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Resilience to terms of trade shocks in Sub-Saharan Africa: the role of fiscal Policy and exchange rate regime

By

Aminou Yaya

*Research associate, Center for Applied Economics and Management of
Organizations (CREAMO),
University of Lomé, Togo*

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ABSTRACT

This paper's objective is to analyse the role of fiscal policies and the exchange rate regime in the effect of terms of trade shocks on growth volatility in SSA. To achieve this objective, we use an estimation technique based on instrumental variables (2SLS) for a sample of 44 sub-Saharan African countries covering the period spanning 1980 to 2020. The results show that terms of trade shocks as well as discretionary policy contribute to growth volatility in sub-Saharan Africa. However, fiscal rules reduce the effects of terms of trade shocks and discretionary policy volatility on growth volatility. Furthermore, exchange rate regime fixity tends to positively affect growth volatility. This result implies the need for sub-Sahara African countries to consider fiscal policies, and the nature of the exchange rate regime in their resilience and volatility reduction strategy.

Key words: shocks; terms of trade; volatility of growth; resilience; exchange rate regime

Jel classification : E32 ; E62 ; F10

1. INTRODUCTION

The frequency and severity of economic, financial and health crises in recent decades have raised important questions regarding appropriate policies that are needed to strengthen economic resilience to shocks, particularly in developing countries (Azomahou et al., 2021; Gnanon, 2021). These countries suffer negative shocks causing macroeconomic volatility, which has the disastrous effect of widening development gaps between poor and developed countries (Balavac and Pugh, 2016).

In the literature, volatility is seen as a result of several factors (Loayza et al., 2007). On the one hand, domestic shocks caused by the intrinsic instability of the development process, the volatility of fiscal policy (Fatás and Mihov, 2006), social conflicts, and economic mismanagement and political instability (Raddatz, 2007). On the other hand, external shocks induced by the instability of commodity prices, the global interest rate as well as natural disasters (Aizenman et al., 2005). Added to these factors are the weakness and ineffectiveness of shock-absorbing mechanisms, which can amplify the effects of shocks (Loayza et al., 2007).

However, terms of trade shocks appear to be the most important determinant of macroeconomic volatility, particularly in developing countries. According to the World Bank (2017), most of the volatility in developing countries comes from external factors, which are themselves mainly the result of terms of trade shocks (Aizenman et al., 2018; Kose, 2002; Mendoza, 1995; World Bank, 2018). This observation rings true because developing countries depend on commodities whose exposure to sectoral shocks has repercussions throughout the economy, including increasing macroeconomic vulnerability (Acemoglu and Zilibotti, 1997; Lederman and Porto, 2016).

In sub-Saharan Africa (SSA), the problem of terms of trade shocks and growth rate volatility deserves particular attention. These countries are dependent on commodities, but do not have adequate resources to cope with the effects of shocks. According to an UNCTAD (UN Trade and Development, 2022) report on economic development in Africa, 45 African economies are dependent on commodities and their income is volatile due to price instability in the market. Recent disruptions to international trade induced by current geopolitical tensions in Eastern Europe have once again exacerbated the vulnerability of SSA economies to terms of trade shocks and their dependence on commodities. These reasons provide an explanation why, on average, SSA countries display greater volatility in their terms of trade compared to other regions of the world, and have relatively low and volatile growth rates. However, the problem of terms of trade shocks can become acute in the presence of weaknesses in shock-absorbing mechanisms that amplify their effect on growth volatility. In this context of volatile growth induced by exogenous shocks, one may ask: What are the factors that mitigate the effects of terms of trade shocks on growth volatility in SSA?

Previous studies in this area have proposed various factors and mechanisms to improve the resilience of economies to the effects of external shocks. The channels that are generally mentioned centre around financial development, capital accumulation (Duryea, 1998; Flug et al., 1998), trade (Agénor et al., 2000) and capital mobility, as well as the channel of political institutions (Aizenman et al., 2005). However, fiscal policy and the nature of the exchange rate regime also appear to be decisive in the effect of terms of trade shocks on growth volatility.

Indeed, the economic literature highlights that countercyclical policy can compensate for demand shocks. For example, Céspedes and Velasco (2014) find that fiscal policy tends to be more countercyclical during a commodity price boom, due to the presence of fiscal rules. Furthermore, Medina (2016) shows that public spending in countries with fiscal rules reacts

less to commodity price shocks. Lopez-Martin et al. (2019) presents a model that illustrates the mechanism underlying the positive correlation of commodity revenues with government spending, and a negative correlation with tax rates. According to Adler and Sosa (2011), the ultimate degree of a country's vulnerability to commodity price shocks is to a large extent determined by the flexibility and quality of its policy framework.

Debates also focus on the nature of the exchange rate regime. From a theoretical point of view, when shocks are real in nature, flexible exchange rate regimes are more effective because they allow for a smoother adjustment to real shocks. In contrast, in fixed exchange rate regimes, the money supply declines as the monetary authority contracts the money supply to avoid a nominal depreciation of the domestic currency. This response is intrinsically restrictive and leads to an additional decline in real production. Therefore, fixed exchange rate regimes must rely on domestic price adjustment to pull the economy out of recession.

On the empirical level, Adler et al. (2018) show that exchange rate flexibility plays an important role during booms, but less so during recessions. Conversely, Baxter and Stockman (1989) show an insensitivity of production volatility to the type of exchange rate regime. They also find that a wide range of real macroeconomic variables are independent of exchange rate regimes. Devereux (1999) finds that the exchange rate responds neither to supply shocks nor to fiscal shocks, so that macroeconomic volatility is the same in fixed and flexible regimes. In contrast, Collard and Dellas (2002) suggest larger differences in volatility between regimes. They find that output volatility is significantly higher in fixed exchange rate regimes than in flexible exchange rate regimes. Using data from 80 developing countries, Bleaney and Fielding (2002) also show that countries with a fixed exchange rate have significantly higher output variances than a typical country with a flexible regime.

The main objective of this research is to analyze the role of fiscal policy and the nature of the exchange rate regime in the effects of terms of trade shocks on growth volatility in SSA.

