Linking Fiscal Policy and External Competitiveness in Sub-Saharan Africa – Does Government Spending Drive The Real Exchange Rate in Sub-Saharan Africa

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Fiscal Policy, Productivity and the Real Exchange Rate: Is Government Spending a Significant Determinant of the Real Exchange Rate? New Evidence from Sub-Saharan Africa

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First Draft. Comments Welcome.

Abstract

Do government spending patterns and composition tell us anything about the behaviour of the real exchange rate in Sub-Saharan Africa? We develop a simple 2-sector small open economy model which shows that government spending and productivity differential are associated with the real exchange rate appreciation. Using a panel of Sub-Saharan Africa (SSA) countries, we perform a coordinated empirical analysis that overwhelmingly confirms the predictions of the model. Next, we disaggregate government spending into three major components - consumption, investment and transfer payments – and check whether the composition of government spending provides any insight into the dynamics of the real exchange rate in SSA. Our results suggest a yes. In particular, government consumption and transfer payments generate real appreciation, while government investment depreciates the real exchange rate. These findings are robust in magnitude and signed direction, but their effects are not always significant. We also show that the composition of government spending provides a good insight into the effects of government spending shocks in the short run, but the short and long run effects of fiscal shocks are in general not equivalent.

Keywords: Government spending, spending composition, and the real exchange rate
JEL classification: F30, F32, E39, F40, F41, E62.

1. Introduction

Government spending, comprising government final consumption expenditure, government investment expenditure and transfer payments, is one of the main fiscal policy tools common to different economies across the world. This spending serves as a source of stimulus or austerity in times of uncertainty. Economies facing volatile changes in growth can be stabilized and sustainably repositioned with an appropriate mixture of government spending, often financed with borrowing, taxes or seigniorage. The use of government spending as a fiscal tool to provide fiscal stimulus in the different episodes of stunted growth experienced in SSA, and across the world, especially after major incidents of recessions, attests to its importance to policy makers. As a result, it is important to understand the consequences of variations in government spending on macroeconomic variables, especially those variables for which the literature finds a mixed evidence of their

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relationships with government spending. In this light, this paper presents an investigation into the effects of government spending on the real exchange rate in SSA. Our empirical analysis uses yearly data from a panel of 31 SSA countries over the period 1980 - 2011 and employs a panel dynamic ordinary least squares (PDOLS) estimator to establish the relationship between the variables of interest and the real exchange rate.

In the literature, extensive studies have been done on the consequences of government spending shocks on domestic aggregate activity, private absorption and crowding out effects. In a recent paper, Ravn et.al (2012), in line with other previous studies, find that government spending shocks raise output and consumption. However, the effects of government spending shocks on external competitiveness, i.e. the real exchange rate, have received significantly less attention. In the instances where this has been studied, the results have diverged more often than not and produced no consensus. In general, the effects of government spending on the real exchange rate depend on whether the spending is directed towards the tradable or non-tradable sector. If the spending is more consumption-based and geared towards the non-tradable sector, then it may quicken the appreciation of the real exchange rate and hurt external competitiveness. Inversely, if the spending is directed towards the tradable sector, this may depreciate the real exchange rate and enhance competitiveness. So, the effect of government spending on the real exchange rate is not obviously clear cut and requires a lot of deep digging.

Earlier studies in this area produced theoretical models which predict that an unanticipated expansion in government spending appreciates countries' real exchange rates. Among them are Edwards (1989), Froot and Rogoff (1991) and De Gregorio, Giovanni, and Wolf (1994). They find that government spending does affect the real exchange rate and is a significant determinant of external competitiveness because it falls more heavily on nontraded goods and thus has more impact on the real exchange rate. These studies on the effects of government spending on the real exchange rate use different models to show that government spending trajectories provide a plausible explanation for the divergence observed in the behaviour of the real exchange rate, wherein positive shocks to government spending appreciate the real exchange rate and vice versa. In an influential paper, Alesina and Perotti (1995) further observe that fiscal policy can have long-run effects on the real exchange rate and prevent it from being constant in the long run, as suggested by theory, in instances where government spending is financed with distortionary taxes.

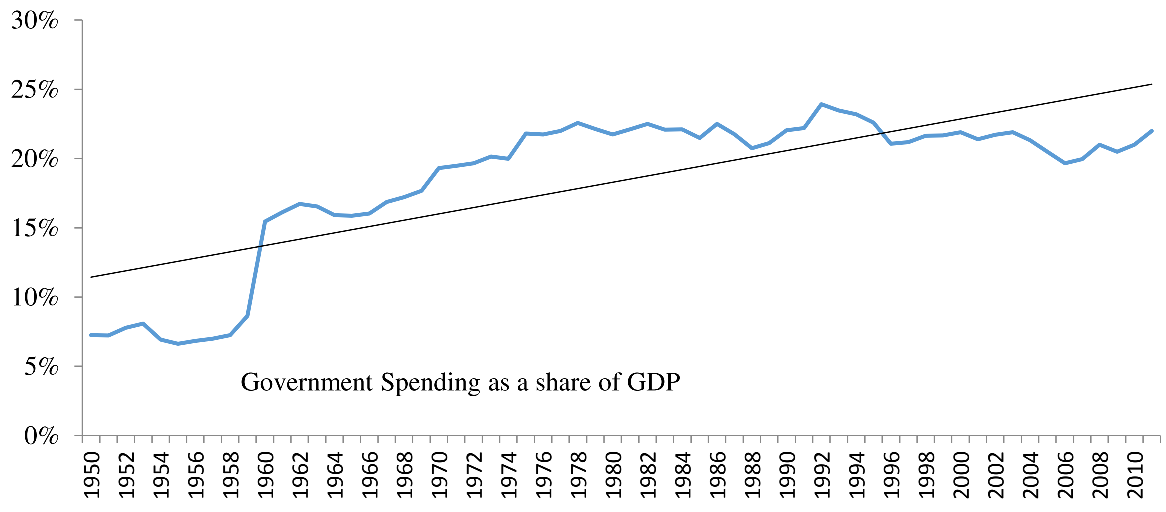
In recent times, conclusions reached in earlier studies have been questioned, revisited and even put to a series of rigorous tests using the richly available data samples that have accumulated over the years. The results have been a coordinated list of empirical findings that diverge considerably from those reached in earlier studies and thus go completely against the conventional wisdom that an increase in government spending drives up the relative price of nontraded goods and hence domestic prices, rendering the domestic economy under competitive relative to the rest of the world. For instance, a new wave of recent studies such as Bouakez et al. (2014), Kim and Roubini (2008), and Ravn et al. (2012) all conclude that positive shocks to government spending attract significant and persistent depreciation, rather than appreciation, of the real exchange rate. This suggests that an (unanticipated) increase in government spending stimulate real depreciation and makes a country over competitive relative to the rest of its trading partners. The actual responses of the real exchange rate to innovations in government spending are hard to unravel in light of the predictions of existing theoretical models on the transmission of government spending shocks.

Another important insight is that when disaggregated, the different components of government spending might also have different impacts on the real exchange rate for economies at different stages of development. Caputo and Fuentes (2010) find that in developed countries, changes in government spending does not significantly impact the real exchange rate while for developing economies, they conclude that government transfers appreciate the real exchange rate because they induce an increase in the relative demand for nontraded goods whereas government investment depreciates the real exchange rate. For both sets of countries, government expenditures tend to appreciate the real exchange rate, although the impact is comparatively larger in developing economies. Galstyan and Lane (2009) propose that an increase in government consumption leads to real appreciation while an increase in government investment causes real depreciation, confirming that government consumption and government investments might well have different effects on the real exchange rate.

Drawing from the evidence available in the extant literature, there is no dispute that the number of studies analysing the macroeconomic effects of fiscal shocks has increased in the last decade. While the most prominent of these studies have focused on the developed economies of the US and Europe, little is known on the impact of fiscal shocks on external competitiveness in SSA. In Africa, government spending has been on the rise in the last decades (Fig. 1) as evidenced by the region's expanding deficits in periods of benign but relatively flattish fiscal revenue (Fig. 2). The International Monetary Fund (IMF) in 2009 reports that many countries in SSA are using fiscal policy to counter the impact of economic slowdown. Yet how government spending directly impacts the competitiveness of SSA countries is neither known nor well-understood. It is widely agreed in open economy macroeconomics that the real exchange rate is hard to crack because despite much research, no consensus exists on the variables that explain its movements. Having an understanding of the real exchange rate relationship with fiscal policies can help explain the root causes of its behaviour. Moreover, our interest becomes even more pronounced when one realises that an often asked question 'does SSA's fiscal policy influence the real exchange rate behaviour' has yet to receive an answer. In view of this, this paper explores and confirms whether government spending is a significant determinant of the real exchange rate in SSA, utilising a simple neoclassical theoretical model that builds on, and extends, existing neoclassical models connecting fiscal policies and the real exchange rate.

