctuations in output and consumption growth over time. Although it is true that financial openness can enhance growth through various channels, there is also evidence that financial globalization has caused greater income and consumption volatility in developing countries where the level of financial integration is low or moderate (Prasad, Rogoff, Wei and Kose, 2003). In these countries, financial openness has adverse effects on both output and consumption growth, and they incur large welfare costs.

Having grouped the sample countries into more financially integrated Sub-Saharan African economies (MFISSA) and less financially integrated Sub-Saharan African economies (LFISSA),[12] the evolution of the average volatility of income and consumption growths over 5-year rolling window are plotted in Figures 1(a) and (b) respectively. We depict volatility dynamics of these variables using three different measures of income (Vy, Vq and Vy*) and consumption (Vc, Vcg and Vr) which are also used as dependent variables. Upon examination of Figure 1(a), there is evidence that volatility of income growth in MFISSA countries experiences a significant decline in post reform era (1991-2000 periods) and is lower than that of LFISSA, irrespective of the volatility measures used. This initial inspection indicates that the establishment of financial integration for both regional and international markets in SSA countries can enhance financial risk sharing, and bring about income smoothing benefits in post-reforms.

- Figures 1(a) and (b) about here -

From Figure 1(b) we observe that the volatility of private consumption growth as well as total consumption growth has in fact risen for the LFISSA since late 1990s. As opposed to this, more international financially integrated SSA countries have appeared to experience declining volatility on private and total consumption growth. Prasad et al. (2003) emphasize that a significant welfare gain through greater financial market integration is to

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[12] More financially integrated SSA countries are South Africa, Mauritius, Ghana and Botswana. The rest are classified as less financially integrated.

provide better opportunities for countries to share macroeconomic risk and hence smooth consumption. Overall, the evidence here supports the general view that regional and international integration contribute to the lowering of income and consumption growth volatilities.

Figure 2(a) shows a positive relationship exists between trade openness and output growth volatility in SSA countries. This is consistent with the finding of Dupasquier and Osakwe (2006) on African countries. The work of Kose and Reizman (2001), and Bleaney and Greenaway (2001), amongst others, also document that more open trade regimes lead to higher macroeconomic volatility in SSA. Moreover, Dupasquier and Osakwe (2006) emphasize the importance of trade shocks in accounting for variation in investment, output, consumption, and labour supply. Although trade openness may decrease output volatility by diversification of exports and imports and provide related insulation against domestic demand shocks, trade liberalization can also lead to a greater exposure to sectoral and external demand and supply shocks.

- Figures 2(a) and (b) about here -

In general, financial market reforms can be associated with lower output and economic volatility when they allow public and private economic agents to smooth their consumption and investment patterns. Figure 2(b) supports the prediction that financial liberalization and output growth volatility are negatively associated. For SSA countries that have undertaken more open financial reforms they have also experienced a greater decline in the volatility of aggregate output.[13] This may be due to the fact that financial sector development can amplify the growth benefit associated with FDI inflows, and through expanding the scope of diversification possibilities, it can also moderate the effect of external shocks (Kose et al., 2006). However, the beneficial impact of a more liberalized trade and financial markets in SSA is still subjected to debates. The empirical work undertaken in the next section will attempt to improve on recent studies on this issue.

- Table 1 about here -

Table 1 shows decade averages of other important macroeconomic variables used in the next section. Terms of trade volatility and volatility in M2 appear to have improved in recent years, seemingly reducing the vulnerability of these economies to external shocks,

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[13] Similar finding was reported by Easterly et al. (2001) for a sample of 74 developed and developing countries.

while average annual inflation and its volatility have moderately been increasing. The data indicate that SSA countries have experienced some success in financial deepening in the post 1991 reform era. Its trade and financial openness have also improved to accelerate per capita income (YPC). There is evidence that the degree of discretionary fiscal policy (VDFP) has been increasing over time and it ranges from 0.17 in 1971-80 to 0.28 in 2001-2005. It is pertinent to determine whether this upward trend in discretionary fiscal policy has an influence on macroeconomic volatility. The proportion of population in SSA that is affected by natural disasters has remained more or less constant over time.

(c) Econometric Methodology

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

$$y_{it} = \alpha_i + \beta' x_{it} + \eta_i + e_{it} \tag{3}$$

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 time effects (5-year period dummies), proxies of trade and financial openness, measures of external shocks, interaction terms between the explanatory variables and other control variables; η_i is the unobservable country-specific fixed effect for country i; and e_{it} is a disturbance term. 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. Using the least square dummy variable estimator (LSDV) is not an option given the endogeneity of the regressors and the small time dimension in the fixed effect model (Kiviet, 1995).

It is common to use the generalised method of moments (GMM) estimator of Arellano and Bond (1991) when estimating a panel data model. Arellano and Bond (1991) generate moment conditions to estimate the parameters of interest by assuming the future realizations of the error are not correlated with current values of the explanatory variables, that the error term is serially uncorrelated and homoskedastic, and that the explanatory variables are uncorrelated with the unobserved country-specific effect. In the event that the error term is heteroskedastic, Arellano and Bond (1991) propose a two-step GMM estimator

where in the first step of the estimation, the disturbance terms are assumed independent and homoskedastic across countries and over time. This assumption is relaxed in the second step when a consistent estimate of the variance-covariance matrix is constructed from the residuals that are obtained in the first-step estimation. The two-step GMM is regarded as more efficient when the disturbance term is heteroskedastic.