The ability of SSA countries to overcome external shocks by identifying relevant shock adjustment factors is crucial for one main reason. Experiences from recent crises have highlighted that the ability to overcome a shock and quickly return to high levels of growth after a shock is a characteristic that is not widely shared by all global economies. However, a rapid recovery in growth after the shock is crucial for these countries in order to maintain the increase in their average income and to contain the social tensions that structural changes and ruptures can cause (Rodrik, 1999). For this reason, shock resilience factors are of considerable importance because their effective functioning can mitigate the economic and social impact of external shocks, while their inability to manage social conflicts and drive macroeconomic adjustment will have an aggravating effect (Alesina and Perotti, 1996; Rodrik, 1999).

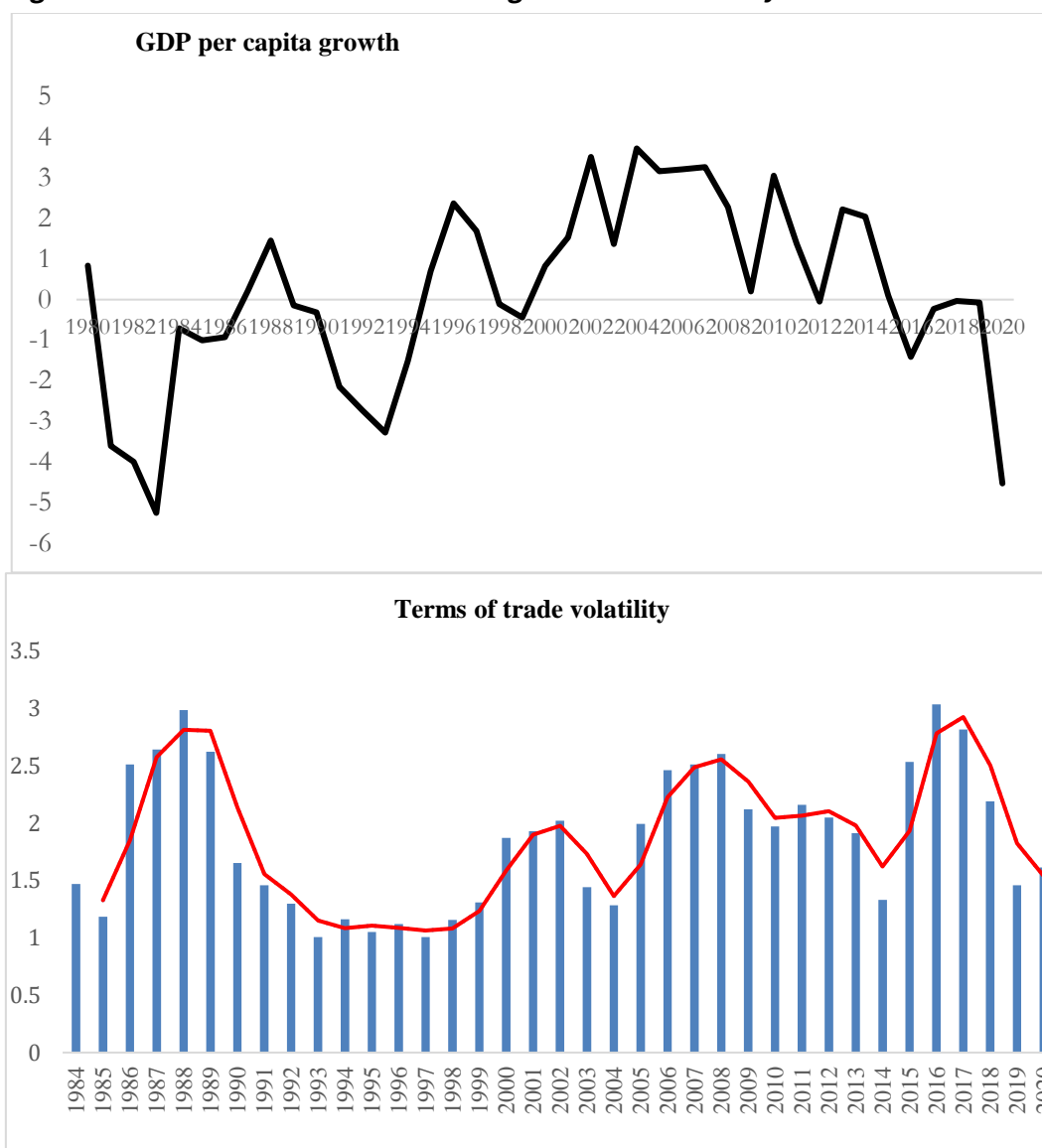
This study will contribute to the literature in several ways. First, the study focuses on the capacity of fiscal policies and the nature of the exchange rate regime to reduce the effects of terms of trade shocks on growth volatility in SSA. Second, compared to previous studies, this study adopts a terms of trade measurement approach based on commodity prices. Finally, by extending the sample period to 2020, this study is more up to date with existing literature sources in the sense that it incorporates recent economic progress and global trends that may have altered countries' growth trajectories.

The remainder of this article is organized as follows: after this introductory section, Section 2 below presents the stylized facts, Section 3 discusses the review of the literature. Section 4 presents the methodology and data. The results and discussion are presented in section 5, followed by the conclusion in section 6

2. STYLIZED FACTS

Figure 1 presents an evolution of growth and volatility of SSA terms of trade for the period 1980 to 2020. Graphical analysis makes it possible to distinguish several important periods linked to the different shocks. The period 1980–2000 was marked by unstable and low growth rates. This period saw structural adjustment programmes whose implementation was unable to address the socioeconomic challenges to initiate the structural transformation of African economies for real development. Rather, the period was characterized by specialization based on primary products whose world prices remained unstable (Diarra, 2014). This explains the high level of volatility in the terms of trade, particularly in the period 1985–1990. However, from 2000 to 2008 SSA experienced significant economic growth with an upward trend. GDP per capita in the area reached 3.2% in 2007. According to the African Development Bank (AfDB, 2015) this increase is mainly due to exogenous factors. The surge in commodity prices, as well as the marked increase in foreign direct investment, considerably contributed to the acceleration of growth during this period (AfDB, 2015). This is the reason for the low volatility of the terms of trade for the period 2001–2004.

Figure 1: Evolution of rate of economic growth and volatility of SSA terms of trade



From 2010 to 2015, economic growth fell from 3.1% (in 2010) to 0.1% (in 2015). This period saw instability in economic growth induced by political unrest and civil conflicts occurring since 2010 in several African countries. In 2016, falling commodity prices destabilized many countries that were dependent on natural resources. As a result, the average level of terms of trade volatility reached a peak in 2016.

