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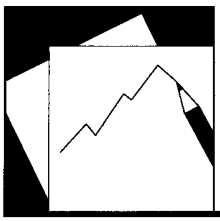

IMF Working Paper

The Sources of Business Cycles in a Low Income Country

Romain Houssa, Jolan Mohimont, and Christopher Otrok

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Abstract

We examine the role of global and domestic shocks in driving macroeconomic fluctuations for Ghana. We are able to study the impact of exogenous shocks including productivity, credit supply, and commodity price shocks. We identify the shocks with a combination of sign and recursive restrictions within Bayesian VAR models. As a benchmark we provide results for South Africa to document the difference between two economies with similar structures but different levels of development. We find that global shocks play a more dominant role in South Africa than in Ghana. These shocks operate through three channels: trade, credit and commodity prices.

JEL classifications: C51, C33, C15, C53, E3, E43, E52, N17

Keywords: Credit Shocks, Developing Countries, Macroeconomic Stabilization Policies, Sign Restrictions, Bayesian VAR.

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1 Introduction

Developing policies for stabilizing macroeconomic fluctuations has been the subject of many papers in both advanced and emerging markets. A prerequisite for building the structural models to develop these policies is knowledge of the main sources of fluctuations in these economies. In this paper we take the first step towards developing stabilization policies in a low-income country by documenting the driving forces of fluctuations in this type of economy.

Empirical work for low-income countries has unique challenges. First, data is typically of poor quality and the time series length is short relative to those available for more advanced economies. Second, the economic structure of these economies is typically quite different from more advanced economies. In this paper we address the data issue by constructing our own time series for GDP. This allows us to create longer time series than is available historically. We take a first pass at issue two by studying a more advanced economy with a similar production structure.

In our case we study Ghana. Ghana is a good test case because it is the only Low-income Country (LIC) that is currently operating with an explicit inflation targeting framework in Sub-Saharan Africa. Moreover, the Bank of Ghana has been granted full independence since the bill was passed in December 2001 and the Monetary Policy Committee was established in September 2002.

Our objective is to develop a set of stylized empirical facts about Ghana in terms of the shocks that drive fluctuations. Our purpose is to investigate the type of shocks and model features that one would want to consider in building a structural dynamic stochastic general equilibrium (DSGE) model. The empirical facts here can then be used in such a model building exercise. This objective guides us in the type of shocks we consider. We are interested in the extent to which Ghana is exposed to international versus domestic shocks. This will motivate us to consider global counterparts to all of our shocks. We study a sequence of shocks that may be of importance to a country such as Ghana. First, we consider productivity shocks to measure the extent to which business cycles are driven by real factors. Second, we study credit market shocks to understand the importance of financial sector disruptions. Third, we consider commodity price shocks to measure the importance of such price changes of a dominant primary goods sector. We do not consider monetary policy shocks due to changes in monetary policy over the sample period. We leave this latter issue to a more structural investigation.

To identify shocks we use a standard macroeconomic tool–the Vector Autoregression (VAR), which we estimate with Bayesian methods. Identification of shocks is through a set of sign restrictions in the spirit of Uhlig (2005) for both the credit and productivity shocks.

These use minimal but robust implications of structural models to impose restrictions on impulse response functions. For commodity price shocks we exploit the exogeneity of commodity prices for a small economy such as Ghana and use a recursive setup, with commodity prices ordered first. Global shocks are estimated using a similar set of restrictions on data constructed using the first principal component of G7 country level data.

In addition to studying the impact of shocks in Ghana we also study the impact of the same set of shocks in South Africa. The important question here is whether or not Ghana, which has a similar production structure and a monetary policy framework as South Africa, is fundamentally different. That is, in building a structural model for Ghana how much of our experience with models from more advanced and stable economies can we import?

This paper is related to the literature on the sources of macro-economic fluctuations in developing countries. One strand of this literature employs univariate methods to estimate cyclical variations in macroeconomic series (e.g. Agenor et al. (2000), Cashin (2004), du Plessis (2006) and Male (2011)). For instance, Agenor et al. (2000) employ de-trended methods to a set of macro-aggregates for 12 developing countries and find procyclical real wages, suggesting that productivity shocks play a dominant role in macroeconomic fluctuations of these economies. They also find countercyclical government expenditure, which implies that the government plays a stabilizing role in these economies. Finally, their analysis shows that the business cycle of advanced countries has a significantly positive impact on economic activity of developing countries. However, Male (2011) recently challenged this last finding. She applies the classical cycle analysis, of Harding and Pagan (2002), to 32 developing countries and finds no clear patterns in the co-movement between business cycles of developing and advanced countries.

Another strand of the literature employs structural VAR (SVAR) or theoretical models (e.g. see for instance, Broda (2004) Deaton and Miller (1996) Hoffmaister and Roldós (1997); Hoffmaister et al. (1998), Houssa (2008, 2009), Houssa et al. (2010), Houssa et al. (2013), Kose (2002), Kose and Riezman (2001), Mendoza (1995), Chia and Alba (2006)) and highlights the importance of two types of shocks: productivity shocks and terms of trade shocks.