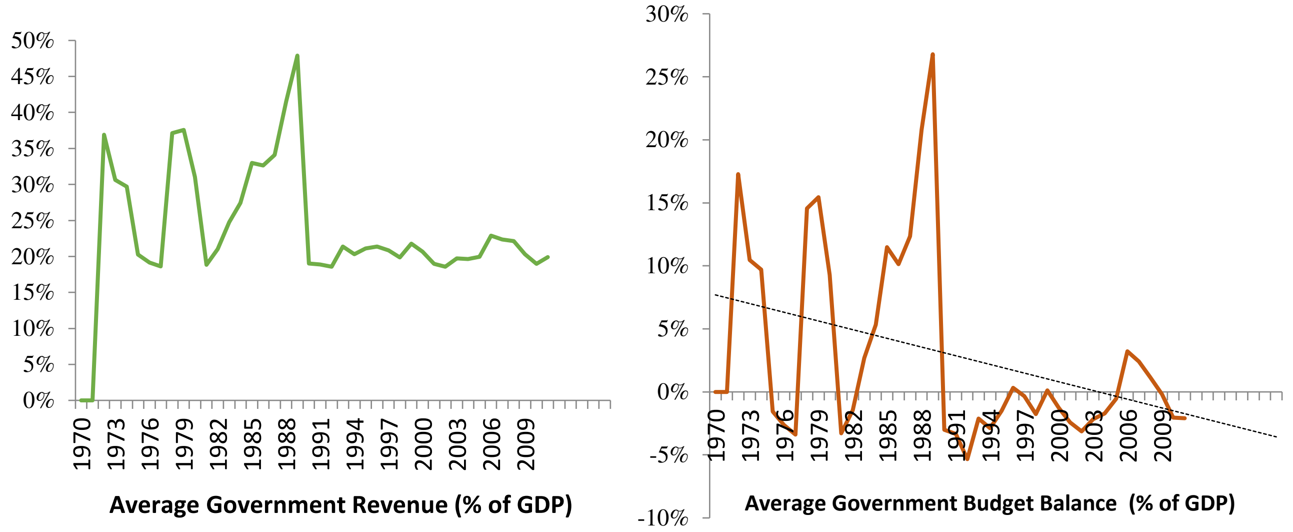
Our study of the government spending-real exchange rate nexus is based on an intertemporal maximizing model of the exchange rate where prices are assumed to be fully flexible. One interesting question this paper answers is whether government spending provides a plausible reason, among other reasons, as to why the real exchange rate is highly volatile and hardly constant even in the long run. The analysis focuses on SSA because to date no research contribution exists in determining whether the growing government spending is responsible for the real exchange rate behaviour in the region. We suspect the issue of sparse data samples on the real exchange rate in SSA is largely responsible for the lack of research in this area. As a result, we address this vacuum by turning to the recently constructed CPI-based real effective exchange rate datasets in Darvas (2012, 2016). By exploiting these new data samples, this paper is able to fill a void in the literature via analysing the effects of government spending on the real exchange rate across SSA.

Fig. 1 Average Government Spending as a Share of GDP in Sub-Saharan Africa



Source: Penn World Tables, World Bank Economic Development Indicators and Author's Calculations

Fig. 2 Average Government Revenue and Budget Balance Share of GDP in Sub-Saharan Africa



Source: World Bank Economic Indicators, International Monetary Fund, and Author's Calculations

We develop an adapted version of a simple 2-sector Ricardian neoclassical model of the real exchange rate in the spirit of Froot and Rogoff (1991) and Obstfeld and Rogoff (1996). We derive two versions of the model – one version where output in the traded and nontraded sectors is exogenously determined, and another version where fixed labour and constant capital are supplied to the traded and nontraded sectors and output in both sectors is endogenously determined. In both instances, our models show that government spending and productivity differential, at least in theory, are potential determinants of the behaviour of the real exchange rate. Whilst these variables provide theoretical justification as potential determinants of the real exchange rate, they by no means capture all possible influencers of the behaviour of the real exchange rate in SSA. In this light, we follow influential studies in the literature such as Galstyan and Lane (2009) and include into our empirical analysis the different composition of government spending as possible determinants of the real exchange rate in SSA. Among other things, these added variables help to establish the effects of other plausible determinants on the results obtained for our variables of interest.

In the end, how these variables influence the real exchange rate in SSA is an important empirical question addressed in this paper. Motivated by this, we execute a broad empirical exercise, employing a mix of empirical specifications that allow us to analyse the behaviour of the real exchange rate. One of our major goals is to expand the government spending-real exchange rate nexus to include in particular the roles of government consumption and investment in the evolution of the real exchange rate in SSA. This is important, since existing studies suggest government consumption and government investment do not always have the same effects on the evolution of relative price levels and hence the real exchange rate. We also examine the short-run effects of shocks to government spending on relative per capita output and the real exchange rate in SSA, employing a panel vector autoregressive (VAR) representation. Under this representation, we follow Benetrix and Lane (2009, 2013) and assume government spending is unreactive to contemporaneous shocks to output and real exchange rate but can have immediate impact on these two variables when subject to exogenous shocks. Thus, besides making it feasible to study the effects of government spending shocks and productivity shocks on the real exchange rate, this assumption also allows us to understand how government spending shocks affect relative per capita output or productivity differential in SSA.

Our empirical results are as follows. In line with the benchmark model, our results sufficiently confirm that increases in government spending and productivity differential appreciate the real exchange rate in SSA. This finding continues to hold even after holding fixed the effect of net foreign assets to control for the possibility of a transfer problem. Digging further, we disaggregate government spending into consumption, investment and transfer payments and study the effect of each component on the real exchange rate. Consistent with government spending, we find that government consumption along with productivity differential appreciates the real exchange rate; whereas government investment depreciates the real exchange rate while government transfer appreciates the real exchange rate. We note that except for government spending and productivity differential, our results are not always significant but the signs of the coefficients of the variables of interest remain consistent across all estimations and robust to different empirical specifications employed. In particular, our findings from the disaggregated analysis are robust to the inclusion of net foreign asset as a control for a plausible transfer problem.

Lastly, the main message from the short-run empirical analysis of the impact of fiscal shocks is that, as in the long run analysis, differences exist between shocks to government consumption and shocks to government investment, suggesting that the effects of fiscal shocks to a considerable extent depend on the underlying fiscal innovation. However, unlike the long run analysis, there is no convincing evidence that positive shocks to government spending leads to real appreciation in the short run in SSA. To the best of our knowledge, this is the first study that investigates how government spending and its main components influence the behaviour of the real exchange rate in SSA. Thus, it constitutes a fresh contribution to the literature. The rest of the paper is organised as follows. Section II presents the theoretical framework. Section III describes in detail the data that enables the research presented in this paper and discusses empirical methodology and results. Section IV concludes with pointers to possible future extension.

2. The Model

The model we present is a simple Ricardian neoclassical model that forms the building block of our empirical analysis of government spending and its effect on the real exchange rate in SSA. Our model builds largely on Froot and Rogoff (1991). To begin, we consider a small open economy (SOE) that produces traded and nontraded goods and has a representative infinitely-lived household that consumes goods according to established preferences represented by a utility function in an objective function U_i. The small open economy, given its size and the SOE assumption, has no influence on world prices, international capital markets and traded goods; so it is a price taker that takes the price of tradables and the world interest rate r (denominated in terms of tradables) as a given, with no power to influence them. The SOE comprises tradable and nontradable sectors and thus produces tradable and nontradable goods. The output of the tradable sector is an endowment Y_{Tt} that trades on the international market while the output of the nontradable sector is an endowment Y_{Nt} that trades domestically, where the relative price of nontraded goods in terms of traded goods is given by P_t and, as a starting assumption, Y_{Nt} and Y_{Tt} are exogenously given.

2.1 Households

The infinitely-lived household with a perfect foresight derives utility from consumption C_t. The lifetime objective function of the representative household is

$$U_i = \sum_{t=0}^{\infty} \beta^t \left[\frac{\sigma}{\sigma - 1} C_t^{\frac{\sigma-1}{\sigma}} \right], \quad 0 < \beta < 1 \quad \text{and} \quad \sigma > 0 \tag{1.0}$$

where σ is the constant relative risk aversion parameter, β is the household's discount factor and C_t denotes consumption basket comprising both tradable and nontradable goods. All parameters are positive. In this model, we assume the household is not restricted in its investing activities and can invest in any asset class of its choice, denominated in units of tradable goods, in the world markets, without restrictions. Let W_t denote wealth at time t accrued by the representative agent from its investing activities and T_t denote lump-sum taxes generated by government from which it finances spending, then the representative household faces a flow budget constraint given by

$$W_{t+1} = (1 + r)W_t + Y_{Tt} + P_t Y_{Nt} - C_{Tt} - P_t C_{Nt} - T_t, \tag{1.1}$$

where C_t represents the consumption index, W_{t+1} is the wealth holdings in the next period and W_t denotes the wealth (in units of tradable goods) accruing an exogenously given real return (real interest rate) r. We adopt Obstfeld and Rogoff (1996) timing convention so that C_t denotes the consumption index between period t and period $t+1$, while W_t denotes bonds between period $t-1$ and t.