However, in 2018 growth recovered slowly and reached a positive value, partly thanks to the resilience of domestic demand and a rise in oil prices.

From Figure 1, we can see that international financial, health and geopolitical crises have not spared SSA from their devastating effects. Indeed, because of its dependence on basic products, SSA is very exposed and remains vulnerable to external shocks that destabilize and slow down economic and social development.

3. LITERATURE REVIEW OF SOURCES OF VOLATILITY

The economic cost induced by macroeconomic volatility has led to a search for the main sources of volatility. The economic literature groups the main sources of volatility into domestic and exogenous shocks (Loayza et al., 2007). Domestic shocks are caused by the intrinsic instability of the development process, the volatility of fiscal policy (Fatás and Mihov, 2006), social conflicts, economic mismanagement and political instability (Raddatz, 2007). Conversely, exogenous shocks can come from the instability of commodity prices, the global interest rate as well as natural disasters (Aizenman et al., 2005).

Exogenous Factors and the Contribution of Terms of Trade Shocks

Exogenous shocks is one of the main causes of volatility, particularly in developing countries. For example, these shocks can come from financial markets in the form of sudden stops in capital inflows, for example. However, shocks from goods markets, particularly sudden and large changes in the terms of trade, appear to be an important source of volatility in developing countries. According to the World Bank (2017), the terms of trade explain most of the volatility in growth in developing countries. This is explained by the dependence of these countries on basic products (Kose, 2002). Frequent fluctuations in world prices mean that these countries are faced with the problem of terms of trade volatility.

In the economic literature, Mendoza (1997, 1995) was one of the first to analyze the relationship between terms of trade shocks and fluctuations in business cycles. Using an intertemporal general equilibrium framework, he manages to show that terms of trade shocks explain 37% and 56% of the volatility of production, import prices and domestic prices, respectively.

However, in the Mendoza model, shocks linked to the terms of trade do not have a direct impact on the dynamics of the non-commercial sector, because the only endogenous factor in this sector is national labour. To remedy this, Kose (2002) considers a variant of the specific factors model with two sectors: the production of exportable primary goods presenting diminishing returns because these goods are produced with imported capital; and labour and national and inelastically supplied land. The non-traded final goods sector uses capital, imported intermediate inputs and domestic labour. Kose (2002) finds that terms of trade shocks contribute to 88% of production fluctuations. Furthermore, Easterly et al. (1993) studied the sources of long-term growth and overall volatility for a large sample of countries for the period 1960–1988. They reach the same conclusion that terms of trade shocks explain growth volatility just as well. The positive effect of terms of trade volatility on growth volatility is confirmed by Alimi and Aflouk (2017) and also by Beck et al. (2006). The latter used a panel of 63 countries over the period 1960–1997 and find that the increase in the standard deviation of terms of trade volatility from 0.04 to 0.11 leads to an increase of 0.5 points percentage of growth volatility.

Terms of trade shocks are therefore a key source of macroeconomic instability. However, the effects of these factors can be amplified in the presence of weakness and ineffectiveness of shock absorption mechanisms. Researchers are therefore interested in the factors that make

it possible to improve the resilience of economies to the effects of terms of trade shocks on the volatility of economic growth.

Channels of Transmission of External Shocks to Volatility

In the economic literature, various arguments have been put forward regarding the transmission channels of exogenous shocks to volatility. These arguments mainly concern financial development, capital accumulation (Duryea, 1998; Flug et al., 1998), trade (Agénor et al., 2000) and capital mobility, as well as the channel of political institutions (Aizenman et al., 2005).

Regarding financial development, studies prove that a deeper financial system would absorb external shocks and make an economy more resilient (Acemoglu and Zilibotti, 1997). Thus, unfavourable terms of trade could lead to a contraction in the production of exporting companies, which could exacerbate financial constraints. By granting short-term loans, banks allow these companies to smooth out fluctuations in production. However, the financial system can be a source of volatility, because in the presence of market imperfections it can amplify the shocks that occur (Aizenman et al., 2005).

Other analyses were based on an accumulation of factors. Volatility can influence the type of investment by directing incentives towards the accumulation of less specialized and less profitable capital goods, which can be reallocated more easily in response to shocks. Human capital accumulation can be similarly affected (Duryea, 1998; Flug et al., 1998).

Furthermore, trade allows better insulation against shocks from domestic demand. However, if accompanied by greater specialization, it may lead to greater exposure to sectoral shocks and increase exposure to external demand and supply shocks. Openness also strengthens the role of the real exchange rate which, in turn, can act as both a stabilizing element and a source of additional volatility.

The research also focused on capital mobility (Faia, 2001; Sutherland, 1996). This channel reflects the fact that greater financial integration allows economies, particularly emerging markets, to use external sources of financing to diversify their production structures and thus reduce their exposure to sectoral shocks. However, integration also creates new transmission channels for external shocks and can amplify the effect of internal distortions (Buch and Pierdzioch, 2005).

Finally, the role of political institutions in the transmission of external shocks was analyzed. Studies prove that the severity of a shock to growth or its volatility depends on the interaction between conflict management institutions and the shock. For example, Rodrik (2000) maintains that institutions, particularly democratic ones, that promote consensus around the responses to be given to various shocks, contribute to reducing the volatility of growth rates. Ultimately, several factors have been cited as determining the mediation of shocks. However, some arguments have focused on the role of fiscal policies and the nature of the exchange rate regime on volatility.

Role of Fiscal Policy and Nature of Exchange Rate Regime

Fiscal Policy

Recent research has focused on the role of fiscal policies in macroeconomic stability. The seminal article by Fatás and Mihov (2003) shows that the aggressive use of discretionary fiscal policies induces significant macroeconomic instability. This discovery was later confirmed by

other works, in particular by Fatás and Mihov (2006) for the United States, and Badinger (2009) for OECD countries.

From a theoretical perspective, one of the main ways that fiscal policy affects macroeconomic volatility is through the operation of automatic stabilizers. These are components of taxes and spending that are designed to respond automatically to economic cycles. Automatic stabilizers are generally considered the most effective tool for fiscal stabilization of fluctuations in production and employment. Thus, countries with strong automatic stabilizers tend to have lower output volatility (IMF, 2015).