This paper contributes to this literature by documenting the roles of credit supply and productivity shocks in developing countries, comparing domestic versus foreign nature of these shocks and their role in economies with a similar structure but at different stage of development. Especially, the study of macroeconomic impacts of credit supply shocks fills an important gap in the literature of Emerging Markets and LICs. To the best of our knowledge only Tamasi and Vilagi (2011) explicitly identify credit supply shocks for emerging markets. They employ a Bayesian VAR (BVAR) model with sign restrictions and report that credit supply shocks account for a larger share of output fluctuations in Hungary. Other

related studies have mainly used regression techniques to document a positive co-movement between credit and real activity (e.g. Akinboade and Makina (2010)). However, in such a framework is it difficult to distinguish correlation from causality. Moreover, such techniques do not systematically analyze the impacts of non-expected shocks. For research studying international transmission of credit shocks to emerging markets; see Schnabl (2012) and Cetorelli and Goldberg (2010)).

The remainder of this paper is organized as follows. Section 2 presents a historical background on macroeconomic conditions in Ghana. Section 3 introduces the VAR model and discusses the structural identification strategy. Section 4 presents empirical results. Section 5 concludes.

2 Background on Macroeconomic Conditions in Ghana

Figure 1 and 2 present selected macroeconomic indicators for Ghana in $1980:1-2012:4$. Quarterly data on real activity is only available from 2006 for Ghana. As such, we estimate a measure of real activity growth for Ghana that covers a much longer time period. For this purpose we pool data from different frequencies (yearly, quarterly and monthly) and experienced with two approaches. We use the common component and the now-cast measures of real output (Giannone et al. (2008)). A plot of the series based on the former is on the left top panel of Figure 1.

Insert Figures 1 and 2

Prior to 1983 Ghana suffered from macroeconomic instability which was most characterized by large internal and external deficits, limited foreign exchange reserves, high inflation, overvalued exchange rate, and negative economic growth (see Figures 1 and 2). In 1983 a Structural Adjustment Program was initiated under the denomination of Economic Recovery Program (ERP). ERP covers the period from April 1983 till March 1992. Its main components include a reduction of government deficit, tight (credit and) money growth, and a number of liberalization programs (in trade, prices, exchange rates). This break in policy leads to the start date of our sample.[1]

Monetary policy from 1983 switched from a direct control of credit and interest rates to a monetary targeting regime. The liberalization of interest rates charged by banks takes a

[1] Actually we start in 1985 to account for this break in monetary policy in Ghana but also to account for the start of the globalization period in 1985.

gradual route. Minimum and maximum deposit (except saving) rates were removed in 1987; minimum lending rates for commercial banks were abolished in 1988 and commercial banks were given the right to fix their own rates in 1989 (Sowa and Acquaye (1999)).

In the framework of the new monetary policy three targets were set: *i)* the reserve money as the operating target; *ii)* the money supply as the intermediate target; *iii)* and the general price level as the ultimate target (Abradu-Otoo et al. (2003)). The implementation of monetary policies with these targets was undertaken within the Financial Programming Framework. Explicitly the implementation of monetary policy involved four phases. In the first step the money supply target is determined, with the quantitative money equation, given the target for the price level and the level of activity. In the second step, the money base target is determined given the money multiplier. Third, the level of net domestic asset (NDA) is determined using the balance sheet identity of BOG given targets of reserve money and the net foreign asset (NFA). Fourth, an open market operation is used to achieved the level of NDA. These procedures were in place till 2001 where the Bank of Ghana (BOG) started the transition to inflation targeting regime, which was formally adopted in 2007. These changes in policy throughout the sample motivate us to not consider VAR based monetary policy shocks. We conjecture that a structural approach will be more appealing for these shocks.

Prior to ERP Ghana operated a fix exchange rate regime but adjustments of the cedi were frequent (1967, 1971, 1972, 1976). In 1983 a liberalization of the exchange rate begun with a gradual approach in six phases where full liberalization was achieved in 1990 when for the first time the exchange rate was set in the inter-bank market (Sowa and Acquaye (1999)). Since then the currency is in principle allowed to fluctuate. As most small open economies, however, authorities intervened in the foreign exchange market. With flexible exchange rate global shocks are likely to impact Ghana, in part motivating our consideration of augmenting our VAR with global factors.

Ghana exports three main commodities: cocoa and gold are traditional commodities and from 2011 Ghana started exporting crude oil. Our commodity price shocks will focus on the former two as they are produced for the entire sample.

3 Methodology

3.1 Bayesian Vector Auto-Regressive (BVAR) Model

Consider the following Vector Auto-Regressive (VAR) model,

$$Y_t = A_0 + A_1 Y_{t-1} + ... + A_P Y_{t-P} + \mu_t, \tag{1}$$

where Y_t is a $n \times 1$ vector of home and foreign real, nominal and financial indicators; the A_i are $n \times n$ auto-regressive coefficients, A_0 contains the constant terms, and μ_t is a $n \times 1$ vector of Gaussian white noise with covariance matrix $\Psi = E(\mu_t \mu_t')$. The G7-countries represent our foreign economy whereas for the home economy we focus on either Ghana or South Africa.

The series included in Y_t depend on the type of structural shocks being estimated. We identify two categories of shocks: credit and productivity shocks, on the one hand; commodity price shocks on the other hand. For credit and productivity we consider global as well as domestic versions of the shocks.

3.2 Credit and Productivity Shocks

The productivity shocks we consider are interpreted as exogenous shocks to total factor productivity. In the context of a DSGE model this would be the standard Solow residual. The credit shocks we study are exogenous shocks to the supply of credit. To study credit and productivity shocks we estimate a VAR model with 16 variables. In particular, Y_t includes six indicators of the foreign economy: G7-real GDP; G7-inflation; G7-real credit; G7-short-term interest rates; US-credit spread; and US-default rates. The four G7-factors are estimated by extracting the first principal component from the series of G7 countries. For the remaining two indicators we use US series because of data limitation.