One drawback of the Arellano and Bond (1991) two-step GMM estimator, however, is that it fails to exploit all of the available moment conditions under standard assumptions. The results may thus yield consistent but not efficient estimates (Ahn and Schmidt, 1995). Arellano and Bover (1995) subsequently improve upon the first-differenced GMM estimator by jointly estimating the original level and first-differenced regressions. They 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 (Blundell and Bond, 1998; Blundell, Bond and Windmeijer, 2000). For this reason, we use the system-GMM estimator in our dynamic panel data estimation.

(d) Instruments

The specification (3) for growth in output and consumption volatility may be influenced by simultaneity bias between growth volatility and contemporaneous measures of economics development, financial depth and institutional quality. Greater growth volatility which impedes output growth can also hamper economic development, and by the same token, a more developed economy will experience lesser macroeconomic volatility. Easterly et al. (2001) argue that institutions and shocks are likely to be endogenous; the extent of financial depth could be closely associated with the intensity and frequency of shocks, and hence the extent of growth volatility. To ameliorate the potential problem of endogeneity in regressors like economics development and financial depth, we use their values in the starting year of each five-year period as instruments. However, this method of instrumentation is not applicable to institutional quality, given that the legal index for proxies does not vary significantly in the five-year period.[14] This observation is consistent with the general belief that institutional rigidity and inertia may persist for a considerable period of time.

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[14] This observation can be confirmed by the lack of variation in the LEG variable in Table 1.

We follow La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999) in instrumenting institutional quality by using three key determinants, namely economic, political and cultural characteristics of the country. Different exogenous sources of variation in the economic, political and cultural characteristics of the SSA countries are required to explain the variation in institutional quality. For economic determinant of institutional quality, it is believed that better institutions and government performance commensurate with the scale of economic activity. Economic determinant is proxied with real GDP per capita. As for the political contribution towards institutional quality, we measure it by the extent of political divergence in society between social, ethnic, class or other interests. A proxy for this variable is ethnic heterogeneity.[15] Another variable that captures political contribution is the legal system and its origin. The SSA economies national and commercial legal traditions fall into two categories, namely the common law and the French civil law. Finally, for cultural determinant, we use "religion as a proxy for work ethic, tolerance, trust and other characteristics of society that may be instrumental in shaping its government" (La Porta et al., 1999, pp. 224), and categorise religious affiliations into Protestants, Catholic, Muslim and other denominations. Other than these determinants, La Porta et al. also account for the position of the country with respect to the equator and the poles (i.e. its latitude). This consideration takes into account the colonial period when Europeans lacked immunity to tropical diseases and tended to reside in temperate latitudes. This explains why historical creation of economic institutions is correlated with latitude.

To determine whether these variables are valid instruments, we run a pooled regression of institutional quality on a constant, a French civil law dummy which takes the value one if the country's legal origin is French and zero otherwise, the population percentages of Catholics, Muslims and other religions, an index of ethnolinguistic heterogeneity, latitude and real GDP per capita. The dependent variable, institutional quality, is proxied by the legal structural and security of property right index, which is made up of an average of five indices, namely judicial independence, impartial courts, protection of intellectual property, military interference in rule of law and the political process, and integrity of the legal system.[16] Data on the determinants of institutional quality are obtained from La Porta et al. (1999).

- Table 2 about here -

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[15] The zero to one value of the index of ethnolinguistic fractionalisation is an average value of five indices. La Porta et al. (1999) outlined a detailed description of the five component indices in Table 1.
[16] For further detail on the five component indices, refer to the Economic Freedom in the World Database.

Table 2 reports the pooled regression results. It can be seen from the negative coefficients of the ethnolinguistic fractionalisation and French legal origin dummy, that institution quality becomes inferior with the increase in ethnolinguistic heterogeneity as well as the use of a more interventionist legal system like the French civil law. This finding is consistent with that reported by La Porta et al. (1999). In addition, we find that all other explanatory variables contribute positively to the quality of institution. An important contrast in our results is the statistically significant and positive sign associated with the coefficients of shares of Catholic and Muslims in the population. La Porta et al. find that the quality of institution deteriorates with the increase in percentages of Catholics and Muslims in the economy. The basis of their observation is supported by the cultural theory that both Muslims and Catholics are more interventionist who supported State power. Moreover, cultural theories predict that governments in predominantly Catholic and Muslim countries are less efficient because bureaucracies in these countries have evolved from religious ranks and are therefore less dependent on the sovereign. Nonetheless, we fail to find evidence in support of these cultural theories for the SSA countries. Based on our regression results, we show that the use of these explanatory variables as instruments for institutional quality is indeed appropriate.

4. Empirical Results

(a) Do trade and financial liberalisations increase SSA's macroeconomic volatility?

We first report the estimation results of model (3) which exclude any interactive terms between institutional quality, financial development, inflation levels and volatility, and proxies for international and financial liberalisations. In each of the panel regression, we conduct tests for the validity of instruments and the presence of second order serial correlation in the residuals. The tests results support the validity of instruments used and show no evidence of second order serial correlation in the residuals.