In addition to automatic stabilizers, fiscal policy has a component called discretionary fiscal policy. Countercyclical discretionary fiscal policy is when the government increases taxes and/or cuts spending during an expansion, and cuts taxes and/or increases spending during a recession. To the extent that these policies reduce macroeconomic volatility, they can be expected to have favourable welfare effects. However, fiscal procyclicality tends to exacerbate economic cycles by amplifying economic expansions and prolonging economic downturns. Brueckner and Carneiro (2017), for example, show that the negative effects of terms of trade shocks are significantly greater in countries where public spending is procyclical (Davoodi et al., 2021).

Some studies analyze the role of fiscal policies from the perspective of fiscal rules. However, the effect of fiscal rules on macroeconomic stability is not unambiguous. On the one hand, fiscal rules can limit the volatility of discretionary fiscal policy and, hence, the volatility of output. On the other hand, the rules may also limit the ability to use discretionary fiscal policies to smooth out fluctuations in the business cycle.

Existing empirical evidence seems to favour the first effect of fiscal rules. Using a large representative sample of countries, Fatás and Mihov (2003) argue that the presence of constraints explains much of the cross-country variation in the use of fiscal policy. Similarly, Fatás and Mihov (2006) find that fiscal policy restrictions are effective means for reducing policy volatility in US states which, in turn, contributes to macroeconomic stability.

The work of Sacchi and Salotti (2015) and Badinger and Reuter (2017) considers the effect of fiscal rules by focusing on two channels. Sacchi and Salotti (2015) show that the presence of strict fiscal rules reduces destabilizing procyclicality in the conduct of discretionary fiscal policy. They argue that balanced budget rules are more effective than other types of rules as a macroeconomic stabilization tool. However, fiscal rules mitigate procyclicality only in countries with high institutional quality where fiscal authorities are able to manage and enforce these rules. Unlike Sacchi and Salotti (2015), Badinger and Reuter (2017) show that fiscal rules mitigate the volatility of fiscal policy per se (rather than reducing its procyclicality) and, therefore, implicitly contribute to macroeconomic stability. Furthermore, stricter fiscal rules that have strong legislative support, broader coverage and a formal enforcement procedure in place appear to be more effective in reducing fiscal policy volatility than less restrictive rules.

Nature of Exchange Rate Regime and Volatility

Since Friedman (1953) defended the idea that a flexible exchange rate system offers a better capacity to adjust to volatility, the choice of exchange rate regime has been the subject of great controversy and debate. In theory, the relative merits of exchange rate regimes crucially depend on the type and nature of shocks hitting the economy. When shocks are nominal in nature, fixed exchange rate regimes automatically prevent them from affecting real output. For example, when the demand for money increases, under fixed exchange rate regimes, the money supply increases because the monetary authority buys foreign currencies to prevent

an appreciation of the local currency. This leaves actual output unchanged. By contrast, in flexible exchange rate regimes, the money supply remains unchanged, and the local currency is allowed to appreciate, so that real output falls and the demand for money returns to its initial level.

Conversely, when shocks are real in nature, flexible exchange rate regimes are more effective because they allow for a smoother adjustment to real shocks. For example, when the terms of trade deteriorate in a price-sticky economy, under flexible exchange rate regimes, the nominal exchange rate depreciates. The depreciation of the nominal exchange rate, in turn, reduces the price of tradable, which partially offsets the effect of the negative terms of trade shock. However, in fixed exchange rate regimes, the money supply declines as the monetary authority contracts the money supply to avoid a nominal depreciation of the local currency. This response is intrinsically restrictive and leads to an additional decline in real production. Therefore, fixed exchange rate regimes must rely on domestic price adjustment to pull the economy out of recession.

Existing empirical evidence on the shock absorption properties of exchange rate flexibility is inconclusive. Many articles have estimated the role of the exchange rate as a shock absorber for terms of trade in small open economies, and many have found evidence that more flexible exchange rates allow for a certain stabilization of the national economy after external shocks. Using a de facto classification of exchange rate regimes, Edwards and Yeyati (2005) find that flexible exchange rate regimes reduce the real impact of terms of trade shocks in emerging and industrial economies. Likewise, Broda (2004) studies the reaction of real GDP to a terms of trade shock in a sample of developing countries and notes a stronger reaction of production in the case of anchoring. More recently, Martin (2016) and Ghosh et al. (2019) show that flexible regimes are associated with a faster adjustment of the current account, particularly in emerging economies.

Many empirical papers have also found evidence rejecting Friedman's hypothesis. Chinn and Wei (2013) warn against what they call a “faith-based initiative,” finding no strong evidence that flexible exchange rates are associated with a faster return of the current account. While Towbin and Weber (2013) find that economies with more flexible exchange rates experience smaller output declines than those with fixed exchange rates; this result is invalidated when the share of homogeneous imports is low and when the debt is denominated in foreign currencies. This last point confirms the importance of the repercussions of the exchange rate and balance sheet effects in determining gains from exchange rate flexibility (Carrière-Swallow et al., 2021). Zeev (2019) studies the response of national variables to exogenous shocks on credit supply in a large sample of countries. Using a local projection specification, he finds evidence that emerging economies with flexible regimes experience significantly smaller output declines following these external shocks.

4. METHODOLOGY

The methodology adopted for this research is based on a parametric approach to direct and indirect effects. We investigate whether the exchange rate regime and fiscal policy affect the effect of terms of trade shocks on growth volatility. The specification of the empirical model is inspired by work found in the literature on the determinants of volatility (Badinger, 2009; Fatás and Mihov, 2006, 2003; Sacchi and Salotti, 2015). Thus, the following model is specified.

$$\sigma_{it} = \varphi'X_{it} + \beta_1TERMS_{it} + \beta_2RB_{it} + \beta_3DISC_{it} + \beta_4(RB * TERMS_{it}) + \varepsilon_{it} \quad (1)$$

$$\sigma_{it} = \mu'X_{it} + \gamma_1TERMS_{it} + \gamma_2REGIME_{it} + \gamma_3(REGIM * TERMS_{it}) + \varepsilon_{it} \quad (2)$$

Equation 1 evaluates the effects of fiscal policies and terms of trade volatility, while Equation 2 analyzes the role of the nature of the exchange rate regime in the effect of terms of trade shocks on the volatility of the growth. In these two equations, i and t represent the country and the period, respectively, σ_{it} represents the volatility of real GDP growth, DISC is a discretionary policy measure, and TERMS and RB represent the terms of trade volatility and the fiscal rules index, respectively. $(RB * TERMS_{it})$ is the interaction term between the RB and TERMS. Their coefficient reflects the effect of the presence of fiscal rules on the relationship between terms of trade volatility and growth volatility. Specifically, we examine how fiscal rules affect the relationship between terms of trade shocks and growth volatility. From Equation 1 we calculate the marginal effect of the presence of budgetary rules as follows:

$$\frac{\partial \sigma}{\partial TERMS} = \beta_1 + \beta_4 RB \quad (3)$$

This equation shows that the marginal effect of terms of trade volatility on volatility depends on the presence of fiscal rules. Fiscal rules are expected to reduce the marginal effect of terms of trade volatility, which should be reflected by a coefficient $\beta_4 < 0$.