The remaining 10 series of Y_t relate to the home economy. We include six indicators of the domestic economy analogous to those of G7-countries. Moreover, the home- block contains four indicators allowing to capture the transmission of foreign shocks to the domestic economy: exports, imports, primary commodity prices, and the real exchange rate. The VAR is setup so that global shocks impact Ghana (or South Africa), but domestic shocks have no impact on global aggregates.

Insert Table 1

We use quarterly data from Ghana, South Africa and G7-countries in $1985:1-2010:3$.[2] Where appropriate we transform the series in year to year growth rates. Table 1 reports detailed information on the dataset and the transformation applied to each series. For the South African economy we measure the credit spread by the difference between the yield on Eskom and the US baa bond. As a proxy for the default rate we make use of data on the number of insolvencies on loans.

[2]We start in 1985 to account for the break in monetary policy in Ghana that occurred in 1983 but also to account for the start of the globalization period in 1985. We end the SVAR analysis sample in 2010:3 for data limitation on the coverage of the US default rate.

We use the US corporate credit spreads (baa-aaa) as the measure of the price of risky credit for G7-countries. To measure default on credit for G7-countries we also use a proxy for the US economy. In particular, we use the distance to default measure proposed by Gilchrist et al. (2009). We take the inverse of this indicator and transform it to a year to year growth rate.

We estimate Eq. (1) using Bayesian methods with 3 lags. In all BVAR models we employ a combination of two types of priors: *i)* a Normal-inverted Wishart prior; and *ii)* a Minnesota type prior that assigns low weights on off-diagonal AR coefficients and specifically zero weights on coefficients related to the home economy's indicators in the block defined by (primary) commodity prices and G7-factors.[3] The later restrictions are consistent with the Small Open Economy (SOE) assumption for Ghana and South Africa.

For the structural identification, we employ a set of zero and sign restrictions. These restrictions are implemented with the penalty function approach proposed by Mountford and Uhlig (2009) and Uhlig (2005). We explicitly modify the objective function in order to also allow for zero restrictions. The results reported in the paper are based on the following sequential ordering: G7-credit shocks, G7-productivity shocks, domestic (SA or GHA)-credit shocks and domestic (SA or GHA)-productivity shocks. However, using a different ordering does not change the main results of the paper. Table 2 reports the identification restrictions for the four shocks. In all cases, the restrictions assume negative shocks and are imposed over the first four quarters.

Insert Table 2

Zero restrictions allow to disentangle South African shocks from global shocks. In particular, we assume that G7 countries do not respond to shocks originating from South Africa. On the other hand, sign restrictions help to distinguish exogenous credit supply shocks from the endogenous response of credit to macroeconomic conditions. The identification of credit supply shocks is based on the recent literature (e.g. Helbling et al. (2011) and Meeks (2012)). We assume that an adverse credit supply shock is characterized by an increase in the credit spread and a decrease in real credit. In addition, we require that default rates on corporate bonds do not increase. This additional restriction helps to isolate the endogenous response of credit to fundamental macroeconomic shocks (see Meeks (2012)). Note that we leave unrestricted the IRFs of other series in Y_t including Real GDP, inflation, the monetary policy rate etc ...

For adverse productivity, we impose that real credit does not increase. Moreover, we

[3]The results reported in the paper are based on 250 draws. Using a larger number of draws leaves qualitatively the results unchanged.

require for these shocks that default rates do not decrease. Again, this later restriction is employed to discriminate credit supply shocks from endogenous responses of credit to fundamental (productivity and demand) macroeconomic shocks. We identify negative productivity shocks as decreases in output that increase inflation, as implied by a New Keynesian DSGE model. For advanced economies one can also include productivity itself in the VAR. Helbling et al. (2011) do so and find that the additional data does not affect the estimated responses. As we do not have productivity data for Ghana we do not include any measure of productivity in the VAR.

3.3 Commodity Price shocks

To identify commodity price shocks we consider a VAR model with six variables: commodity price; CPI, GDP, Credit; short-term interest rate and the real effective exchange rate. We follow the standard approach of the literature and impose the recursive identification scheme on these shocks, with commodity prices ordered first (e.g. Broda (2004) and Mendoza (1995)).

Analysis focuses on gold price allowing to understand how Ghana and South Africa respond to similar commodity price shocks. We deflate the nominal commodity price series by the US producer price index (PPI). Moreover, we estimate the economic impact of an increase in commodity prices over three sample periods: i) the full sample ($1985:1-2010:3$); i) before the introduction of the inflation targeting framework (IT); and iii) after the introduction of the inflation targeting framework. For South Africa, the before and after IT periods are: $1985:1-1999:4$ and $2001-2010:3$. For Ghana these are $1985:1-2001:4$ and $2002-2010:3$.[4] In each case we fix the lag length to 3.

4 Empirical Results

4.1 *Global Shocks and Fluctuations in Ghana and South Africa*

In this section we study the impact of global productivity and credit shocks on Ghana and South Africa. Figures 3 and 4 report the medians together with the 16th and 84 percentile responses to G7 shocks. A full analysis of G7 responses to these shocks can be found in Helbling et al. (2011). The results can be briefly summarized as credit supply shocks have negative but relatively modest impacts on global output, while productivity shocks have sharp and persistent impacts on global output.

[4] This change in monetary policy regime could have also changed the monetary policy responses to other shocks.