- Table 3 about here-

Table 3 reports growth volatility dynamics of income and consumption as explained by a host of economic, socio-economic and structural characteristics outlined in Section 2. In columns two to four, the dependent variables are measures of income growth volatility while the last three columns are the volatilities of different consumption growth measures. We start by focusing on the effects of financial market reform on consumption and output

growth volatility. In line with previous studies (Kose et al. 2006; IMF, 2002), we find that the presence of capital account transaction restrictions (i.e. CAP=1) to be positively associated with Vq (income growth volatility that accounts for international risk sharing) and the three measures of consumption growth volatility. All things being equal, the capital account restriction increases the standard deviation of GNP growth by 0.31. To give a quantitative assessment of this result, we compare the size of the increment with the mean of Vq (0.21) and it can be seen that the effect of CAP on Vq is very substantial. The capital account restriction has a statistically significant and positive effect on Vr, raising it from 2.97 on average to 5.09, *ceteris paribus*. The significant increase in Vr suggests that the benefit of consumption smoothing is markedly reduced with increased capital account restrictions. The coefficient of FINO, the *de facto* measure of financial openness, is always negative for both output growth and consumption growth volatilities. This result is not inconsistent with the *de jure* measure CAP because it implies that output and consumption growth volatility tends to diminish with the degree of openness in the financial market. One way of assessing the results is to consider a one standard deviation change in the financial openness index (FINO) which decreases Vy by 0.00068 (0.027*0.025). The effect of financial liberalisation measured by FINO on output growth volatility is clearly smaller than that by CAP, implying that one should be cautious in interpreting the effects of financial openness using the *de jure* and *de facto* measures.

Turning to the coefficients of the trade restriction variables (i.e. CAR and TDO), they indicate that trade openness is detrimental to growth stability for income and consumption in the SSA countries. The coefficient of CAR is negative but it is only significant in the case of Vy* - an output growth measure that takes into account fluctuations in the term of trade. The coefficient of TDO is also the largest for Vy* suggesting that trade openness has a larger effect on output growth once changes in export and import prices are factored in. A one standard deviation change in the trade openness index increases the terms of trade adjusted output growth volatility by about 0.10 (0.29*0.34). This magnitude of increment is relatively large when compared with the mean of Vy* (0.25). The significance in the effects of trade liberalisation on Vy* is perhaps not surprising given that most SSA countries are dependent on exports for primary goods, and their prices are often subjected to significant fluctuations in the world market. In other words, trade openness that promotes exports in traditional sectors may result in greater output growth fluctuations. Referring to the effects of trade liberalisation on consumption growth volatility, we find that CAR reduces growth volatility in consumption and total

consumption by 0.019 and 0.037 respectively. The magnitude of these reductions are of significant order given that the mean levels of consumption growth and total consumption growth volatility are 0.086 and 0.109 respectively. The use of de facto measures of trade liberalisation does not, however, yield results that are statistically significant. There is also no evidence that trade liberalisation in SSA improves the efficacy of consumption smoothing.

Apart from trade and financial liberalisations, there are other economic factors that influence macroeconomic volatility which include the volatility of the terms of trade, the size and/or the extent of economic development, financial market development, inflation (both in levels and volatility) and fiscal impulses. There is evidence to suggest that the degree of economic development or the size of economic activity is negatively associated with the volatility in GNP growth and consumption growth. The depth of the financial market also plays an important role in mitigating macroeconomic volatility, a result that concurs with findings in previous literature (Easterly et al., 2001). A one standard deviation increase in the proportion of M2 to GDP decreases Vy by 0.002 (0.013*0.131) and Vr by 0.97 (7.435*0.131).

On the other hand, consistent with predictions made by theory, factors such as terms of trade volatility, fiscal policy changes, inflation and inflation volatility tend to be positively associated with volatility in income growth and consumption growth. It is interesting to note that the coefficient of the term of trade volatility in the Vy* regression is statistically significant at the 5 per cent level and has a magnitude that is about twice as large as that in the Vy regression. This could be due to the fact that the Vy* measure accounts for import and export prices in the trade adjusted income growth. The empirical link between fiscal impulses and macroeconomic volatility is equally evident. The parameter estimate of the variable FPP is positive and significant for Vq and Vy*, indicating that fiscal policy shocks exacerbate output growth volatility. It is not clear the channel by which fiscal impulses affect consumption and output growth volatility, although it is possible that this comes about through building non-sustainable long-term debts. Fiscal indiscipline can also cause fluctuation in output through building inflationary pressure which damage government credibility. The volatility of discretionary fiscal policy also exerts an influence on both Vy and Vq, but impacts only on Vc and not on total or relative consumption growth volatility. Inflation is seen to exert the largest effect on Vy* and Vq than the other variables with output growth volatility increasing by about 1.01 for every one per cent increase in inflation rate.

Non-economic factors such as natural disasters and institutional quality are also found to impact macroeconomic volatility. Institutional quality appears to play an important role in determining economic volatility. Our institution quality indicator is is ranked on 1-10 scale, with 1 representing the lowest degree of economic freedom (highest risk) and 10 the highest level of economic freedom (lowest risk). The coefficient estimate of institutional quality is negative and statistically significant in Vy, Vy*, Vcg and Vr regressions. The results imply that African countries with institutional problems (worsening governance) suffer substantially more economic volatility. Our findings support previous literature which argue that better governance reduces volatility in a number of ways: reduce capital flight (Kose et al., 2006), help 'tilt' a country's capital market structure towards FDI and portfolio flows (Acemoglu et al., 2003), and generally bring further collateral benefits of financial integration to stabilize within-market financial flows (Faria and Mauro, 2005). Apart from institutional quality, we also find that natural disasters tend to destabilise trade adjusted income growth and markedly reduce the efficacy of consumption smoothing. When compared with other determinants of macroeconomic volatility, the effects of natural disasters on output growth volatility is the smallest.