The aggregate consumption index C_t is a composite of traded C_{Tt} and nontraded C_{Nt} goods. Following Froot and Rogoff (1991), we define the consumption index as a simple neoclassical model, with Cobb- Douglas intratemporal preferences

$$C_t = C_{Tt}^{\rho} \times C_{Nt}^{1-\rho}, \qquad \rho > 0 \tag{1.2}$$

where ρ measures the constant elasticity of substitution between traded (C_{Tt}) and nontraded (C_{Nt}) goods. Under the assumption that the largest part of government spending G_t falls on home goods (nontraded goods), it follows that the endowment or output (Y_{Nt}) from the nontradable sector is split between households (C_{Nt}) and government (G_t) and so it must satisfy the equilibrium condition

$$Y_{Nt} = C_{Nt} + G_t, \tag{1.3}$$

Finally, since Ricardian equivalence is taken to hold in the model, it is assumed, in the spirit of Froot and Rogoff (1991) that government optimises spending and thus runs a budget balance at the most. Essentially, this assumption yields

$$T_t = P_t G_t, \tag{1.4}$$

2.2 First-order conditions

The intertemporal problem of the infinitely-lived household is to maximize lifetime objective function, U_i, subject to (1.1) – (1.4). We derive the optimality conditions as follows. The Lagrangian L is given by

$$L = \max \sum_{t=0}^{\infty} \Big\{ \beta^t \frac{\sigma}{\sigma - 1} C_t^{\frac{\sigma-1}{\sigma}} + \beta^t \lambda_t \big((1+r)W_t + Y_{Tt} + P_t Y_{Nt} - C_{Tt} - P_t C_{Nt} - T_t - W_{t+1}\big) \Big\} \tag{1.5}$$

which yields the following first-order conditions for our variables of interest

$$\begin{cases} \dfrac{\partial L}{\partial C_{Tt}} = \rho C_t^{-\frac{1}{\sigma}} C_{Tt}^{\rho-1} C_{Nt}^{1-\rho} - \lambda_t = 0 \\ \dfrac{\partial L}{\partial C_{Nt}} = (1-\rho) C_t^{-\frac{1}{\sigma}} C_{Tt}^{\rho} C_{Nt}^{-\rho} - P_t \lambda_t = 0 \\ \dfrac{\partial L}{\partial W_{t+1}} = -\lambda_t + \beta(1+r)\lambda_{t+1} = 0 \\ \dfrac{\partial L}{\partial \lambda_t} = (1+r)W_t + Y_{Tt} + P_t Y_{Nt} - C_{Tt} - P_t C_{Nt} - T_t - W_{t+1} = 0 \end{cases} \tag{1.6}$$

Under the assumption that $\beta(1+r) = 1$, so that there is no Ponzi scheme and the desire to lend or borrow in steady state is infinitely ruled out, the optimal decisions generate the following first order relationships

$$
\begin{cases}
P_t = \dfrac{(1-\rho)C_{Tt}}{\rho(Y_{Nt}-G_t)} \\
\dfrac{P_{t+1}}{P_t} = \left[\left(\dfrac{C_{Tt+1}}{C_{Tt}}\right)^{\rho(\sigma-1)}\left(\dfrac{Y_{Nt+1}-G_{t+1}}{Y_{Nt}-G_t}\right)^{(\rho-\sigma\rho-1)}\right]^{\frac{1}{\sigma}} \\
\dfrac{C_{Tt+1}}{C_{Tt}} = \left[\left(\dfrac{Y_{Nt}-G_t}{Y_{Nt+1}-G_{t+1}}\right)^{(1+\sigma)(1-\rho)}\right]^{\frac{1}{\rho(\sigma-1)-\sigma}}
\end{cases}
\tag{1.7}
$$

If we follow Froot and Rogoff (1991) and Lane and Milesi-Ferreti (2004) and define the the real exchange rate as the relative price of nontradables in terms of tradable goods as dictated by the ratio of domestic consumption price index (CPI) to foreign consumption price index (CPI), where foreign CPI is normalized to unity and held fixed at this level throughout our analysis, then we have

$$
RER_t \equiv P_t = \frac{(1-\rho)C_{Tt}}{\rho(Y_{Nt}-G_t)}, \tag{1.8}
$$

The first order conditions provide some insightful results worthy of elucidation. The last equation of (1.7), which relates future consumption of tradable goods to current consumption, suggests that consumption of tradable goods, which impacts current account, is driven in parts by variations in production of nontraded goods. If production of nontraded goods (and government spending) is constant, then consumption of tradable goods is unchanged across time, which means there is no impact on current account. If production of nontraded goods increases intertemporarily, this induces a reduction in the consumption of traded goods and this improves the current account. On the other hand, an intertemporal decrease in the production of nontraded goods increases the consumption of traded goods, weakening the current account. In all, these results depend on the values of the intertemporal and intratemporal substitution. A quick look at (1.8) shows that a rise in government spending raises the real exchange rate. To see this, notice that $\frac{\partial RER_t}{\partial G_t} = \frac{(1-\rho)C_{Tt}}{\rho(Y_{Nt}-G_t)^2}>0$. This is a theoretical prediction that will be tested in our empirical analysis. Also notice from (1.8) that a rise in productivity in the traded goods sector that induces a rise in the consumption of tradable goods has similar effects on the real exchange rate as an increase in government spending, since $\frac{\partial RER_t}{\partial C_{Tt}} = \frac{(1-\rho)}{\rho(Y_{Nt}-G_t)}>0$, albeit our model does not confirm whether the magnitudes of the effects are equal, and determining which effects dominate would depend on current levels of consumption of traded relative to nontraded goods.

2.3 Endogenously determined output – Are the results similar when output is endogenous?

So far, in the preceding section, our model and results are analysed under the assumption that output in the traded and nontraded sectors is exogenously given. In this section, we consider the case where output in both sectors is no more exogenous but determined endogenously by a production law which supplies fixed capital to both sectors, and labour supplied to both sectors is freely mobile. To this end, we suppose now that the infinitely-lived household with a perfect foresight continues to derive utility from consumption C_t but now experiences some disutility from labour $L_t = L_{Tt} + L_{Nt}$ supplied to the competitive traded and nontraded sectors. The lifetime objective function of the infinitely-lived household, incorporating the labour supplied to the traded and nontraded sectors, now becomes

$$
\aleph_i = \sum_{t=0}^{\infty}\beta^t\left[\frac{\sigma}{\sigma-1}C_t^{\frac{\sigma-1}{\sigma}} - \frac{\vartheta}{1+\varphi}L_t^{1+\varphi}\right],\ \ 0<\beta<1 \ \text{ and } \ \sigma,\vartheta,\varphi>0 \tag{1.9}
$$

where L_t represents the aggregate amount of labour supplied to the traded and nontraded sector, σ is the constant relative risk aversion parameter and β is the household's discount factor. All parameters are positive and the last term in the utility function captures the disutility of work effort emanating from reduced leisure associated with supplying an amount L_t of labour to both sectors, where $\varphi > 0$ represents the inverse Frisch elasticity of labour supply with respect to the real wage.

Suppose further that the household uses the following production technology in the supply of output to the nontradable and tradable goods sectors at time t and the production function in both sectors is identical

$$Y_{Nt} = A_{Nt}L_{Nt}^{\delta} \text{ and } Y_{Tt} = A_{Tt}L_{Tt}^{\mu}$$

where A_{Nt} and A_{Tt} represent efficiency or total factor productivity and changes in their values imply efficiency shocks to the nontraded and traded sectors, respectively. Because the household now supplies labour interchangeably to the traded and nontraded sectors, where the aggregate or maximum available labour supply at any time is fixed, its flow budget constraint changes to

$$W_{t+1} = (1+r)W_t + A_{Tt}L_{Tt}^{\mu} + P_tA_{Nt}L_{Nt}^{\delta} - C_{Tt} - P_tC_{Nt} - T_t, \tag{2.0}$$

In this case, the Lagrangian L is given by

$$L = \max\sum_{t=0}^{\infty}\left\{\beta^t\left[\frac{\sigma}{\sigma-1}C_t^{\frac{\sigma-1}{\sigma}} - \frac{\vartheta}{1+\varphi}(L_{Tt}+L_{Nt})^{1+\varphi}\right] + \beta^t\lambda_t\left((1+r)W_t + A_{Tt}L_{Tt}^{\mu} + P_tA_{Nt}L_{Nt}^{\delta} - C_{Tt} - P_tC_{Nt} - T_t - W_{t+1}\right)\right\} \tag{2.1}$$

and the first order conditions with respect to the labour supplied to the tradable and nontradable sectors are

$$\begin{aligned} \frac{\partial L}{\partial L_{Tt}} &= -\vartheta(L_{Tt}+L_{Nt})^{\varphi} + \mu A_{Tt}L_{Tt}^{\mu-1}\lambda_t = 0 \\ \frac{\partial L}{\partial L_{Nt}} &= -\vartheta(L_{Tt}+L_{Nt})^{\varphi} + \delta P_tA_{Nt}L_{Tt}^{\delta-1}\lambda_t = 0 \\ \frac{\partial L}{\partial \lambda_t} &= (1+r)W_t + A_{Tt}L_{Tt}^{\mu} + P_tA_{Nt}L_{Nt}^{\delta} - C_{Tt} - P_tC_{Nt} - T_t - W_{t+1} = 0 \end{aligned} \tag{2.2}$$

which, together with (1.8), yield

$$RER = \frac{\mu A_{Tt}L_{Tt}^{\mu-1}}{\delta A_{Nt}L_{Nt}^{\delta-1}} \tag{2.3}$$

The above results for endogenous output, where there is a fixed supply of capital and labour is freely mobile, suggest that a persistent flow of labour into the nontraded goods sector relative to traded good eventually weakens or diminishes the real exchange rate. That is, the effect of a permanent shock to government spending on the real exchange rate is mitigated by the flow of labour into the nontraded sector. In fact, depending on the momentum and speed of such flows, this could reverse the effects of permanent government spending on the real exchange rate. An improvement in the efficiency or productivity of the nontraded goods sector, via a positive productivity shock, also has the same effects. Turning to the tradable goods sector, (2.3) suggests that any positive shocks to the productivity of the tradable goods sector is strong enough to withstand and overcome the effects of an increase in the flow of labour to the nontradable sector on the real exchange rate, providing evidence supportive of the hypothesis that productivity growth in the traded goods sector accelerates the real exchange rate and is a cause of the non-constant, highly volatile real exchange rate observed in some countries even in the long run.