Insert Figures 3 and 4

The IRFs to the global credit supply shocks in Figure 3 show that there is a significant impact on output in South Africa, but not in Ghana. Looking at the responses to other variables we see that the credit shock has a modest reduction in credit in both countries. This is suggestive that while South Africa is financially integrated such that global credit conditions affect the domestic economy, Ghana is not. In other words, global credit supply is not important for financing the production of Ghanian GDP. The difference in impact of the shock can also be seen on commodity prices. The credit supply shock lowers commodity prices in South Africa, while raising them in Ghana. Understanding the differences in the financing of the production of the two types of commodities will be important for understanding the role of credit markets in these primary goods producing countries.

In Figure 4 we plot the responses to G7 productivity shocks. For both Ghana and South Africa we see similar shapes and magnitudes for the response. Given that Crucini et al. (2011) find that the global business cycle is primarily driven by productivity shocks this result is not surprising. From a modelling perspective it suggests that standard formulations for global productivity shocks are appropriate for Ghana. The response of inflation is also in line with the prediction of a New Keynesian model, where drops in productivity are inflationary. Note that while global inflation is constrained to rise after the contractionary shock, there are no restrictions on Ghanian inflation. In terms of commodity prices we see that prices fall in both South Africa and Ghana, though the impact is not significant in Ghana. Again, highlighting that Ghana is not as integrated with the world as is South Africa.

Finally, we see that the world gold price increases following adverse productivity and credit shocks, though the impact is modest.

4.2 *Domestic Shocks and Fluctuations in Ghana and South Africa*

Domestic credit supply shocks are shown in Figure 5. They generate similar inflationary pressures in South Africa and Ghana as did the global shocks. They have a quantitatively larger impact in Ghana. The inflation pressures of credit supply shocks are in line with the models presented in Atta-Mensah and Dib (2008) and Gerali et al. (2010). The effects of the shock leads to an increase in interest rates in Ghana and South Africa, though the impact is only significant for a short period of time. This is suggestive that inflation is more important for both countries than the small output losses caused by financial market disruptions. The similarities in responses suggest that monetary policy rules in South Africa can be exploited in building a model for Ghana.

Insert Figures 5 and 6

Domestic productivity shocks, shown in Figure 6, have a significant impact on Ghana, and a more muted impact on South Africa. By construction these shocks lower output and raise inflation in both countries. The interesting result is the difference on the other variables in the VAR. In response to the shock short term interest rates rise in Ghana and fall in South Africa. These responses cause a real exchange rate appreciation in Ghana, lowering exports and raising imports. In South Africa real exchange rates do not move, while exports fall and imports rise. This points to monetary policy focusing on inflation pressures more than output drops in Ghana then in South Africa. A interesting question is if a policy rule in the context of a DSGE model can justify such a strong response. If not, a lack of credibility for the central bank may be leading to aggressive responses of monetary policy to inflation in order to build credibility.

4.3 *Commodity Price Shocks*

Figure 7 displays the dynamic responses of various indicators to gold price shocks in both countries. Considering first the full sample results shows that output decreases on impact in South Africa but latter increases significantly and turns to positive values during several quarters. On the contrary, output increases significantly on impact following an increase in gold prices. A similar result can be observed before IT but during the IT period the impact response is negative in Ghana as well. One explanation of the different impact period responses could capture the earlier result that G7 adverse shocks cause an increase in gold price but also a much stronger recession in South Africa.

Insert Figure 7

Comparing the results across sub-periods shows that for South Africa output response to gold shocks have become less persistent during the IT period. This result may have to due to do with the different responses of inflation and the policy rate to gold price shocks across the two periods. In particular, before the IT inflation increases on impact but decreases significantly following the shocks. During IT, on the other hand, inflation show positive responses. As such, the central bank raises the policy rate to respond to inflationary pressure during the IT period and this policy action also helps in containing the output boom. The response of the bank of Ghana during IT follows a similar line in responding to inflation that decreases on impact and increases later. As such, the policy rate also decreases first and later increases. The BOG before IT is more difficult to explain as inflation and output

increase on impact but the policy rate is reduced.

4.4 *Variance Decomposition Analysis*

Tables 3 and 4 report the median percentage variance shares of selected series that are due to each of the shocks. Considering the 3-year horizon for credit and productivity shocks shows that the global shocks are more important in both countries although these shocks have a larger impact in South Africa than in Ghana (Table 3). Moreover, these two global shocks explain about the same share of variation of the macroeconomic aggregates in both countries. For instance, each of these global shock explains about 8 and 11% of output variation in Ghana and South Africa, respectively. Helbling et al. (2011) report a similar finding indicating that the global credit and productivity shocks explain each about 12% of output fluctuation in G7-countries.

Insert Tables 3 and 4

In the short-term domestic credit and productivity shocks dominate their global counterparts for inflation and credit. Especially, domestic productivity shocks are the main drivers of output and inflation fluctuations in the short run. For real credit domestic credit shocks account for a large portion of the volatility, with productivity shocks contributing as well. For the short-term interest rates and the real effective exchange rates the global credit and productivity shocks are still important, explaining 10 percent of the volatility. This result may reflect the use of those two instruments for stabilizing external shocks.

Finally, commodity price shocks are also more important for South Africa than for Ghana (Table 4). Moreover, the share of variance due to this shock is in general a bit larger than the one of productivity or credit shocks for both countries. In addition, there has been an increase of the role of commodity price shocks in macroeconomic fluctuation in Ghana and South Africa in recent years. In the inflation targeting regime commodity price shocks account for 20-25 percent of the volatility of all variables in the VAR. This reflects the dependence on the commodity sector in these economies.