(b) How do institutional quality and financial development mitigate macroeconomic volatility?

In this sub-section, we examine the way by which institutional quality and financial development influence trade and financial liberalisations and their effects on macroeconomic volatility. We assess whether SSA countries with a low score of institutional quality and financial market development will benefit less from financial and trade openness compared to their more financially developed and better institutional quality counterparts. In addition, we consider the interactions between institutional quality, inflation levels and inflation volatility and how they impact on macroeconomic volatility.

There is extensive evidence to suggest that political and institutional factors are the main determinants of inflation volatility (Cukierman, Sebastian, and Tabellini, 1992; Aisen and Veiga, 2006). While a study by Rother (2004) indicates that volatility in discretionary fiscal policies has contributed to inflation volatility in a panel of 15 OECD countries for a period of 35 years, the deep determinant of inflation volatility is still linked to institutional factor. Politically-unstable countries are prone to political shocks that often result in discontinuous monetary and fiscal policies which in turn lead to higher inflation volatility. Aisen and Veiga (2006) show empirical evidence based on a panel data set covering around

100 countries from 1975–99, that greater political instability, lower economic freedom and higher degrees of ideological polarization and political fragmentation, do lead to higher inflation volatility. Huang and Wei (2006) further argue that monetary regimes such as pegged exchange rate regimes, currency boards and dollarization may not be very credible and can fail in countries where institutions are seriously weak. They may also not increase the credibility of a government's resolve to maintain low inflation. We examine the effects of inflation and inflation volatility on macroeconomic volatility observed in Table 4 in conjunction with institutional quality in the SSA countries.

- Table 4 about here-

Table 4 reports the estimation results for income and consumption growth volatility models which include the interactive terms between institutions, financial development, trade and financial openness, inflation levels and volatility. Turning to the interactive variable between financial development and trade openness, we find that the coefficient changes sign when compared with the coefficient of trade openness in Table 3. This result is interesting because it implies that trade openness in itself contributes to greater volatility in income growth. However, in the presence of a deeper financial market, the detrimental effect of trade openness is mitigated. In fact, the evidence implies that macroeconomic volatility can be reduced, if the SSA countries have a sound financial system to cope with large and sudden fluctuations in resource income generated by increased trade flows. For a one standard deviation increase in financial development and trade openness, the reduction in output growth volatility ranges from 0.005 (0.61*0.29*0.03) to 0.01 (1.26*0.29*0.03). Jointly both trade openness and financial development works to reduces consumption growth volatility by about 0.007 (0.80*0.29*0.03) *ceteris paribus*. The negative and statistically significant coefficient of FINO*FD indicates that financial openness when complemented with a developed financial system, can improve international risk sharing and contributes to lower GNP growth volatility. The combined effects of financial openness and development also strongly promote consumption smoothing (Vr).

By allowing institutions to interact with trade and financial openness, we find that institutions unlike financial market development do not reduce the effects of trade openness on macroeconomic volatility. This may be so because institutions operate differently in mitigating the effects of trade openness on macroeconomic volatility. We find that financial openness when supported with good institutions is also prone to reduce output growth

volatility even if it fails to exert any influence on consumption growth volatility. Finally, looking at the coefficient of the interactive terms between inflation and institutions, we find that the combined effects of both generate lower macroeconomic volatility. This is because the presence of a good institution promotes a credible policy framework which harnesses lower inflation and macroeconomic volatility. By and large, the joint effects of institutions and inflation volatility also give rise to lower output and consumption growth volatility even though the reduction in volatility is smaller than that of inflation and institutions. Without elaborating on the other sources of macroeconomic volatility, we find that the results for the other determinants generally concur with those reported in Table 3.

5. Conclusion and Policy Implications

For a long time economists have been concerned about the growth-promoting effects of trade and financial liberalisations in developing economies. Recent empirical research, however, has shifted its attention to the growth volatility effects of trade and financial liberalisations. In this paper we focus on the SSA countries to show that both trade and financial liberalizations matter for macroeconomic volatility. Our results support the claim that increased financial openness leads to lower volatility in output and consumption growth. However, contrary to conventional belief, trade openness in SSA invokes greater macroeconomic instability. These results are robust having accounted for a plethora of sources of macroeconomic volatility, including terms of trade volatility, depth of financial market, economic development, inflation levels and volatility, natural disasters, institutional quality, and fiscal impulses. The extent by which trade and financial openness is effective in reducing volatility depends on the degree of financial development and institutional quality. The SSA economies with less diversified production structures and tend to be very open to trade, could dampen output growth volatility by deepening their financial markets. Good institutions are also the cornerstone of a stable macroeconomic environment, where policymakers can foster low inflation and inflation volatility – both of which are crucial for maintaining low macroeconomic volatility.