Under the standard neoclassical framework, capital and labour have transitory effects, impacting the real exchange rate via their effects on the traded and nontraded output up until steady state. Once steady state is reached, changes in factors have little or no more impact on the real exchange rate. In this instance, only unanticipated shocks to productivity in both the traded and nontraded sectors drive the relative price of nontraded goods and hence the real exchange rate. The effect on the real exchange rate is given by

$$\frac{drer}{rer} = \frac{da_{Tt}}{a_{Tt}} - \frac{da_{Nt}}{a_{Nt}} \tag{2.4}$$

where the small letters denote that both sides of (2.3) have been logged before the differential is taken. Notice that, were the shocks anticipated, there would be movements in labour across either sectors which would dampen or mute the effect on the real exchange rate emanating from the productivity shocks. Unanticipated shocks ensure that such movements in labour do not occur and so changes in labour supply in each sector following this shock is zero. On the whole, two important theoretical results emerge. First, increases in government spending via positive shocks lead to real appreciation. Second, high positive shocks to productivity in the traded goods sector or a positive productivity differential in favour of the traded goods sector appreciate the real exchange rate[2]. The validity of these predictions will be tested empirically using data samples drawn from SSA.

2.4 Steady-State Analysis

An interest to us in this paper is to understand the long-run behaviour of the real exchange rate. To achieve this, we need to solve for the steady-state solution of the models in (1.8) and (2.3). The first step in obtaining this solution is to consider a benchmark steady state in which all variables are constant. We normalize the labour supplied to the traded and nontraded sector so that the relative labour supplied to the traded sector in terms of nontraded sector is unity. Following this, we perform a steady state log-linearization of the system around this benchmark. The log linearization aims at examining the response of the steady-state real exchange rate to variations in the steady-state values of our variables of interest.

Let tildes denote percentage changes relative to the benchmark steady state. Log linearizing from (1.8) and (2.3) around the benchmark steady state yields[3]

$$\widetilde{RER} = \tilde{C}_T + \alpha_1 \tilde{G} - \alpha_2 \tilde{Y}_N = \gamma(A_T - A_N), \qquad \alpha_1 = \frac{G^*}{Y_N^* - G^*} > 0,\ \alpha_2 = \frac{Y_N^*}{Y_N^* - G^*} > 0 \text{ and } \gamma = 1 \tag{2.5}$$

Equation (2.5) shows that in steady state, the impact of productivity on the real exchange rate is influenced by the sector experiencing productivity shocks. For instance, it suggests that productivity improvement in the nontraded sector depresses the real exchange rate, whereas an increase in productivity in the traded sector generates real appreciation, in line with the celebrated Balassa-Samuelson hypothesis. Since $\alpha = (\alpha_1, \alpha_2) > (0,0)$, then (2.5) also suggests that in the steady state, an increase in government spending generates a real exchange rate appreciation while a steady state rise in nontraded output invites a real depreciation. Finally, a shift in the composition of aggregate consumption towards the traded sector is associated with real appreciation in the long run. In the empirical analysis, we test the implications of these predictions.

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[2] This result is analogous to that obtainable when a production technology that linear in labour supplied to the traded and nontraded goods sector is utilized to generate output. In such as case, $\delta = \mu = 1$.

[3] Log linearizing from (1.8) and (2.3) around the benchmark steady state proceeds as follows

$$\log RER^* + \frac{1}{RER^*}(RER - RER^*) = \log\frac{1-\rho}{\rho} + \log C_T^* + \frac{1}{C_T^*}(C_T - C_T^*) - \log(Y_N^* - G^*) + \frac{1}{Y_N^* - G^*}[(G - G^*) - (Y_N - Y_N^*)]$$

$$\log RER^* + \frac{1}{RER^*}(RER - RER^*) = \log\frac{\mu}{\delta} + \log A_T^* + \frac{1}{A_T^*}(A_T - A_T^*) - \log A_N^* - \frac{1}{A_N^*}(A_N - A_N^*)$$

$$\widetilde{RER} = \frac{1}{RER^*}(RER - RER^*),\ \tilde{C} = \frac{1}{C_T^*}(C_T - C_T^*),\ \tilde{G} = \frac{1}{G^*}(G - G^*),\ \tilde{Y}_N = \frac{1}{Y_N^*}(Y_N - Y_N^*),\ \tilde{A}_T = \frac{1}{A_T^*}(A_T - A_T^*) \text{ and } \tilde{A}_N = \frac{1}{A_N^*}(A_N - A_N^*)$$

$$\log RER^* = \log\frac{1-\rho}{\rho} + \log C_T^* - \log(Y_N^* - G^*) = \log\frac{\mu}{\delta} + \log A_T^* - \log A_N^*$$

$$\widetilde{RER} = \tilde{C}_T + \alpha_1 \tilde{G} - \alpha_2 \tilde{Y}_N = \gamma(A_T - A_N), \qquad \alpha_1 = \frac{G^*}{Y_N^* - G^*} > 0,\ \alpha_2 = \frac{Y_N^*}{Y_N^* - G^*} > 0 \text{ and } \gamma = 1 > 0$$

3. Data and Empirical Specification

3.1 Data

Our sample includes 31 SSA countries over the period 1980 - 2011 selected based on data availability. The sources of the data samples are Penn World Tables, the World Bank, and Darvas (2012, 2016). The data samples for net foreign assets come from Lane and Milesi-Ferretti (2001, 2004) and the updated and extended version of Lane and Milesi-Ferretti (2007) which is a newly constructed dataset on countries' net external positions. We draw data from diverse sources as no one source provides data on SSA countries for an extended time period. Furthermore, given that productivity data by sectors are not reported for SSA countries, we follow Lane and Milesi-Ferretti (2004) and proxy productivity differential using relative per capita output. The relative per capita output is based on per capita data, in dollars, sourced from the World Bank, and is taken as relative to the per capita output of countries major trading partners. We proceed with the empirical analysis by studying the impact of the whole governing spending and each of its components on the real exchange rate in SSA. This helps us to answer the question of not only whether government spending significantly impacts the real exchange rate but also whether the composition of government spending provides any insight into the behaviour of the real exchange rate in SSA. The specific data sources are as follows – government spending comes from Penn World Tables while its individual components – government consumption, investment and transfer payments – come from the World Bank. Apart from the real exchange rate variable which we sourced from Darvas (2012, 2016), net foreign assets which came from Lane and Milesi-Ferretti (2001, 2004, 2007) and government spending extracted from Penn World Tables, the rest variables that appear in the empirical analysis originated from the World Bank Economic Indicators.

3.2 Empirical Evidence

Drawing from (1.8), (2.3) and (2.5), we adopt a single-equation approach and specify the structural model which relates the real exchange rate to the variables of interest in a reduced form as

$$RER_{it} = \alpha_i + \beta_1 G_{it} + \beta_2 YD_{it} + \varepsilon_{it} \qquad (2.6a)$$

where G_{it} and YD_{it} are government spending to output ratio and per capita GDP of country i relative to its trading partners, respectively. Government spending can be further split into

$$G_{it} = G_{it}^C + G_{it}^I + G_{it}^T \qquad (2.6b)$$

where G_{it}^C, G_{it}^I and G_{it}^T represent government consumption, investment and transfer payments so that we test how the composition of government spending affects the real exchange rate by estimating the reduced form

$$RER_{it} = \alpha_i + \beta_1 G_{it}^C + \beta_2 G_{it}^I + \beta_3 G_{it}^T + \beta_4 YD_{it} + \varepsilon_{it} \qquad (2.6c)$$

Under the specifications in (2.6a) and (2.6c), the real exchange rate is affected from a flow perspective by variables collectively termed flow fundamentals. To conduct subsequent robustness checks, we will control for net foreign assets, a stock variable, as another real exchange rate determinant and estimate the following reduced form equations

$$RER_{it} = \alpha_i + \beta_1 G_{it} + \beta_2 YD_{it} + NFA_{it} + \varepsilon_{it} \qquad (2.6d)$$

and

$$RER_{it} = \alpha_i + \beta_1 G_{it}^C + \beta_2 G_{it}^I + \beta_3 G_{it}^T + \beta_4 YD_{it} + NFA_{it} + \varepsilon_{it} \qquad (2.6e)$$

to distinguish two types of fundamentals – flow and stock – and their effects on the real exchange rate. In line with the empirical literature, real effective exchange rate and productivity differentials enter the estimations in logarithm levels, where an increase (+) in the real effective exchange rate indicates a real appreciation.

Meanwhile, the expected relationships are as follows. The first flow variable in (2.6a), government spending share of GDP, is expected to appreciate the real exchange rate while the second variable, which is a proxy for relative productivity between traded and nontraded sector, is also expected to catalyse a real appreciation, in the spirit of Balassa-Samuelson hypothesis which we expect to be supported in each estimation. In all cases, we also expect the control variable, net foreign asset, to appreciate the real exchange rate in line with the transfer problem as in Lane and Milesi-Ferretti (2004). There is no strong consensus on the impact of other components of government spending on the real exchange rate, so we adopt an open expectation.

The empirical analysis is in two parts. In the first part, we directly perform unit roots and cointegration tests and show that a cointegrating relationship exists among the components of the vector containing our variables of interest. In the second part, we estimate the coefficients of the variables of interest and perform robustness checks to confirm the validity of our results. By estimating the coefficients of the cointegrating vectors, the long-run relationship among these variables can be uncovered. One major advantage of cointegrated equations, as noted by Lane and Milesi-Ferretti (2004), is superconsistency which guarantees that any possible endogeneity from the real exchange rate to the independent variables does not alter the estimated coefficients.