Taken together our five shocks (using the IT period of commodity price shocks) account for half the fluctuations in our main macroeconomic variables. A full accounting of the macroeconomic volatility in Ghana will likely require both fiscal and monetary policy shocks in addition to our shocks. In this study we have chosen to focus on exogenous shocks rather than policy shocks. Limits on data on fiscal policy make studying the impact of Fiscal shocks in a VAR framework difficult. As noted earlier, the frequent changes in monetary policy structure do not lend themselves well to a VAR analysis. The former would be best studied using a narrative approach, while the latter with a regime switching structural model.

5 Conclusion

In this paper, we analyze the role of domestic and global shocks in explaining business cycles in Ghana and South Africa. For this purpose, we use a medium-scale Bayesian Vector Auto-Regressive (BVAR) model that captures the dynamics macroeconomic indicators in G7-countries and in each of these two countries.

We find that global productivity and credit shocks have a greater impact on South Africa than in Ghana. The fact that global credit market shocks do not affect Ghana while productivity shocks do is suggestive that Ghana's integration with the world is more through trade channels, and less through financial channels. Domestic versions of both shocks highlight a key difference between South Africa and Ghana in that monetary policy in Ghana has responded more strongly to inflation than drops in output. Finally, we find that commodity shocks are an important driver in business cycles in both countries. This result highlights the importance of a primary goods sector in developing a model for business cycle stabilization in Ghana. In contrast, shocks traditionally emphasized in advanced economies (i.e. productivity and credit) play a more muted role.

Appendix: Nowcasting

The detailed exposition on nowcasting can be found in Giannone et al. (2008) and related studies.

A sequence of nowcasts of y_t^Q at different vintages $v, v+1; v+2$ is:

$$E\left[y_t^Q \left|\Omega_v\right.\right]; E\left[y_t^Q \left|\Omega_{v+1}\right.\right]; E\left[y_t^Q \left|\Omega_{v+2}\right.\right]; \ldots$$

where E is the expectation operator and the Ω_v represent the information set used to make the forecast.

A Dynamic Factor Model (DFM) is employed to compute $E\left[\bullet \left|:\right.\right]$. DFM can be summarizing the dynamic of N series can be written as follows:

$$X_t = \mu + \lambda f_t + \xi_t, \tag{2}$$

where $X_t = (x_{1,t}, \ldots, x_{N,t})'$, $\xi_t = (\xi_{1,t}, \ldots, \xi_{N,t})'$ is the vector of idiosyncratic component, $f_t = (f_{1,t}\ f_{2,t}, \cdots, f_{r,t})$ are the r common factors, and λ, is a $N \times r$ matrix of series-specific factor loadings. The model is estimated with the two-step approach proposed by Doz et al. (2011). The method relies on Kalman filter and Kalman smother which helps to estimate missing values. The latter occur because of the mixed frequency nature of the data set. For instance, a monthly definition of a quarterly data is one observation with two missing

observations. Table 5 contains the data used.