There are important policy implications that can be drawn from these results. Apart from existing reforms on trade and the financial market, policymakers in Africa should focus on policies that foster institutional development. Contrary to the argument that institutions are largely the result of a country's history and culture, and therefore difficult to change, recent empirical studies have shown that there is a role for policies to accelerate the

transition to better institutions. One way is through trade openness. It has been argued that the opening up of markets can discourage vested interests and diminish rents obtained from existing convenient economic and institutional arrangements (Ades and Di Tella, 1999). Market openness also spurs the development of institutions to be better equipped to handle an increasingly varied, complex and possible risky range of transactions (World Bank, 2002). Another advantage is the increasing transparent and improved dissemination of information that may contribute to higher efficiency and better policies. Transparency not only provides more information to the markets to help identify the presence of economic rents, it also creates checks and balances on what policymakers can do, such as increasing the penalty for rent extraction (Fischer, 2002). The IMF, the World Bank and other international agencies are instrumental in instilling discipline on transparency as their support to countries are made conditional on steps to improve exactly that. Finally, the use of external incentives and agreements can lead to positive institutional change. In SSA, the New Partnership for Africa's Development (NEPAD) operates via regional arrangements to monitor and strengthen institutions so as to create a virtuous cycle of institutional development in the neighbourhood. This is consistent with the belief that countries are more likely to experience institutional development if their neighbours have higher institutional quality.

The empirical evidence of lower macroeconomic volatility also highlights the importance of a well-functioning financial system. To enhance financial deepening and improve financial service delivery, policymakers in SSA should promote foreign ownership of banks and/or privatise government banks. With these participations, a country's access to international financial markets can be made easier. In addition, the improved regulatory framework of a domestic banking industry will diminish government influence, and heighten the quality of loans in the financial sector. Notably, foreign banks are likely to introduce new financial instruments and technologies to increase competition and improve the quality of financial services. Moreover, their presence can also provide a safety valve when depositors become worried about the solvency of domestic banks. But of course, foreign banks may be less likely to participate unless there is a strong commitment from the government in SSA to strengthen the infrastructure in the country.

Finally, while trade openness is crucial for decreasing economic volatility, the reform strategy is limited in its success unless there is diversification in Africa's production and export structures. African countries exports are predominantly in primary commodities with very unstable and volatile prices. A diversification away from traditional, often

primary, exports is a significant obstacle to many African countries owing to the lack of infrastructure and human and physical capital. Thus, one way of overcoming this challenge is for governments to focus on regional integration that promotes infrastructure development. It is believed that the reduction of transaction costs through better infrastructure can make exports more competitive and accesible to foreign markets. Apart from the establishment of infrastructure, the export diversification strategy also relies on the efficacy of financial deepening where financing can be afforded to convert exports to new sectors. In addition, competitiveness on international markets also relies on effective access to markets via active participation at multilateral trade organisations like the WTO and by being able to negotiate favourable trading terms with bilateral and/or regional partners.

Data Appendix

Appendix 1: Variables, sources and list of countries.

Variable	Definition	Source
Vy	Real GDP per capita growth volatility	World Development Indicators and Penn World Tables (PWT6.2).
Vq	GNP growth volatility.	World Development Indicators
Vy*	Terms-of-trade adjusted real GDP growth volatility.	World Development Indicators and Penn World Tables (PWT6.2).
Vc	Standard deviation of the growth rate of private consumption.	World Development Indicators and Penn World Tables (PWT6.2).
Vcg	Standard deviation of the growth rate of private and public consumption.	World Development Indicators
Vr	Relative total consumption growth volatility to that of income (GNP)	World Development Indicators
YPC	Initial real per capita GDP in 2000 PPP adjusted US$.	Penn World Tables (PWT6.2) .
CAR	Dummy variable capturing current account restriction	Glick and Hutchison (2005), Reinhart and Tokatlidis (2003), various Central Bank Bulletins and International Financial Statistics.
CAP	Dummy variable capturing capital account restriction	As above.
TDO	(i)Trade openness which is a ratio of exports and imports to GDP (constant 2000 US$).	World Development Indicators
FINO	Financial openness is obtained as 5-yr average of ratio of the sum of foreign direct investment and portfolio inflows to GDP.	UNCTAD, FDI Database
FD	Financial development is measured by M2	World Development Indicators
M2	Measure of financial deepening (M2 as %GDP)	World Development Indicators
INF	Annual log difference of CPI	World Development Indicators
INFV	Standard deviation of the annual log difference of CPI.	World Development Indicators
TOTV	Standard deviation of the annual log difference of the terms of trade.	International financial statistics (IMF).
FPP	Fiscal policy procyclicality	This is constructed following the method of Lane (2003).
VDFP	Volatility of discretionary fiscal policy	This is constructed following the method of Fatas and Mihov (2003).
ND	Natural Disaster measures the impact of the disaster as determined by the proportion of population affected by the disaster averaged across 5 years.	EM-DAT: The OFDA/CRED International Disaster Database Univerite Catholique de Louvain, Brussels, Belgium www.em-dat.net
IQ	Institutional Quality is measured by LEG.	Fraser Institute (2006), Economic Freedom in the World Database.
LEG	Legal index of the legal structure and security of property rights aspects of economic freedom.	Fraser Institute (2006), Economic Freedom in the World Database.
Countries: Botswana; Burkina Faso; Burundi; Cameroon; Chad; Congo Republic; Ethiopia; Gabon; Gambia; Ghana; Kenya; Madagascar; Malawi; Mali; Mauritania; Mauritius; Nigeria; Senegal; Sierra Leone; South Africa; Tanzania; Togo; Uganda; Zambia; Zimbabwe.		