DATA AND VARIABLES

The data used in the empirical analysis comes from multiple sources, namely: the World Bank, International Monetary Fund (IMF) and UNCTAD. The samples cover the period 1980–2020.

Growth volatility measure: Consistent with the literature on the topic of volatility, we measure growth volatility by calculating rolling standard deviations of GDP per capita growth rates over five-year periods. Specifically, the observation given by the standard deviation of GDP per capita growth rates between period st and $t + 4$ is followed by the observation obtained by applying the same calculation technique to the years between $t + 1$ and $t + 5$. Thus, the first observation actually starts from 1984. This approach makes it possible to preserve the size of the sample as much as possible, and therefore avoid sampling bias, unlike the methods traditionally used that are based on standard deviations without slippage. The same method is used to calculate the volatility of the terms of trade.

Terms of trade index: The commodity terms of trade index is used, which is from the IMF database (see Gruss and Kebhaj, 2019). Its construction methodology was developed by Gruss and Kebhaj (2019), inspired by the work of Spatafora and Tytell (2009).

Fiscal policy: Two variables were used. Discretionary fiscal policy and fiscal rules.

Regarding discretionary fiscal policy, the approach used to measure discretionary fiscal policy is inspired by Fatás and Mihov (2003, 2006) and Sacchi and Salotti (2015). So to construct a measure of discretionary fiscal policy, we estimate the following equation:

$$\log(G)_{it} = \alpha_i + \beta_i \Delta \log(Y_{it}) + \gamma_i \log(G)_{it-1} + \theta_1 \pi_{it} + \theta_2 \pi_{it}^2 + trend + \varepsilon_{it}^{discr} \quad (4)$$

In Equation 4, G represents public consumption expenditure, Y is real GDP, π is the inflation rate, and π^2 is its square (see Sacchi and Salotti, 2015). Trend is a linear time trend. The main

purpose of Equation 4 is ε_{it}^{discr} , which is interpreted as a discretionary budgetary shock. Its volatility, that is to say its standard deviation, is considered as an indicator of the aggressiveness of a government's discretionary fiscal policy (Fatás and Mihov, 2003). However, the presence of this variable in the regressions could bias the standard deviation of the estimated coefficient (but not the coefficient). To guard against such bias, we use a bootstrap technique that allows us to estimate the standard deviations corrected for this bias.

As for fiscal rules, the data used in this study were developed by the Fiscal Affairs Department of the IMF. The fiscal rules considered in this study include expenditure rules (ER) and revenue rules (RR). These fiscal rule indices are dummy variables that take 1 if the country has a particular type of fiscal rule, and 0 otherwise. The ER sets limits on total, primary or current expenditure and these limits are generally expressed in absolute terms or as a growth rate, and sometimes as a percentage of GDP. RR set ceilings or floors for revenue and aim to boost revenue collection and avoid an excessive tax burden. Thus, the budgetary rule (RB) is a dummy variable that takes 1 if the country has a rule relating to expenditure or revenue and 0 otherwise. As our data is in five-year intervals, if a given country implemented a given fiscal rule for more than 50% of the period, then the corresponding fiscal rule variable is equal to 1 during that period, otherwise it is equal to 0. A similar approach is used by Levy-Yeyati and Sturzenegger (2003).

Exchange rate regime: Regarding the nature of the exchange rate regime, the economic literature distinguishes the classification of de jure from that of de facto. The de jure classification is based on the declarations of the monetary authorities of the different countries to the IMF regarding exchange rate policy. However, many countries implement policies that differ from their official declaration (Calvo and Reinhart, 2002). This is why the de facto classification, which is based on the investigation of country practices on foreign exchange markets, is preferred. Thus, the exchange rate regime is represented by a dummy variable (*Regime*) that takes the value 1 if the exchange rate regime of the country considered is fixed during the period and 0 otherwise. Data relating to exchange rate regimes are extracted from the database compiled by Ilzetzki et al. (2022).

Other explanatory variables include:

GDP per capita: An increase in income tends to reduce output volatility in developed and developing economies (Kpodar et al., 2019). Furthermore, Sahay et al. (2015) used this indicator to show that the more developed (richer) a country is, the less volatile its growth.

Trade openness: The effect of trade openness on volatility is mixed. Indeed, openness can expose the economy to more external shocks leading to, all things being equal, increased growth volatility (Balavac and Pugh, 2016). However, it can provide better insulation against shocks from domestic demand. Openness also strengthens the role of the real exchange rate which can, in turn, act as both a stabilizing element and a source of additional volatility (Aizenman et al., 2005).

Population: Large countries tend to have a relatively diversified economy, which tends to reduce growth volatility.

Government spending: Measured by government consumption expenditure (Yougbaré, 2009), its effect on volatility is undetermined. Indeed, an increase in public spending can help stabilize growth in periods of decline in private spending. In this case, variations in public spending are negatively linked to growth volatility. However, they can make growth more volatile when they generate distortions in the economy.

ESTIMATION METHOD

There is a potential endogeneity problem between economic growth volatility and several explanatory variables because there may be bidirectional causality between the variables. To resolve the potential endogeneity problem, we search for instrumental variables for our endogenous variables and apply a two-stage least squares (2SLS) estimation. A good instrumental variable must be exogenous and have a significant relationship with the explanatory variables without having a significant impact on the dependent variable. For the exchange rate regime, we use the lagged value of the exchange rate regime as well as the inflation rate as instruments. Indeed, Yeyati et al. (2010) establish that a country that had recorded high inflation in the past will tend to adopt a fixed exchange rate to make its monetary and exchange rate policy credible. Regarding fiscal policy, Fatás and Mihov (2006) use institutional variables as instruments of discretionary policy. Sacchi and Salotti (2015) use lags of fiscal policy variables as an instrument. In this study, the delays of the institutional regulatory quality variables, as well as those of the political variables, are used as instruments.