In performing the test for stationarity, we have adopted the Levin–Lin–Chu (2002), Im–Pesaran–Shin (2003), Fisher-type (Choi 2001) and Hadri (2000) unit root tests because they are designed for cases where the time *T* dimension of a panel is large which is the exact dimension of our panel. In fact, Hadri (2000) recommends that for practical purposes, the test is most suitable for large *T* and moderate to large *N*. Of the four tests, the Hadri (2000) is the most unique one which tests the null hypothesis that all panels are stationary versus the alternative that at least some of the panels contain unit roots. The motivation for using a combination of tests stems from a desire to provide robustness checks for our conclusion that variables contain unit roots. We also control for cross-sectional dependence by removing cross-sectional means, wherever possible, because SSA economies might have shared similarities, and our results could be affected by cross-sectional correlation in the variables of interest. To test for cointegration, we follow Galstyan and Lane (2009) and utilise Kao (1999) test for cointegration to establish a long-run relationship among the variables. Table 1 shows the results from panel unit root and cointegration tests.

Table 1. Panel Unit Root and Cointegration Tests

	Levin, Lin, and Chu	Im, Pesaran, and Shin	PP–Fisher chi-square	Hadri
1. Panel Unit Root Test				
RER	0.00	0.00	0.00	0.00
GS	0.47	0.09	0.00	0.00
YD	0.07	0.91	0.37	0.00
GC	0.00	0.00	0.00	0.00
GI	0.00	0.00	0.00	0.00
GT	-	-	0.00	-
NFA	0.00	0.14	0.68	0.00
2. Kao Cointegration Test				
REER, GS and YD				-2.29
				(0.01)
REER, GS, YD and NFA				-2.02
				(0.02)
REER, GC, GI and YD				-1.96
				(0.02)

REER, GC, GI YD and NFA	-1.98
	(0.02)

RER indicates the real effective exchange rate in logs for each country obtained from Davas (2012, 2016); YD is the productivity differential obtained as the log of per capital output relative to trading partner; NFA is the net foreign asset as a share of GDP; GS, GC, GI, GT are govt. spending, consumption and investment as a share of GDP and transfer payments as a proportion of government spending. In the panel unit root test, the numbers represent the *p*-values for the unit root tests; in the Kao cointegration test, the numbers in parentheses represent the *p*-values for the cointegration test while the other numbers outside of the parenthesis are the test statistic. Except for Hadri which has a null hypothesis of stationarity/no unit root, the null hypothesis of the other tests is the presence of nonstationarity/unit root.

As show in Table 1, the results of the tests are quite mixed and none provides an overwhelming support for the stationarity of the variables. Thus, it is not possible to reject the existence of a unit root. For instance, for all the variables, the Hadri (2000) test rejects the null hypothesis of no unit root. In addition, the tests indicate a sufficiently strong evidence of nonstationarity for several of the explanatory variables such as productivity differential and government spending. The evidence for the other fiscal variables is mixed: while the tests reject the unit root null, Hadri test rejects stationarity, indicating unit root or nonstationarity. To reach a decision, we follow Galstyan and Lane (2009) and perform a panel estimate of an $AR(1)$ specification on the variables for which the conclusion is mixed. The result, available on request, gives estimated coefficients of around 0.9, indicating the variables are highly persistent. Hence, in line with Gatyslan and Lane (2009), we treat the variables as nonstationary. On the back of this evidence, we move to the next phase which is performing a Kao test of cointegration among the set of variables. Based on results presented in the second half of Table 1, the Kao cointegration test rejects the null hypothesis of no cointegration among the variables and this result remains valid even after including our control variable in the cointegration mix. Overall, there appears to be a cointegrating relationship between the real exchange rate and the set of variables.

To appropriately estimate the coefficients of the cointegrating variables, we adopt the panel dynamic ordinary least squares (PDOLS) estimator. The choice of this estimator stems from its suitability when variables are cointegrated. PDOLS also controls for possible endogeneity, autocorrelation and heteroscedasticity using parametric methods, leads and lags of differenced regressors, and incorporates white heteroskedastic standard errors into the estimation process. It yields a t-statistic that closely approximates a standard normal density, and thus more valid for inference unlike ordinary least squares estimator, for example, which is superconsistent but yields a t-statistic that is nonstandard, making correct inference impossible. Among many evidences, Kao and Chiang (2000), Mark and Sul (2002) and Lane and Milesi-Ferretti (2004) find that PDOLS outperforms other panel estimators in obtaining reliable coefficients of cointegrated variables.

The general empirical specification of equations (2.6a-2.6e) based on the PDOLS is

$$RER_{it} = \alpha_i + \beta' X_{it} + \sum_{k=-p_1}^{p_2} \pi' \Delta X_{it-k} + + \varepsilon_{it} \tag{3.0}$$

where RER_{it} is as defined, X_{it} is the vector of explanatory variables, Δ is the first-difference operator, α_i is a country fixed effect and the leads and lags p_1 and p_2 are chosen to satisfy an information criterion. In our application, we follow Galstyan and Lane (2009) and incorporate a $PDOLS(-1,1)$ specification. Including such leads and lags of first differences of the regressors improves the efficiency and consistency of estimated coefficients. The β coefficients in (3.0) capture the impact on RER_{it} of changes in the X_{it} variables. Of particular interest to us is the long-run behaviour of the real exchange rate in response to the aforementioned variables. We proceed with the estimation in several steps. First, we estimate (2.6a). This is akin to directly testing for the basic thrust or prediction of our model. Second, we control for net foreign assets to see if the previous finding is in any way altered. Third, we decompose government spending into its different components and check the impact of each component on the real exchange rate to study whether the composition of government spending matters for the real exchange rate. Finally, we test for the robustness of our results by controlling for net foreign assets, a variable that has been found to alter the real exchange rate.

Table 2: The Real Exchange Rate Effects of Fiscal Policy and Productivity

VARIABLES	1	2	3	4	5	6
GS	0.399**	0.498***				
	(2.24)	(2.58)				
YD	0.284***	0.292***	0.226***	0.200**	0.449***	0.449***
	(5.87)	(5.21)	(3.04)	(2.42)	(5.05)	(4.95)
NFA		0.941		0.530		-0.052
		(0.96)		(0.40)		(0.23)
GC			0.457*	0.468	0.203	0.193
			(1.64)	(1.60)	(1.38)	(1.28)
GI			-0.031	-0.037	-0.239***	-0.246***
			(0.22)	(0.24)	(2.94)	(3.01)
GT					0.010	0.010
					(0.24)	(0.32)
R^2	0.713	0.753	0.642	0.701	0.483	0.483
Observations	899	899	899	899	210	210

RER indicates the real effective exchange rate in logs for each country obtained from Davas (2012, 2016); YD is the productivity differential obtained as the log of per capital output relative to trading partner; NFA is the net foreign asset as a share of GDP; GS, GC, GI, GT are govt. spending, consumption and investment as a share of GDP and transfer payments as a proportion of government spending' *, ** and *** indicates significance at the 10%, 5% and 1% level respectively. Figures in () represent the test statistic values.

The PDOLS results for the real exchange rate are presented in Table 2. Columns 1 and 2 represent the baseline regressions and the baseline regression controlled for the transfer problem, respectively. Columns 3 and 4 represent regressions with government consumption and investment and the controlled results for net foreign assets. Finally, columns 5 and 6 contain results with government consumption, investment and transfer payments and the controlled results for net foreign assets. Column (1) shows the baseline results of the main estimates which can be directly compared to the predictions of the model in section 2, while column 2 tests whether this prediction is robust. In relation to the baseline estimates, government spending has a marginal impact on the real exchange rate in SSA as a 1 percentage point increase in government spending is associated with a less than 1% appreciation of the real exchange rate, and this estimate is significant at the 5% level. In a similar vein, relative productivity differential puts an appreciating pressure on the real exchange rate as a 1 percentage point increase in productivity differential causes a real appreciation of below 1% and this estimate is highly significant at the 1% level. Accordingly, the general pattern of the baseline results agrees with predictions of the theoretical model, in that both government spending and productivity differential appreciate the real exchange rate, although we note that the estimated coefficient of productivity differential is below the theorised value of one. When we control for net foreign assets to check for the robustness of our baseline results, we find that the coefficients of the two variables somewhat increase in value and become even more highly significant, especially for government spending, reiterating our finding that government spending and productivity differential significantly lead to real appreciations in SSA, in line with the theoretical model. In contrast, the control variable being net foreign asset bears the expected positive relationship with the real exchange rate but the relationship is not significant. This suggests some preliminary evidence of a possible transfer problem in SSA that is not significant.

Columns (3) and (4) show the results when government spending is split into its components. We first regress the real exchange rate on government consumption and investment and then control our results for the transfer problem. As the results in both columns show, government consumption leads to real appreciation whereas government investment leads to real depreciation. While the result for government consumption is significant at the 10% level, the result for government investment is not. More importantly though, we find that productivity differential appreciates the real exchange rate and the result is highly significant at the 1% level. In relation to the components of the fiscal variable, a 1 percentage point increase in government consumption leads to a real appreciation of below 1%, as is the case of government spending. This seems to suggest that government consumption has the same magnitude of impact on the real exchange rate as government spending, although the estimate is more statistically significant for government spending than for government consumption which has a significance at the 10% level. In contrast with government consumption, government investment has a negative sign and smaller effect on the real exchange rate, suggesting that an increase in government investment slightly depreciates the real exchange rate, but the effect is not statistically significant.