Figure 1: Income and Consumption Volatility (Median of the Group)

1(a) Income
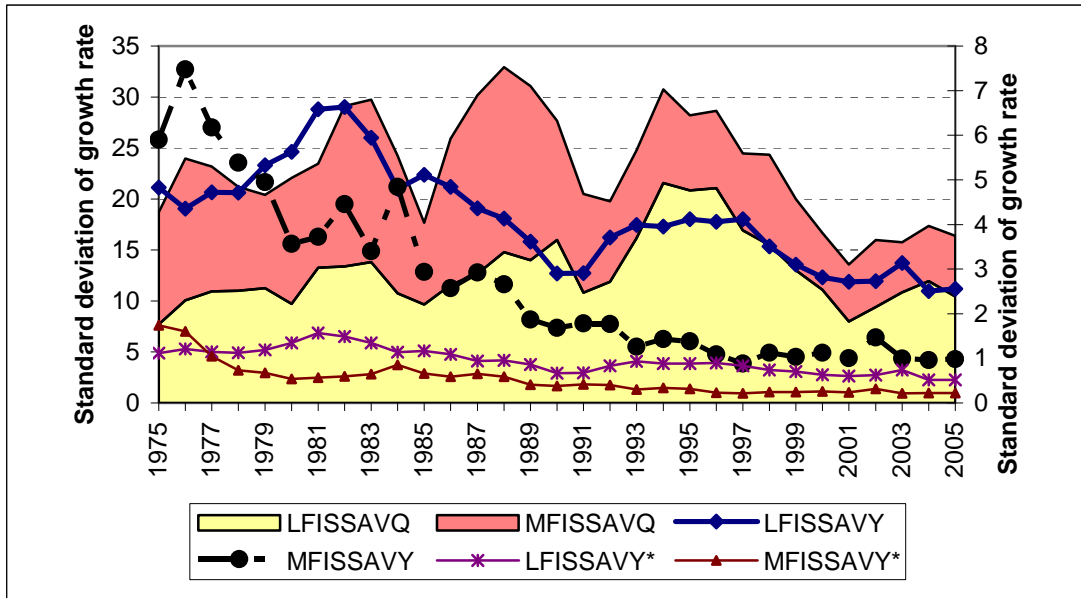
1(b) Consumption
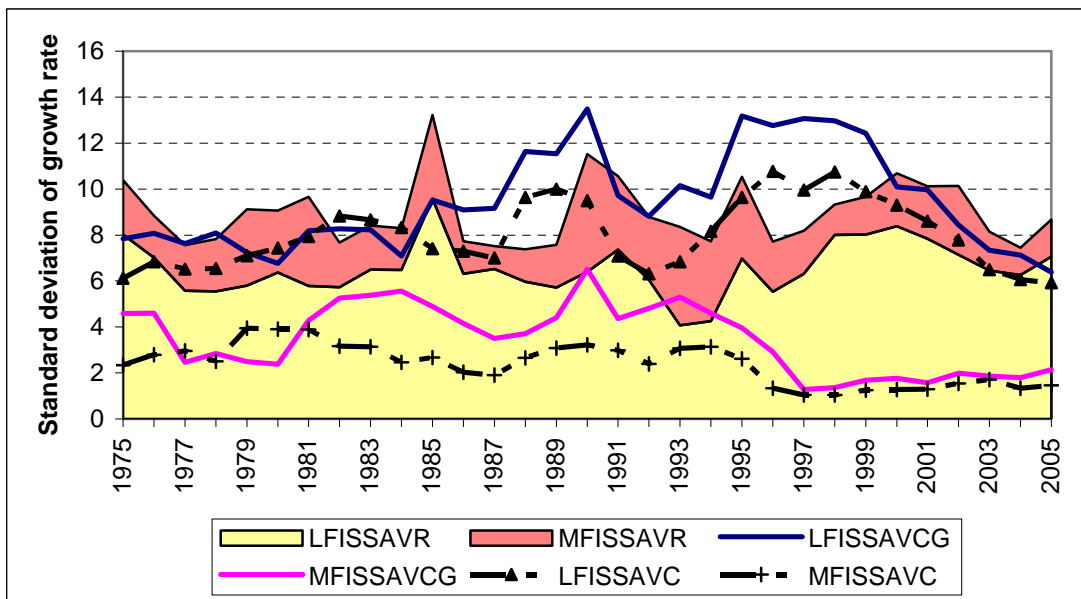
Note: LFISSA and MFISSA indicate less financial integrated and more financially integrated Sub-Saharan African countries.