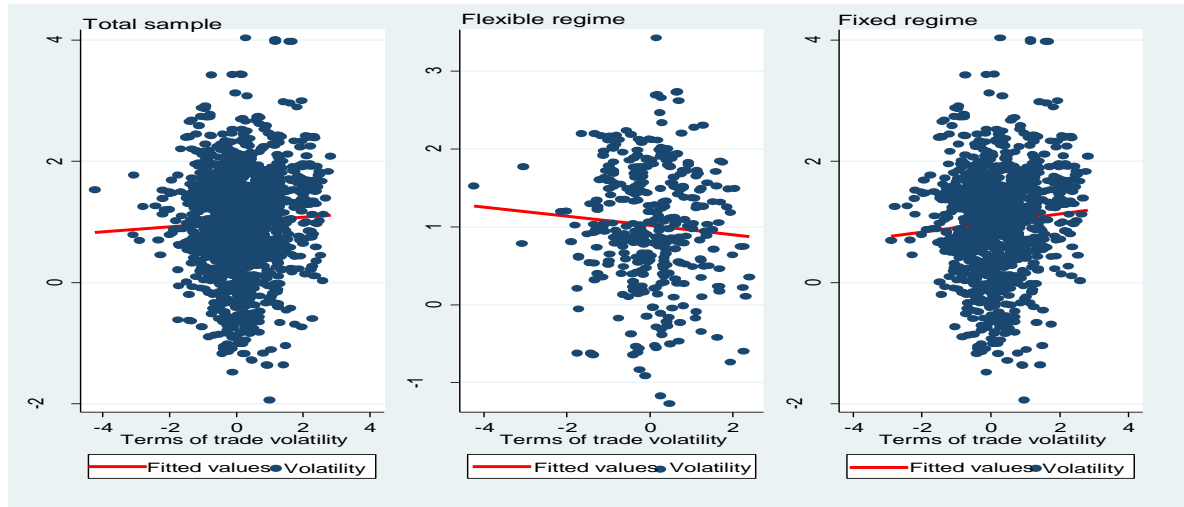
5. RESULTS

Preliminary results

This section presents preliminary results and econometric estimation results.

Before proceeding with the econometric analysis, a quick glance at the data provides the following information: Figure 2 shows the relationship between terms of trade volatility and growth volatility. As is shown, there is a strong positive correlation between terms of trade volatility and growth volatility (left-hand panel). The sample is then divided in two according to the nature of the exchange rate regime. It is evident that the correlation between terms of trade volatility and growth volatility becomes weaker, or even negative, in episodes when the exchange rate regime is flexible (middle panel of Figure 2). Conversely, we observe that countries with a fixed exchange rate regime seem more exposed to terms of trade shocks as shown by the strong positive correlation (Figure 2, right-hand panel). This seems to indicate that the nature of the exchange rate regime may not be neutral in the effect of terms of trade shocks on the volatility of growth rates in SSA.

Figure 2: Relationship between terms of trade volatility and growth volatility depending on nature of exchange rate regime



The same analysis conducted with budgetary rules gives similar results. Figure 3 suggests that fiscal rules appear to play a mitigating role in the transmission of terms of trade shocks to the economy, because the correlation between terms of trade volatility and volatility growth is low during episodes of fiscal rules (Figure 3, middle panel). Conversely, for episodes with an absence of fiscal rules, terms of trade shocks are strongly and positively correlated with growth volatility (right-hand panel). These results could suggest that countries that have adopted fiscal rules have greater opportunities to pursue countercyclical fiscal policies and mitigate the impact of shocks. Given these preliminary results, an econometric analysis is necessary to confirm these results. The following subsection presents the results of the econometric estimations.

Figure 3: Relationship between terms of trade volatility and growth volatility according to budgetary rules



Descriptive statistics

Table 1 presents the results of the descriptive statistics of the variables used in the estimation of the model. Growth volatility has an average value of 3.88 for the region, with maximum and minimum values of 56.53 and 0.14 for Equatorial Guinea (1993–1997) and Mauritius (2014–2018) in the periods considered. Its dispersion compared to the average is 4.33. Furthermore, the average value of terms of trade volatility is 1.86, with corresponding maximum and minimum values up to 16.69 for Congo (2012–2016) and 0.014 for Sudan (1979–1984).

Table 1: Descriptive statistics

Variable	Obs	Average	Standard deviation	Min	Max
Growth volatility	1589	3.875175	4.335353	0.1443068	56.53378
Volatility of terms of trade	1558	1.868208	2.174878	0.0143302	16.69822
Discretionary policy	1159	0.1279451	0.1044489	0.0010733	0.8101383
Population	1877	1.40E+07	2,35E+07	63261	2,06E+08
GDP per capita	1761	1791.955	2450.877	167.2458	16989.96
Trade	1558	67.39131	37.91453	0.7846308	347.9965
Exchange rate regime	1845	0.7631436	0.4252687	0	1
Fiscal rules	1702	0.1333725	0.3400768	0	1

Results of econometric estimations

Before interpreting the estimation results, we carried out validity tests of the IV estimation procedure, which requires that: (i) the instrumental variable must be strongly correlated with the endogenous variable in the equation; (ii) the instrumental variable must be exogenous and uncorrelated with the error term in the models; and (iii) the instrument must be least correlated with the exogenous variables in the model (Baum et al., 2003). These hypotheses were correctly considered by a battery of tests presented in the various regression tables. Indeed, for the adequacy of the instrumental variable's technique, three tests were carried out. The first is the Durbin endogeneity test. Considering probability values below the critical threshold of 5%, the Durbin test makes it possible to assess the endogeneity of the instrumental variable. We can conclude that the variables of interest are endogenous. The study also reports the F statistic of the first-stage regression to assess the joint significance of the instruments. According to the different regression tables, the F statistic, as well as the corresponding p-values, indicate that the instrumental variables used are significantly related to the endogenous variables, thus satisfying hypothesis (i) above. Finally, the study established the independence of the instruments from the unobservable error process by testing the corresponding moment conditions, i.e., using the Sargan test of overidentification restrictions to assess whether the instruments are not correlated with the error term. The results of the Sargan test in Tables 2 and 3 do not reject the null hypothesis of overidentification, which confirms the reliability of the instrumental variables.