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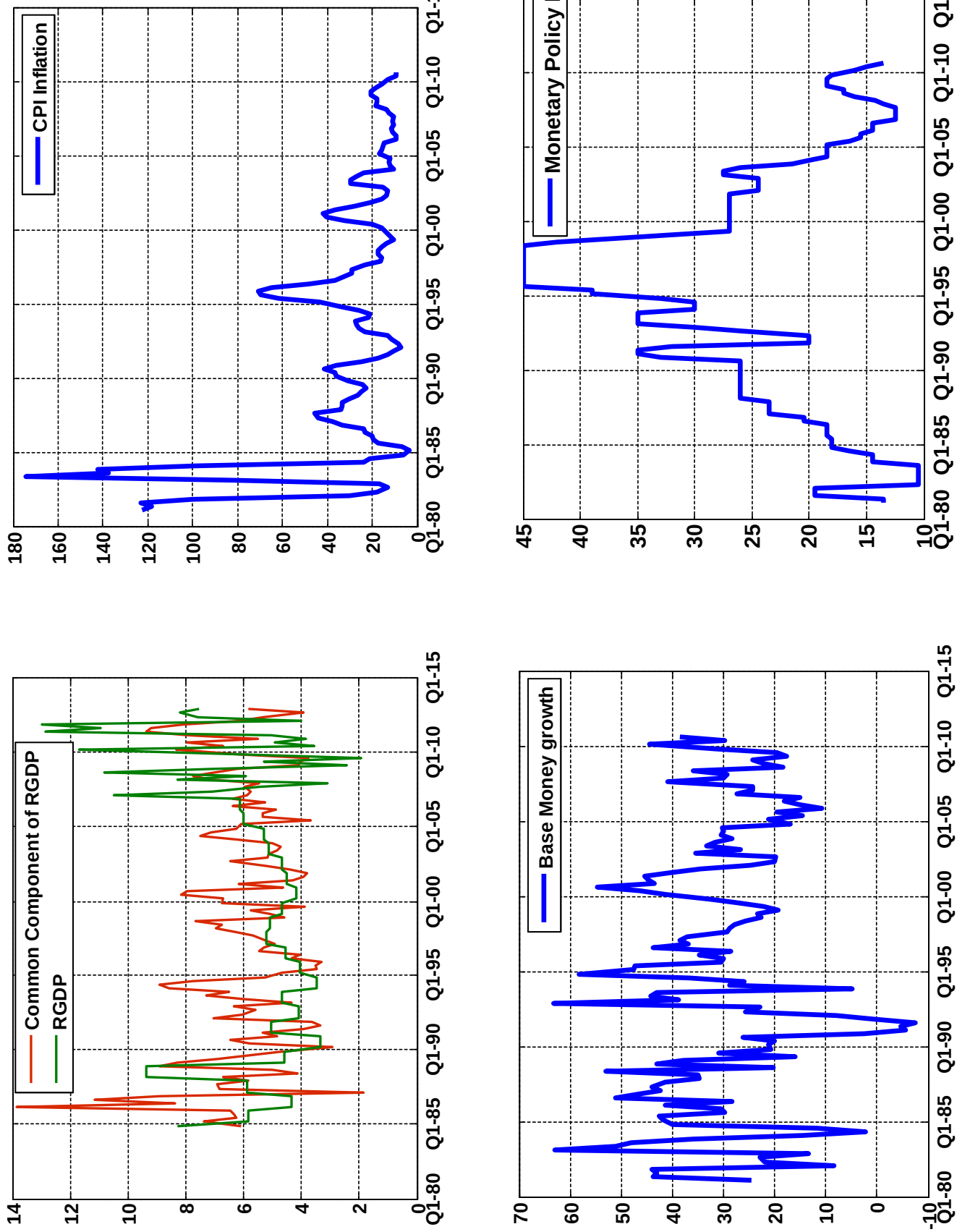
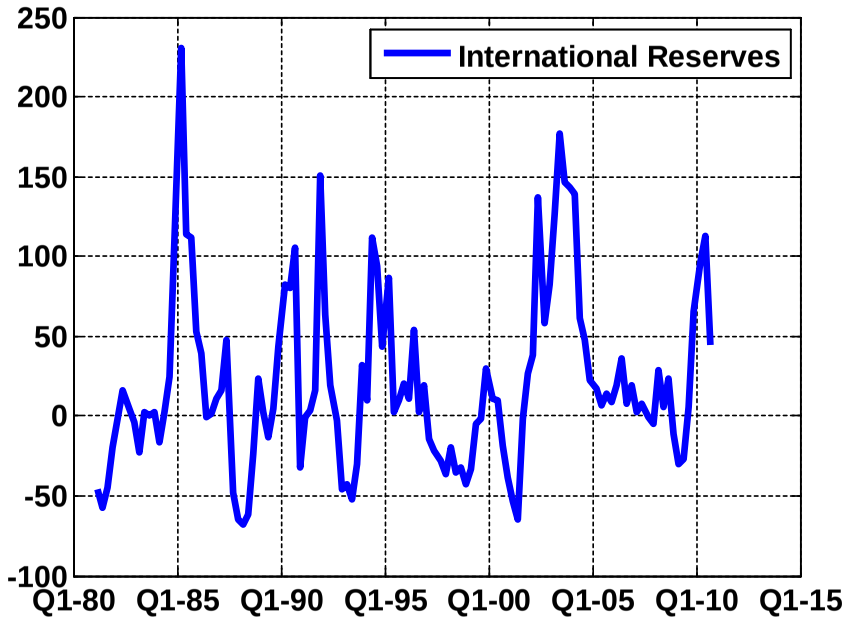
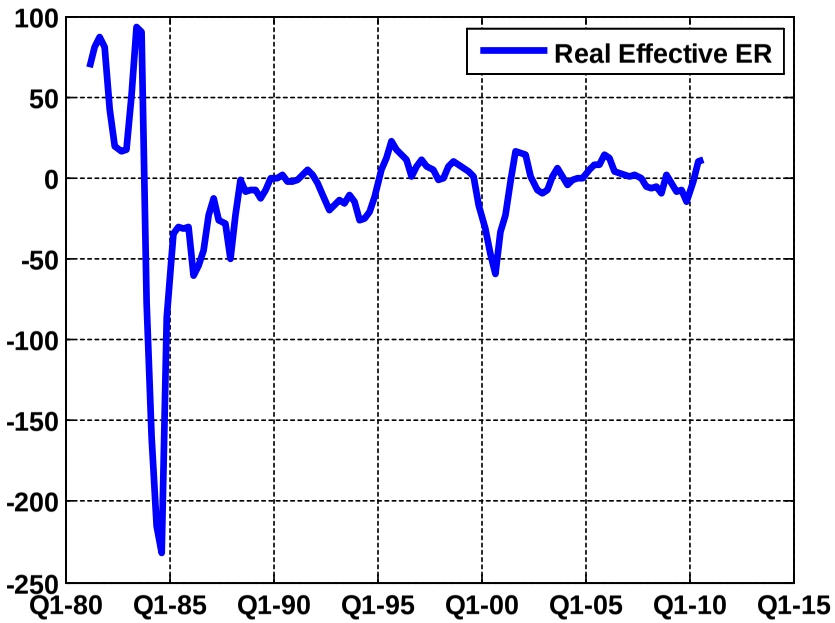
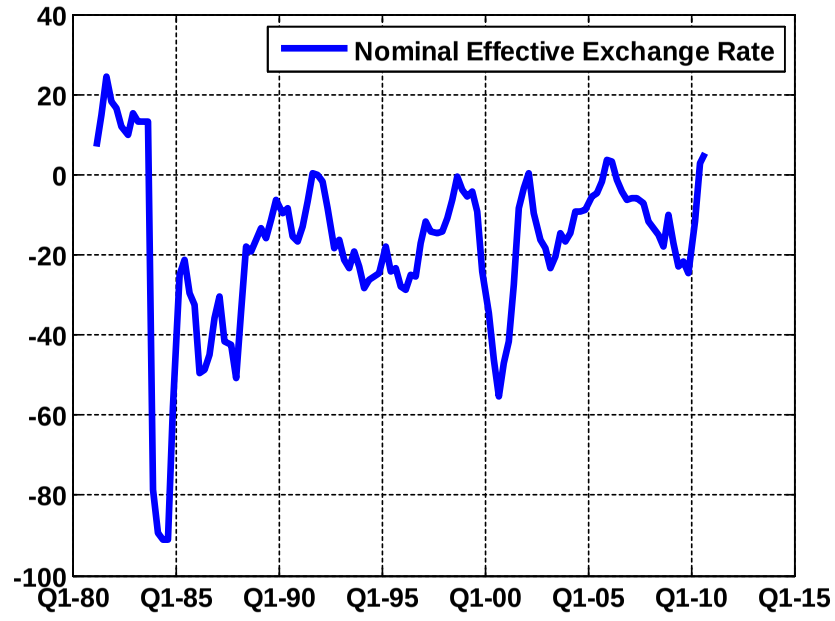