When we include the control variable to confirm robustness of the results, we find that the results remain unaltered, but the effect of government consumption on the real exchange rate loses its statistical significance. The results provide evidence that the composition of government spending offers some insight into the behaviour of the real exchange rate in SSA and this deduction is somewhat in line with the theoretical predictions and empirical findings of Galstyan and Lane (2009) that positive shocks to government consumption and government investment are associated with long run real appreciation and real depreciation respectively, although our estimated magnitude of real appreciation for SSA is comparatively much lower. Turning to the other two variables, the results show that an increase in productivity differential puts a highly significant appreciating pressure on the real exchange rate and we continue to find pointers to a statistically insignificant transfer problem in SSA. Meanwhile, it is noteworthy that the estimated elasticity of the real exchange rate with respect to productivity differential for SSA countries is similar to the estimates reported by Lane and Milesi-Ferretti (2004), Ricci, Milesi-Ferretti, and Lee (2008) and Galstyan and Lane (2009), but our fiscal estimates are significantly much lower. One conclusion that can be averred from this finding is that government spending and its components have different magnitudes of effects on the real exchange rate across different regions of the world. In SSA, the impact is much lower relative to the developed market economies like the EU, for instance.

Finally, moving our attention to columns (5) and (6), we run the regressions with the full components of government spending – government transfer payments, investment and consumption. Government transfer payments appreciate the real exchange rate while net foreign asset now bears a negative relation with the real exchange rate, though none of these effects is individually significant. The rest results are broadly in line with previous results, with the added benefits that the finding that government investment depreciates the real exchange rate is now highly significant and the appreciating pressure of productivity differential on the real exchange rate becomes enlarged, retains its high significance and remains robust. Put differently, the real exchange rate is appreciating in productivity differential across SSA countries, and an increase in government investment improves productivity gains in the nontraded sector which weakens the relative price of nontradables and eventually depreciates the real exchange rate. Thus, in line with Galstyan and Lane (2009), government investment affects the structure of relative prices and hence the real exchange rate in SSA through its impact on productivity.

3.3 The Short-Run Effects of Fiscal Shocks in SSA

This section of the paper focuses on the short-run effects of shocks to government spending and its components on the real exchange rate in SSA using a 3-variable VAR model. To begin, we explain our shock identification strategy. There are several identification strategies in the literature for different sample frequencies. Since our data samples are annual, we follow Beetsma et al. (2008) and Benetrix and Lane (2013) and adopt the Choleski decomposition[4] where we assume that government spending is unreactive to contemporaneous shocks to relative output per capita and real exchange rate but can have immediate impact on these variables when subject to exogenous shocks. Accordingly, our 3-variable structural VAR model can be written as follows:

$$B_0 Y_{it} = B(L) Y_{it-1} + C X_{it} + \varepsilon_{it} \tag{3.1}$$

where Y_{it} is a vector of endogenous variables containing the 3-variables – government spending, relative output per capita and the real exchange rate –, X_{it} is a vector of country-specific intercepts, linear trends and year dummies. As is standard in the literature, the country-specific intercepts address the effect of heterogeneity across countries while the country-specific linear trends are included to rid the variables of the effects of trends at the individual country level and, finally, the year dummies (time fixed effects) are included to control for cross sectional dependence and other common country effects. B_0 is a matrix of contemporaneous relationships among the endogenous variables in Y_{it}, $B(L)$ captures the relationships between Y_{it} and their lags Y_{it-1} as a matrix polynomial in the lag operator L. C is a matrix containing the coefficients of the country fixed effects, the country-specific linear trends and the time fixed effects, and the vector ε_{it} contains the orthogonal shocks to each equation of the VAR, where $var(\varepsilon_{it}) = \Omega$. Accordingly,

$$Y_{it} = \begin{bmatrix} GS_{it} \\ YD_{it} \\ RER_{it} \end{bmatrix}, \; Y_{it-1} = \begin{bmatrix} GS_{it-1} \\ YD_{it-1} \\ RER_{it-1} \end{bmatrix}, \quad B_0 = \begin{pmatrix} 1 & 0 & 0 \\ -\varphi_{GS\to YD} & 1 & 0 \\ -\varphi_{GS\to RER} & -\varphi_{YD\to RER} & 1 \end{pmatrix}, \quad X_{it} = \begin{bmatrix} \alpha_i \\ t_{it} \\ d_t \end{bmatrix}, \quad \varepsilon_{it} = \begin{bmatrix} \varepsilon_{it}^{GS} \\ \varepsilon_{it}^{YD} \\ \varepsilon_{it}^{RER} \end{bmatrix}$$

where, using the Choleski decomposition, we have assumed that $\varphi_{YD\to GS} = \varphi_{RER\to GS} = \varphi_{RER\to YD} = 0$.

To obtain the reduced form version of our model, we pre-multiplying both sides of (3.1) by B_0^{-1}. This yields

$$Y_{it} = D(L) Y_{it-1} + H X_{it} + u_{it},$$

where $D(L) = B_0^{-1} B(L),\ H = B_0^{-1} C,\ u_{it} = B_0^{-1} \varepsilon_{it},\ u_{it} = \left[u_{it}^{GS}, u_{it}^{YD}, u_{it}^{RER}\right]'\ and\ Var\ (u_{it}) = \Sigma$

[4] Refer to Benetrix and Lane (2013, 2009) for a very detailed exposition on the advantages of annual data over higher frequency data, the choice of Choleski decomposition and the disadvantages of competing identification strategies.

3.3.1 Impulse Response Analysis

The coast is now clear for implementation of the identification strategy developed in the previous section. In this section, we examine the responses of the real exchange rate and relative output per capita to shocks in government spending and its components. To achieve this, we estimate a panel VAR model for each type of government spending. As we are considering different kinds of fiscal spending[5] a la government spending partitioned into government consumption and government investment, it follows that there are three panel VAR models[6] to be estimated, with each model containing one of the government spending types. We start with the estimation of the panel VAR model with total government spending (GS).

Figure 3 below presents the mean responses and confidence intervals of a 1 percent shock to government spending share of GDP. It shows that positive shocks to government spending have a statistically zero impact on the real exchange rate in SSA in the short run as the impulse response, though positive which should signify a real appreciation, fails to be significant even from the point of impact and this insignificance continues in the short term, throughout the forecast horizon. This result disagrees with findings in similar studies such as Benetrix and Lane (2009, 2013) and Cebi and Culha (2014) and provides some empirical evidence that government spending might have no significant effects on the real exchange rate in SSA in the short term. It takes some time for the spending to build up and begin to significantly appreciate the real exchange rate. Unexpectedly, we find that positive shocks to government spending are associated with a decline in relative output per capita in SSA vis-a-vis its trading partners. This decline in output is not significant on impact and remains insignificant throughout the impulse-response horizon even though the decline reverses to an increase after year 5. In our interpretation, this finding suggests that positive shocks to government spending are associated with a statistically zero impact on the relative per capita output and, by extension, productivity differential since we proxy SSA productivity differential using relative output per capita. Finally, on the short run responses of the real exchange rate to positive productivity differential shocks, Fig 3 shows that positive shocks to productivity differential depreciate the real exchange rate in the short run in SSA. The depreciation begins on impact and continues until it fizzles out, becoming statistically insignificant as the economy approaches year 2. The evidence here is that gains in relative output per capita do not lead to real appreciation in SSA in the short run. If anything, the result suggests that the appreciating pressure that an increase in relative output per capita puts on the real exchange rate is a long run phenomenon. Overall, these results provide insights that the effects of government spending on SSA economies are not similar in the short and long run. The results strikingly contrast with Benetrix and Lane (2009), among others, who conclude that short and long run responses of the real exchange rate to government spending shocks are analogous, despite our empirical approach being similar to theirs.

Turning to the subcomponents of government spending, we examine one after the other the effects produced by shocks to government consumption (GC) and government investment (GI). Figure 4 shows that the impulse response functions associated with positive shocks to government consumption and government investment are

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[5] We have excluded government transfer payments from the mix because it is highly unbalanced and pose a drag on our empirical work. Since we use annual data, we set the lag length of each endogenous variable to 6 for government consumption (second panel VAR), 6 for government investment (third panel VAR) and 6 for aggregate government spending (first panel VAR). At this lag length, the null hypothesis of no autocorrelation is not rejected at the 1% and 5% levels and the LM test statistic shows that first order autocorrelation is absent. We also include a linear time trend.