Table 2: Effects of existence of fiscal rules and discretionary policy on growth volatility

Variables	(1) Volatility	(2) Volatility
Fiscal rules	-1.209*** (0.238)	-1.196*** (0.261)
Terms of trade volatility	0.0912** (0.0386)	0.0475 (0.0362)
Fiscal rules × terms of trade volatility	-0.326*** (0.116)	
Discretionary policy	0.266*** (0.0389)	0.592*** (0.0622)
GDP per capita	-0.172*** (0.0402)	-0.109*** (0.0397)
Trade	-0.110* (0.0634)	-0.105* (0.0578)
Government spending	0.0857 (0.0712)	0.0170 (0.0756)
Population	-0.127*** (0.0277)	-0.170*** (0.0267)
Fiscal rules × discretionary policy		-0.456*** (0.0999)
Constant	5.170*** (0.708)	6.051*** (0.771)
Observations	946	641
Durban	29.0285	4.11405
(P-value)	(0.0000)	(0.0425)
F-Statistic	47.8938	297.418
(P-value)	(0.0000)	(0.0000)
Sargan	0.040787	0.633303
(P-value)	(0.8399)	(0.4261)

The results in column (1) of Table 2 show that terms of trade volatility has a positive and significant effect on growth volatility. In agreement with the stylized facts and with the work of Easterly et al. (2000), the World Bank. (2018) and Kose (2002), this finding suggests that terms of trade shocks are one of the main sources of growth volatility in low-income countries, and particularly in SSA. This observation is not entirely surprising, given the small export base of many SSA countries and the heavy reliance of the public budget on commodity revenue.

The results also confirm the findings of previous works on the positive relationship between the aggressive use of discretionary fiscal policy and output volatility, meaning that government spending volatility negatively affects output stability (Fatás and Mihov, 2003; 2006).

Table 2 also shows that the coefficient of the fiscal rule variable is negative and significant at 1%. This suggests that the existence of fiscal rules reduces the volatility of a country's growth. In other words, countries that have implemented fiscal rules tend to have growth rates that are less subject to volatility. This result agrees with the work of Reuter et al. (2022), who showed that fiscal rules reduce fiscal volatility and, therefore, contribute to macroeconomic stability. Furthermore, Fatás and Mihov (2006) prove that tight budgetary restrictions lead to less policy volatility (i.e., less aggressive use of power discretion in the conduct of budgetary policy).

Given the positive effect of terms of trade shocks on growth volatility, it is important to verify the indirect effect of the existence of fiscal rules through terms of trade shocks. Thus, by interacting this variable with the fiscal rule variable (column 1), we see that the positive effect of terms of trade shocks on growth volatility is reduced by the negative effect of the presence of budgetary rules. The interaction coefficient (-0.32) is significant at 1%. This result could suggest that countries that have adopted fiscal rules have opportunities to mitigate the impact of terms of trade shocks on growth volatility. This result is also found in the literature. This result is consistent with the work of Roch (2019), who found that fiscal rules help insulate the economy from commodity price fluctuations which, in turn, reduce production volatility. Indeed, Céspedes and Velasco (2014) find that fiscal policy tends to be more countercyclical during a surge in commodity prices, due to the presence of fiscal rules. Similarly, Medina (2016) shows that public spending in countries with fiscal rules reacts less to shocks on commodity prices.

Column (2) considers the interaction between the presence of fiscal rules and discretionary fiscal policy. The coefficient associated with this variable is negative and significant at 1%. This result shows that the presence of fiscal rules reduces the positive effect of discretionary fiscal policy. This result is consistent with the work of Sacchi and Salotti (2015). The latter showed that aggressive use of discretionary fiscal policy, particularly government consumption elements, leads to greater output volatility. However, when strict fiscal rules are considered, discretionary policy becomes stabilizing rather than destabilizing for production (Sacchi and Salotti, 2015). In this way, fiscal rules limit the volatility of discretionary fiscal policy and, therefore, the volatility of output.

Regarding the control variables, the coefficient associated with openness is positive and significant at 10%. As for GDP per capita and population, we note that the coefficients associated with these variables are negative and statistically significant at the 1% level. This result reflects the fact that growth volatility tends to decrease as income increases. This result is consistent with previous studies showing that an increase in income tends to reduce output volatility in both developed and developing economies (Kpodar et al., 2019).

Table 3 presents the effects of the exchange rate regime on growth volatility in SSA. The estimates indicate that the coefficient associated with fixed exchange rate regimes is positive and significant at 5%, but the interaction with terms of trade volatility is not significant. The positive effect of the exchange rate regime is based on the idea that the fixed exchange rate reduces the economy's ability to adjust to shocks. This reduction comes from the elimination of the automatic and continuous adjustment offered by variations in the flexible nominal exchange rate and the slowness of adjustment by prices (Yougbaré, 2009). Indeed, if prices and nominal wages are rigid downwards, a favourable shock leads to an appreciation of the

real exchange rate, whatever the exchange system. In this case, the adjustment is essentially made through prices. Conversely, an adverse disturbance requires a real depreciation of the currency, which occurs slowly in fixed exchange rate regimes. Therefore, the real exchange rate remains overvalued during the transition period towards its new equilibrium value. The real economy then provides most of the adjustment. When the nominal exchange rate is flexible, its rapid depreciation leads to faster real depreciation, thereby mitigating the decline in growth. The asymmetric adjustment to disturbances following the exchange rate regime means that the fixity of the exchange rate accentuates the volatility of growth, other things being equal, relative to flexible exchange rate systems. Moreover, Carrière-Swallow et al. (2021) show that flexible exchange rate regimes play a shock-absorbing role by reducing the response of output to terms of trade shocks.