Figure 1: Selected Macroeconomic indicators for Ghana (YoY percent)

Figure 2: Exchange Rates and International Reserves (YoY percent)







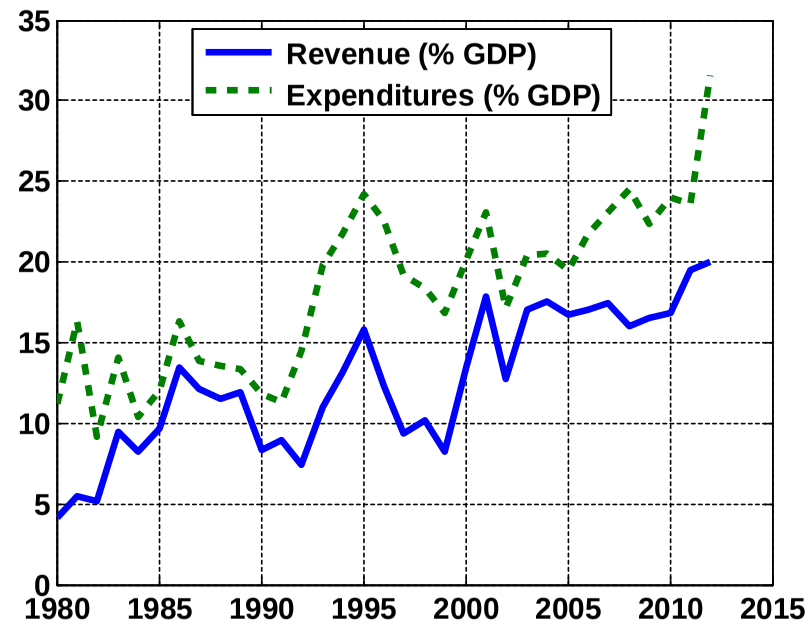