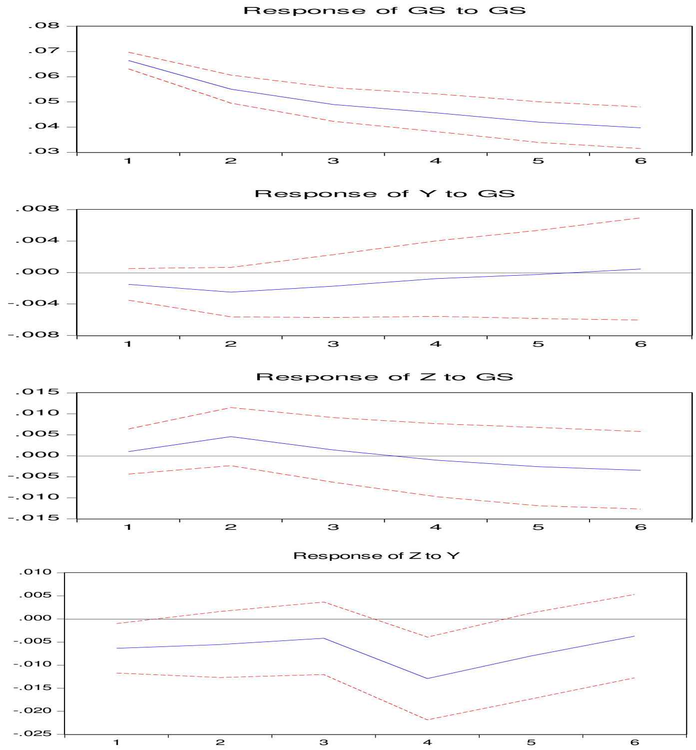
[6] As several of the variables exhibit nonstationarity, we are faced with two options – either difference the data to achieve stationarity and then proceed to the panel VAR analysis using the differenced stationary data (but in the process lose vital information on the dynamics of the data) or analyse the panel VAR model with levels data, though without stationarity. To reach a conclusion, we draw wisdom from Sims (1990), who posits that using data transformed to achieve stationarity leads to a loss of vital information, and hence opt for the latter alternative. This allows us to include in the VAR models the original variables which are all in levels. To induce stationarity whilst maintaining the data in levels, we include a deterministic linear time trend in all 3 panel VAR models. This generates stationarity, so that it becomes unnecessary to perform traditional tests such as differencing that transforms original data but eventually results in significant loss of power. Furthermore, this technique is analogous to de-trending the variables before estimating the panel VAR models. Thus, we proceed with our analysis in levels, including a deterministic linear trend, since using adjusted data for modelling throws away vital information and introduces possibly severe bias.

in consonance with the results for the overall government spending as positive shocks to government consumption and investment have statistically zero impact on the real exchange rates in SSA in the short run, although we note that this begins to change after year 5 as evidence of a significant real exchange rate appreciation from positive shocks to government consumption begins to surface. Government consumption leads to a significant decline in relative per capita output in the short run which persists throughout the impulse-response horizon. By contrast, and as normally would be expected, impulse response functions for government investment are quantitatively benign for relative output per capita. Indeed, a positive shock to government investment persistently leads to strong relative output gains on impact and this continues well into year 6 and beyond, along the whole impulse-response horizon, suggesting that not all types of government spending boost output differential in SSA, at least in the short run; only those channeled towards investments such as infrastructure and other public investments are pro-output. Finally, as with overall government spending, Figure 4 suggests that positive shocks to relative per capita output in SSA leads to real depreciation that is nearly as weakly persistent in the government spending sub-component (consumption) as is predicted by government spending itself. For instance, in the case of government spending, a shock to productivity differential leads to a real depreciation on impact which then fizzles out before year 2. In the same way, a shock to productivity differential in the case of government consumption depreciates the real exchange rate on impact and this persists for a very short period until prior to year 2 at which point it becomes statistically zero. However, no convincing evidence exists that productivity shocks, in the presence of government investment, depreciates the real exchange rate. This lack of evidence continues and retains its zero statistical significance throughout the impulse-response horizon. On the whole, relative productivity shocks lead to a very moderate persistence in real depreciation in the short run in SSA when government consumption and government spending, but not government investment, are included in the dynamic relationship.

In summary, a 1 percent of GDP shock to each of government spending and its components fails to induce an appreciation of the real exchange rate in SSA that is significantly different from zero in the short run whereas a 1 percent of GDP shock to government investment has a persistent positive fiscal multiplier in SSA via improving the relative per capita output while the same magnitude of shocks to government consumption for the most part in the short term decreases the relative per capita output level. Although on most fronts the above results disagree with the long run analysis performed hitherto, we continue to find support that the composition of government spending matters in understanding the effects of fiscal shocks on macroeconomic variables in SSA, especially for relative per capita output for which the different components of government spending shocks suggest a different outcome in the short run.[7]

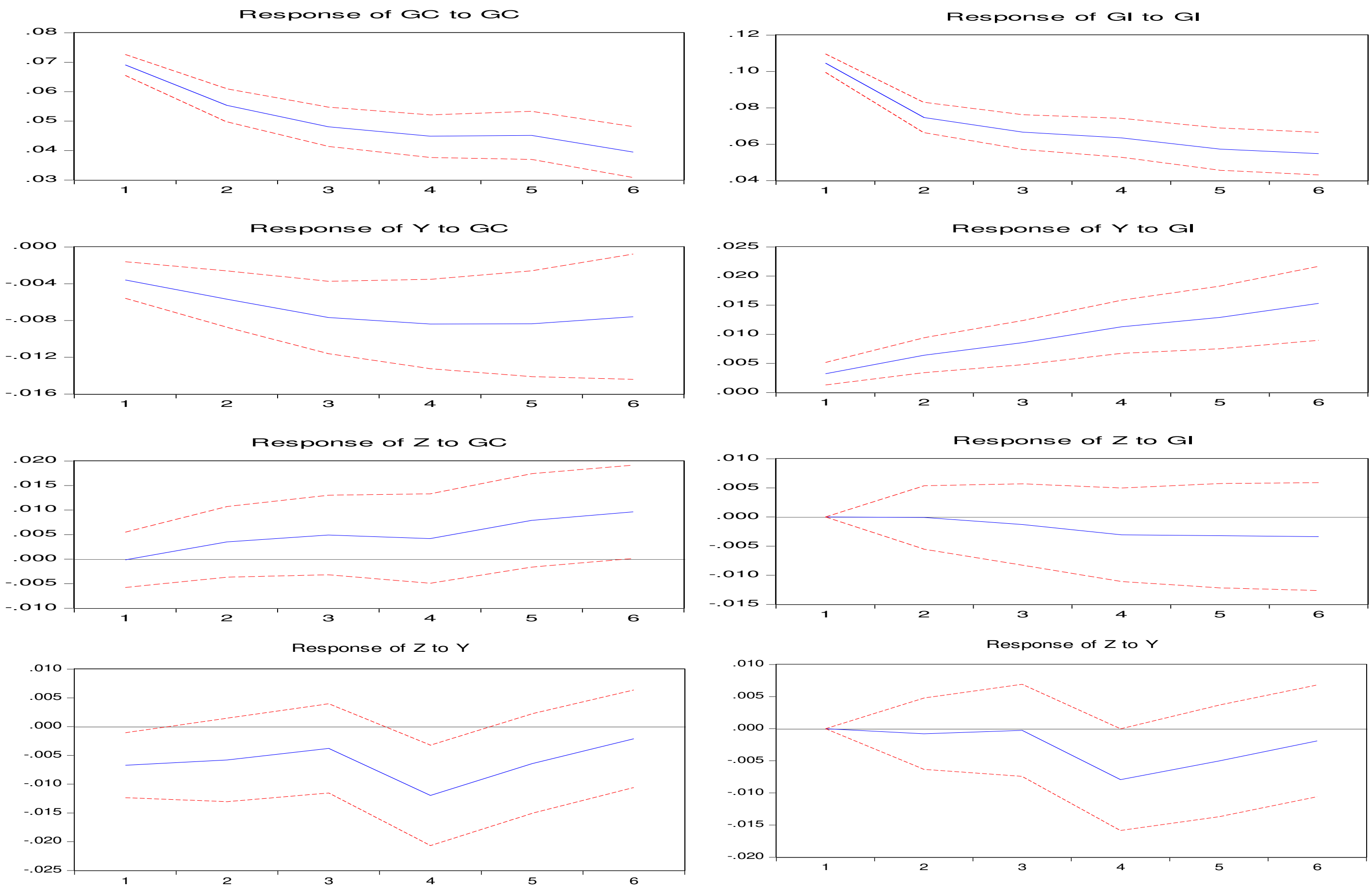
[7] Notice that in the section of the short run analysis as in previous sections of the paper, we have used interchangeably the terms relative productivity, productivity differential, relative output per capita, relative output and per capita output differential because output per capita of each SSA country relative to those of their major trading partners has been used as a proxy for relative productivity or productivity differential between the traded and nontraded sector as in Lane and Milesi-Ferretti (2004) since sectoral productivity data for SSA countries are not reported.

Figure 3: Responses to a Shock in Government Spending (1 Percent of GDP) - Baseline



Notes: The blue thick lines represent the point estimates of the mean of the impulse response while the red dashed lines are the 5th and 95th percentiles from Monte Carlo simulations based on 1,000 replications.

Figure 4: Responses to a Shock in Government Spending Sub-Components (1 Percent of GDP)



Notes: GS=government spending, GC=government consumption, and GI=government investment. Y=YD=relative per capita output=productivity differential, and Z=RER=real effective exchange rate. The vertical axis indicates changes in the response variable to shocks. The horizontal axis represents the impulse-response horizon. For instance, response of Z to GC implies the response of the real exchange rate (Z) to government consumption (GC) shocks (1 percent of GDP), response of Y to GS means response of relative per capita output (Y) to government spending (GS) shocks (1 percent of GDP) etc.

4. Conclusion

Do government spending patterns and composition tell us anything about the behaviour of the real exchange rate in Sub-Saharan Africa? So far, the literature has been silent on the question of the effects of government spending on competitiveness in SSA. Motivated by this vacuum, the aim of this paper has been to determine the impact of fiscal policy via government spending and its composition on the real exchange rate in SSA. To the best of our knowledge, no existing study addresses this question in SSA.

Building on Froots and Rogoff (1991), we develop a simple theoretical model where we show that government spending and productivity differential are associated with real appreciation. Relying on appropriate panel-based techniques, our empirical analysis overwhelmingly confirms that this model-based prediction is indeed true when tested on a cross section of SSA countries. Next, we disaggregate government spending into its three major components being government consumption, government investment and government transfer payments and check whether the composition of government spending provides any insight into the dynamics of the real exchange rate in SSA. This is a purely empirical question which is not firmly rooted in our theoretical model.