Figure 2: Income Volatility vs. Trade and Financial Openness (1975-2005)

2(a) Trade
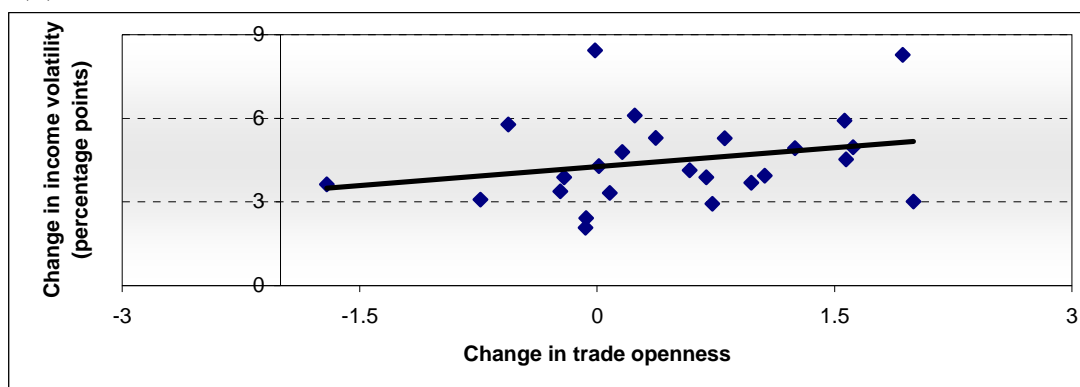
2(b) Financial
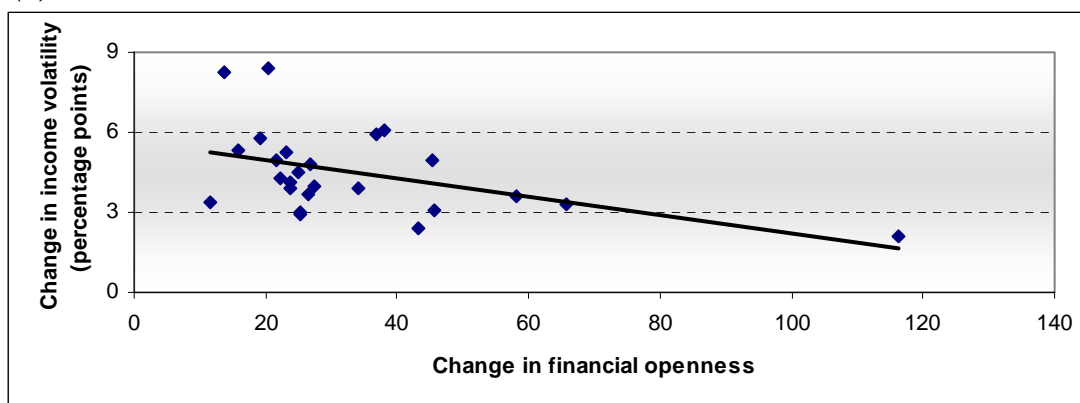
Note: Financial openness is proxied by domestic credit (as a percentage of GDP). A similar negative relationship is observed between change in income volatility and change in financial openness when M2 is used as a proxy for financial openness.

Table 1: Decade Averages of the Explanatory Variables

	1971-80	1981-90	1991-00	2001-05
INF	15.87	19.73	15.83	16.75
INFV	7.72	10.90	11.81	9.54
M2	21.60	23.21	23.07	27.87
M2V	2.63	2.32	2.13	2.37
TOTV	20.30	14.51	11.95	12.74
TDO	0.58	0.58	0.62	0.68
FINO	0.88	0.74	2.31	4.96
YPC	692.06	752.75	792.97	898.28
VDFP	0.17	0.25	0.24	0.28
LEG	4.61	4.63	4.69	4.73
ND	2.36	1.88	2.14	2.00

Note: See Appendix for the definition of the variables. Fiscal policy procyclical (FPP) measure is not reported as by construction these variables do not vary over time.

Table 2: Pooled Regression of Institutional Quality

Independent Variables	
Ethnolinguistic fractionalisation	-0.0586*
	(0.0158)
French legal origin	-0.5286*
	(0.0665)
Catholic	0.0130*
	(0.0028)
Muslim	0.0125*
	(0.0023)
Other denominators	0.0020*
	(0.0028)
Latitude	2.4725*
	(0.1718)
Real GDP per capita	0.00015*
(in 2000 PPP adjusted USD)	(8.58×10^{-6})
Intercept	2.8330*
	(0.2169)
Adj. R^2	0.3222

Notes: The dependent variable is institutional quality that is proxied by LEG. The independent variables comprise (1) an average of five indicators of ethno-linguistic fractionalisation, (2) "legal origin" dummies for French with the omitted dummy being English, (3) Roman Catholic population (as a % of total), (4) Muslim population (as a % of total), (5) Other religious denominators which exclude Protestants, Muslims and Catholics (as a % of total), (6) latitude and (7) Real GDP per capita. * denotes significant at 1% level.