Table 3: Effects of exchange rate regime on growth volatility

Variables	(1) Growth volatility
Exchange rate regime	0.301** (0.133)
Terms of trade volatility	0.072 (0.067)
Exchange regime × terms of trade volatility	-0.002 (0.073)
GDP per capita	-0.101*** (0.036)
Trade	-0.204*** (0.059)
Government spending	-0.017 (0.061)
Population	-0.153*** (0.026)
Discretionary policy	0.394*** (0.035)
Constant	5.511*** (0.683)
Observations	882
Durban	4.44339
(P-value)	(0.0350)
F-Statistic	227.124
(P-value)	(0.0000)
Sargan	2.3621
(P-value)	(0.124)

Robustness analysis

The results indicate that terms of trade shocks as well as discretionary policy contribute to growth volatility in SSA. However, fiscal rules reduce the effects of terms of trade shocks and discretionary policy volatility on growth volatility. Furthermore, exchange rate fixity tends to positively affect growth volatility. To check the robustness of our results, we perform additional analyses. These analyses are carried out in terms of an alternative estimation technique based on generalized methods of moments (GMMs). Several reasons are put forward in favour of selecting this technique. Indeed, this method makes it possible to control individual and temporal effects, and to resolve the endogeneity problem likely to be attached to the different explanatory variables. In addition, this method provides solutions to the problems of simultaneity bias, reverse causality and omitted variables. Furthermore, the Hodrick and Prescott (HP) filter method was used to measure volatility. The results, presented in Tables 4 and 5, are similar to those obtained in Tables 2 and 3 and confirm the hypothesis of the role of fiscal policy and the nature of the exchange rate regime in the effect of terms of trade shocks.

We have also discussed statistical inference based on a bootstrap estimation technique. Wooldrige (2002) has shown that when we estimate a regression that includes an explanatory variable which itself comes from another regression (such as discretionary policy), the standard error of the coefficient of this variable is biased (but not the coefficient). The bootstrap can be used to estimate a standard deviation corrected for this bias. The results presented in the appendix A using the bootstrap technique show that the coefficients of these results remain significant and practically identical to those presented in tables 2 and 3. Consequently, the modification of the standard errors induced by the presence of the estimated variables did not have a significant influence on the results.

Table 4: Effects of existence of fiscal rules and discretionary policy on growth volatility (GMM)

Variables	(1) Volatility	(2) Volatility
L.Volatility of growth	-0.257*** (0.053)	-0.252*** (0.063)
Terms of trade volatility	0.182*** (0.065)	0.007 (0.037)
Fiscal rules	-0.983** (0.466)	-3.136*** (0.880)
Fiscal rules × terms of trade volatility	-0.406*** (0.135)	
Discretionary policy	0.090 (0.070)	0.269** (0.122)
GDP per capita	-0.752*** (0.267)	-0.457 (0.423)
Trade	0.092 (0.221)	1.142*** (0.344)
Government spending	-1.149*** (0.287)	-1.430*** (0.425)
Population	-0.678*** (0.182)	-0.727*** (0.219)
Fiscal rules × discretionary policy		-0.786*** (0.220)
Constant	19.785*** (4.238)	15.380*** (5.561)
Observations	355	355
Number of id	41	41
No. of instruments	35	36
AR2 p-value	0.268	0.541
Hansen p-value	0.258	0.671

Note: AR2 p-value demonstrates an obvious absence of autocorrelation of order 2. The Hansen test does not allow for the null hypothesis of the validity of the instruments to be rejected.

Table 5: Effects of exchange rate regime on growth volatility (GMM)

Variables	(1) Growth volatility
L.volatility of growth	0.380*** (0.107)
Terms of trade volatility	0.094* (0.055)
Exchange rate regime	2.262*** (0.313)
Exchange regime × terms of trade volatility	-0.155 (0.100)
Discretionary policy	0.100 (0.068)
GDP per capita	-0.405** (0.188)
Trade	-0.232* (0.130)
Government spending	-1.152*** (0.124)
Population	-0.062 (0.128)
Constant	6.524** (3.020)
Observations	355
Number of id	41
No. of instruments	36
AR2 p-value	0.727
Hansen p-value	0.950

Note: AR2 p-value demonstrates an obvious absence of autocorrelation of order 2. The Hansen test does not allow for the null hypothesis of the validity of the instruments to be rejected.

6. CONCLUSION

The COVID-19 pandemic and its economic, social and financial fallout have sparked renewed interest in the search for appropriate policies and means to strengthen economic resilience to future shocks, particularly in developing countries. The latter experience negative shocks, but do not have adequate resources to overcome these shocks, which increases the volatility of their growth and inducing costs to the economy. This raises the need to look for factors that improve the resilience of economies to shocks. Studies have been conducted in this area, but have had mixed results. This paper contributes to the literature by focusing on SSA countries and explores the extent to which fiscal policies and the nature of the exchange rate regime could absorb or amplify the effects of terms of trade shocks. Using a sample of 44 SSA countries over the period 1980–2020, using the 2SLS instrumental variables method, the results show that the terms of trade shocks contribute to growth volatility. However, fiscal rules reduce the effects of terms of trade shocks and discretionary policy on growth volatility. That means the fiscal rules limit the volatility of discretionary fiscal policy and, therefore, the volatility of output. Furthermore, exchange rate fixity tends to positively affect growth volatility. This result is relevant, and implies the need for SSA countries to consider fiscal policies and the nature of the exchange rate regime in their resilience and volatility reduction strategy.

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APPENDIX A: ESTIMATION RESULTS WITH BOOTSTRAP TECHNIQUE

Table A1: Effects of existence of fiscal rules and discretionary policy on growth volatility (bootstrap)

Variables	(1) Volatility	(2) Volatility
Fiscal rules	-1.280*** (0.234)	-1.196*** (0.258)
Terms of trade volatility	0.087** (0.034)	0.048 (0.033)
Fiscal rules × terms of trade volatility	-0.263 (0.227)	
Discretionary policy	0.251*** (0.043)	0.592*** (0.072)
GDP per capita	-0.162*** (0.048)	-0.109** (0.047)
Trade	-0.127** (0.058)	-0.105** (0.047)
Government spending	0.066 (0.052)	0.017 (0.069)
Population	-0.132*** (0.025)	-0.170*** (0.025)
Fiscal rules × discretionary policy		-0.456*** (0.094)
Constant	5.289*** (0.570)	6.051*** (0.758)
Observations	911	641

Table A2: Effects of exchange rate regime on growth volatility (bootstrap)

Variables	(1) Volatility
Exchange rate regime	0.301** (0.144)
Terms of trade volatility	0.072 (0.059)
Exchange × terms of trade volatility	-0.002 (0.066)
GDP per capita	-0.101*** (0.037)
Trade	-0.204*** (0.057)
Government spending	-0.017 (0.056)
Population	-0.153*** (0.027)
Discretionary policy	0.394*** (0.041)
Constant	5.511*** (0.718)
Observations	882



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Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org