Our empirical estimates suggest that government consumption and government transfer payments generate real appreciation while government investment depreciates the real exchange rate across SSA. We argue that government spending channelled towards investing activities ultimately raises productivity in the nontraded sector, resulting in a decrease in the relative price of nontradables and a real depreciation. Although these findings are robust in magnitude and direction (sign), their effects are largely marginal in the context of SSA and are not always significant. We consistently find that the appreciation of the real exchange rate is increasing in productivity differential across SSA in all instances. Not only is this finding robust, it is also highly significant on all fronts and its magnitude is in harmony with those obtained in previous studies.

In the last section focusing on the short-run effects of fiscal shocks, the main message from the empirical analysis is that the effects of fiscal shocks on macroeconomic outcomes are not necessarily the same, they depend on the prevailing fiscal innovation. That is, whether the innovations are driven by shocks to public investment or shocks to government consumption. To a large extent, this finding overlaps with the conclusion reached in the long run empirical analysis. However, as our results have shown, the long run behaviour of the real exchange rate with respect to fiscal shocks are quite different from its short run behaviour. Thus, at odds with Galstyan and Lane (2009) who show that the behaviour of the real exchange rate with respect to fiscal spending is similar in the short and long run in European countries, we have found evidence that they are not necessarily similar in SSA, although a common denominator in our short and long run empirical analysis remains that paying particular attention to the composition of government spending is essential when formulating policies that aim to enhance the effects of fiscal policies on domestic and external macroeconomic variables in an open economy.

Looking ahead, the findings presented in this paper suggest possible dissimilarities in the impact of fiscal policy variables on the real exchange rate when SSA countries are characterised in accordance with their exchange rate regimes. Furthermore, since the components of government spending do not all necessarily have the same effects on the real exchange rate, it follows that further disaggregation of each of government consumption, investment and transfer payments might provide more interesting insights into the behaviour of the real exchange rate in SSA. Added to this, countries with different economic characteristics might have fiscal policy variables which behave differently with respect to the real exchange rate and this hints that other economic characteristics that can alter the impact of fiscal policy on the real exchange rate might exist. Therefore, it is left as a future research to identify and model such dissimilarities and characteristics in a theoretical framework and verify the plausibility of the results on data, especially when relevant data sets become available in the near future.

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Appendix

Table 3: Country List

S/N	Country	S/N	Country
1	Benin	16	Madagascar
2	Botswana	17	Malawi
3	Burkina Faso	18	Mali
4	Burundi	19	Mauritania
5	Cameroon	20	Mauritius
6	Central African Rep.	21	Mozambique
7	Chad	22	Namibia
8	Congo, Republic of	23	Niger
9	Côte d'Ivoire	24	Nigeria
10	Equatorial Guinea	25	Rwanda
11	Gabon	26	Senegal
12	Gambia, The	27	Seychelles
13	Ghana	28	South Africa
14	Guinea-Bissau	29	Swaziland
15	Kenya	30	Togo
		31	Uganda

Table 4: Lag length selection for VAR

1. VAR for government spending (GS)

Lags	LM-Stat	P-value
1	51.56528	0.0000
2	16.62317	0.0550
3	90.85432	0.0000
4	54.92143	0.0000
5	36.58171	0.0000
6	8.750329	0.4606
7	20.26168	0.0164
8	10.80880	0.2890
9	29.07492	0.0006
10	10.53930	0.3086

For each table, the null hypothesis is no autocorrelation. At 6 lags (minimum), the null hypothesis cannot be rejected at 1% and 5% level. Hence we choose this lag length for uniformity as the lag for which there is no autocorrelation in our dynamic analysis. P-value are from chi-square with 9 degrees of freedom.

2. VAR for government consumption expenditure (GS)

Lags	LM-Stat	P-value
1	31.89851	0.0002
2	25.89661	0.0021
3	96.71246	0.0000
4	62.02731	0.0000
5	36.75768	0.0000
6	15.98452	0.0672
7	31.15046	0.0003
8	30.36125	0.0004
9	23.31053	0.0055
10	15.15070	0.0869

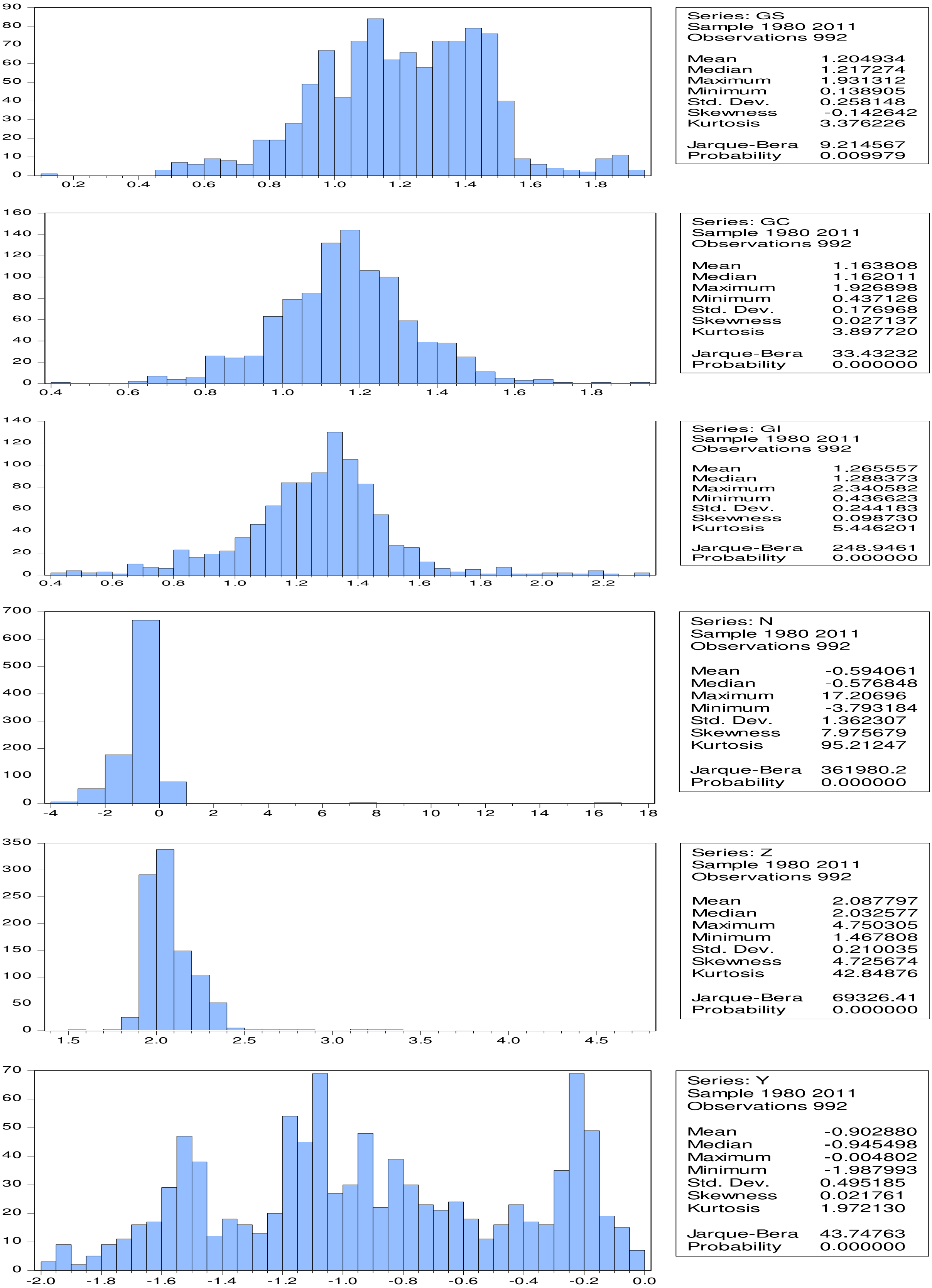
For each table, the null hypothesis is no autocorrelation. At 6 lags (minimum), the null hypothesis cannot be rejected at 1% and 5% level. Hence we choose this lag length for uniformity as the lag for which there is no autocorrelation in our dynamic analysis. P-value are from chi-square with 9 degrees of freedom.

3. VAR for government investment (GI)

Lags	LM-Stat	P-value
1	29.74713	0.0005
2	17.16830	0.0461
3	81.71277	0.0000
4	49.01559	0.0000
5	30.78798	0.0003
6	4.841396	0.8479
7	8.760094	0.4597
8	6.093809	0.7305
9	14.32875	0.1111
10	17.01180	0.0485

For each table, the null hypothesis is no autocorrelation. At 6 lags (minimum), the null hypothesis cannot be rejected at 1% and 5% level. Hence we choose this lag length for uniformity as the lag for which there is no autocorrelation in our dynamic analysis. P-value are from chi-square with 9 degrees of freedom.

Figure 5: Histogram and Descriptive Statistics for Variables



GS, GC, GI, N, Z and Y represent government spending, government consumption, government investment, net foreign assets, real exchange rate and relative real output. These samples come from the sources described in the data section. Except for net foreign assets used briefly to check robustness of long run results, distributions are for log variables; net foreign assets can take negative values and so enter our regression in levels of GDP as in the literature. In the long run analysis, Z and Y alone are in log levels in order to be consistent with the literature.