Table 3: Regression Results on Sources of Macroeconomic Volatility

	Vy	Vq	Vy*	Vc	Vcg	Vr
CAR	-0.042	-0.063	-0.037***	-0.019*	-0.037**	-0.315
	(0.025)	(0.083)	(0.021)	(0.008)	(0.020)	(0.564)
CAP	0.134	0.318**	0.094	0.351**	1.691**	2.117***
	(0.186)	(0.158)	(0.071)	(0.174)	(0.068)	(1.074)
TDO	0.115***	0.249**	0.335**	0.059	0.051	4.184
	(0.059)	(0.121)	(0.135)	(0.074)	(0.047)	(6.003)
FINO	-0.025**	-0.014	-0.023**	-0.032**	-0.006	-0.659**
	(0.011)	(0.040)	(0.011)	(0.012)	(0.023)	(0.271)
YPC	-0.003	-0.059**	-0.172	-0.034***	-0.546*	-0.575
	(0.014)	(0.029)	(0.071)	(0.019)	(0.052)	(0.386)
TOTV	0.047*	0.141	0.108**	0.764***	0.245	0.458
	(0.013)	(0.104)	(0.040)	(0.409)	(0.165)	(1.164)
M2	-0.013*	-0.102	-0.537	-0.043	-2.894*	-7.435*
	(0.004)	(0.412)	(0.399)	(0.180)	(0.107)	(2.814)
INF	0.180	1.011**	1.021**	0.525***	3.232*	2.618*
	(0.153)	(0.505)	(0.495)	(0.283)	(0.523)	(1.073)
INFV	0.003***	0.013**	0.017**	0.010**	0.053*	0.105
	(0.002)	(0.006)	(0.008)	(0.004)	(0.007)	(0.190)
FPP	-0.003	0.031**	0.026***	-0.087	0.416*	0.151**
	(0.005)	(0.014)	(0.014)	(0.053)	(0.060)	(0.075)
VDFP	0.039***	0.087	0.031***	0.124*	0.025	0.340
	(0.020)	(0.178)	(0.022)	(0.048)	(0.091)	(0.552)
ND	0.001	0.003	0.013*	0.001	0.027	0.516**
	(0.001)	(0.003)	(0.005)	(0.002)	(0.057)	(0.217)
LEG	-0.023*	-0.140	-0.213**	-0.027	-0.109*	-0.717**
	(0.010)	(0.095)	(0.103)	(0.028)	(0.030)	(0.212)
Observations	126	126	126	126	126	126
Hansen (p-value)	0.725	0.434	0.635	0.335	0.530	0.645
AR(1)	-2.59**	-1.72	-2.35**	-1.84	-2.68**	-2.84**
AR(2)	-1.49	-1.29	-1.02	-1.46	-1.45	-1.56

Note: Numbers in parenthesis are robust standard errors. *, **, and *** denote statistical significance at the 1, 5 and 10 percent levels respectively. All regressions include fixed country and time-period effects (half a decade dummies). Hansen is the Hansen test of overidentifying restriction. The p-value is the test statistic's probability value for the null hypothesis that the instruments are valid. AR(1) and AR(2) are the test statistics for the null of first and second order autocorrelated disturbances respectively.

Table 4: Regression Results on the Effects of Financial Development and Institutional Quality on Growth Volatility

	Vy	Vq	Vy*	Vc	Vcg	Vr
CAR	-0.310***	-2.865***	-0.227**	-0.570	-0.190	-0.181
	(0.160)	(1.533)	(0.103)	(0.419)	(0.126)	(0.525)
CAP	0.166	0.563***	0.553	3.997*	0.250***	2.183
	(0.102)	(0.286)	(0.382)	(1.166)	(0.138)	(1.805)
YPC	-0.051	-0.034***	-0.023***	-0.571*	-0.012	-0.021**
	(0.043)	(0.019)	(0.012)	(0.221)	(0.013)	(0.010)
TOTV	0.161***	1.065***	0.748**	0.804	0.468	2.522
	(0.091)	(0.674)	(0.358)	(0.689)	(0.321)	(2.233)
FPP	0.193**	1.251	0.411***	0.208**	0.256**	0.043***
	(0.083)	(0.893)	(0.229)	(0.167)	(0.113)	(0.592)
VDFP	0.152	1.183***	0.206	0.429	0.088	0.215
	(0.137)	(0.611)	(0.164)	(0.407)	(0.074)	(0.545)
ND	0.019	0.090***	0.043***	0.054**	0.011***	0.057**
	(0.009)	(0.048)	(0.024)	(0.022)	(0.006)	(0.023)
LEG	-0.812***	-1.058***	-2.118***	-0.671**	-0.890**	-2.467**
	(0.470)	(0.563)	(1.092)	(0.324)	(0.410)	(1.220)
FINO*IQ	-0.023**	-0.034**	-0.019	-0.062	-0.037	-0.260
	(0.011)	(0.017)	(0.015)	(0.042)	(0.014)	(0.126)
TDO* IQ	0.961***	0.565**	2.398***	1.103***	0.879**	2.607***
	(0.559)	(0.224)	(1.244)	(0.617)	(0.411)	(1.373)
INF* IQ	-0.163*	-0.582*	-0.326**	-0.572**	-0.196	-1.265***
	(0.054)	(0.198)	(0.125)	(0.276)	(0.139)	(0.752)
INFV* IQ	-0.014**	-0.005**	-0.004	-0.026**	0.048	-0.020**
	(0.006)	(0.002)	(0.012)	(0.013)	(0.108)	(0.008)
FINO*FD	-0.127	-0.240**	-0.016	-0.328	-0.443	-2.449**
	(0.095)	(0.115)	(0.066)	(0.357)	(0.291)	(1.222)
TDO*FD	-0.715***	-0.614**	-1.261**	-0.804**	-0.120	-2.975
	(0.396)	(0.316)	(0.629)	(0.358)	(0.202)	(1.825)
Observations	126	126	126	126	126	126
Hansen (p-value)	0.318	0.434	0.698	0.526	0.330	0.625
AR(1)	-2.51**	-1.72	-2.85**	-2.92**	-1.89	-2.97**
AR(2)	-1.42	-1.29	-1.44	-1.65	-1.29	-1.22

Note: See note to Table 3.

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