Figure 3: G7 Credit Shocks

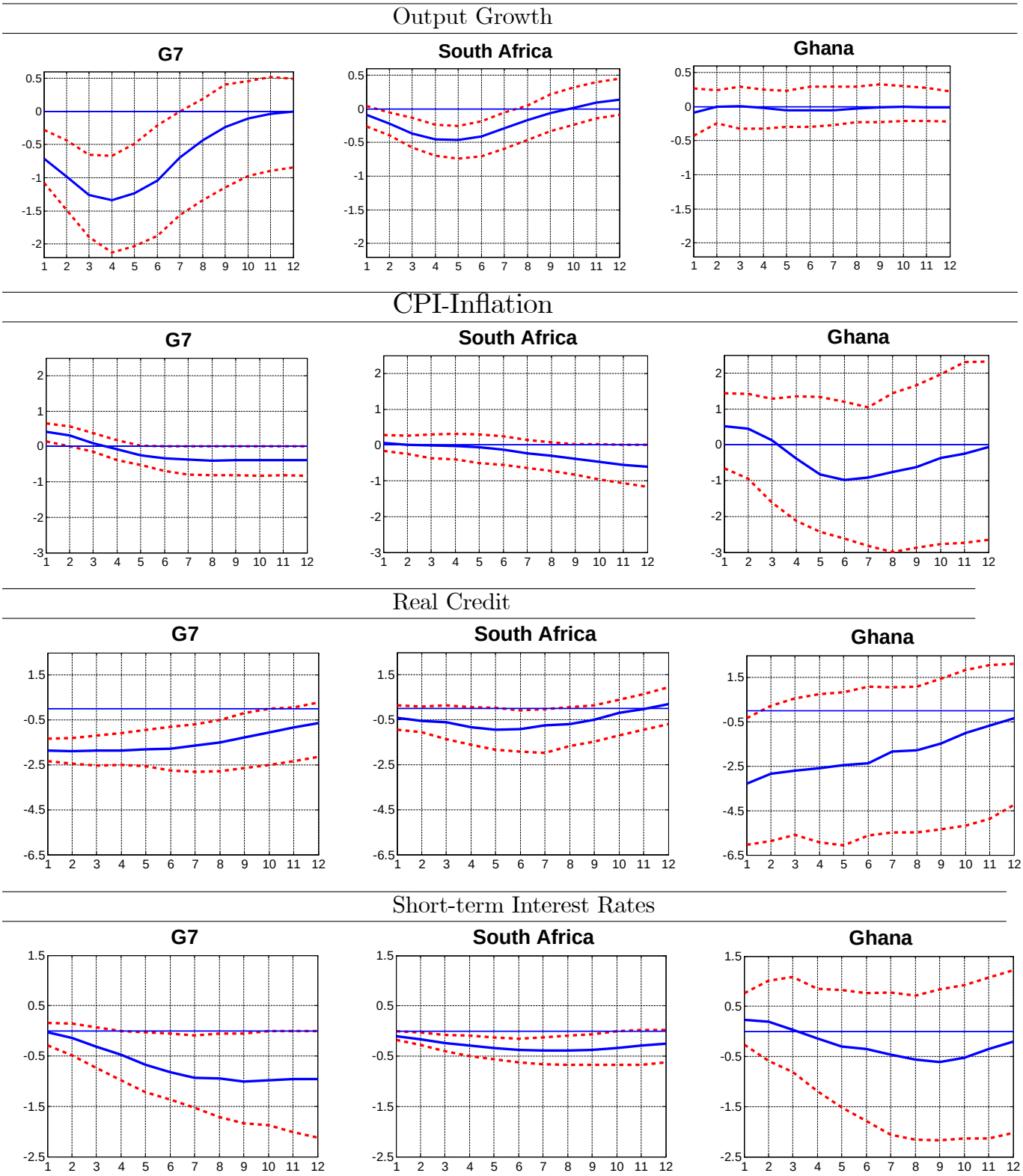


Figure 3: G7 Credit Shocks (Continued)

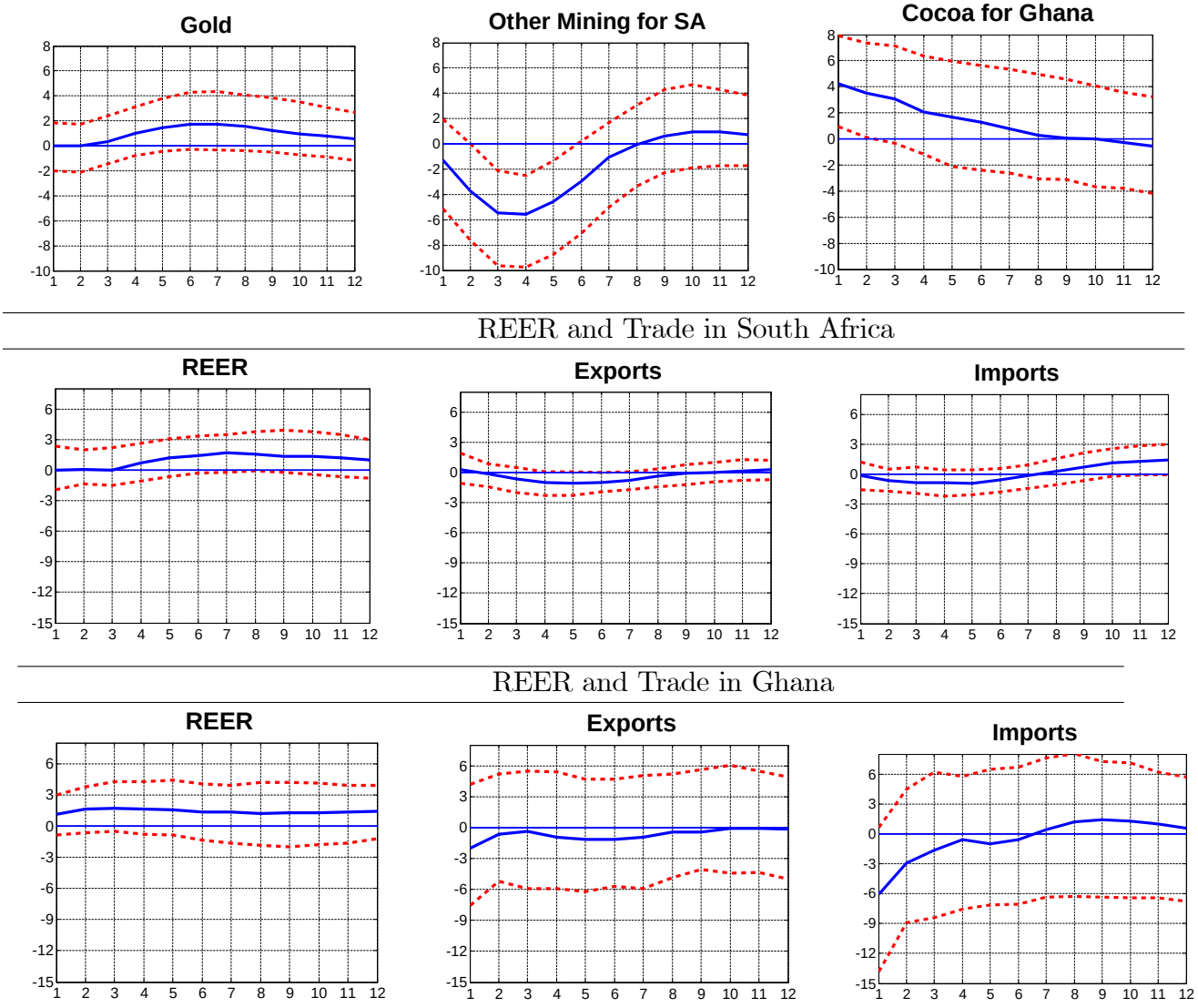


Figure 4: G7 Productivity Shocks

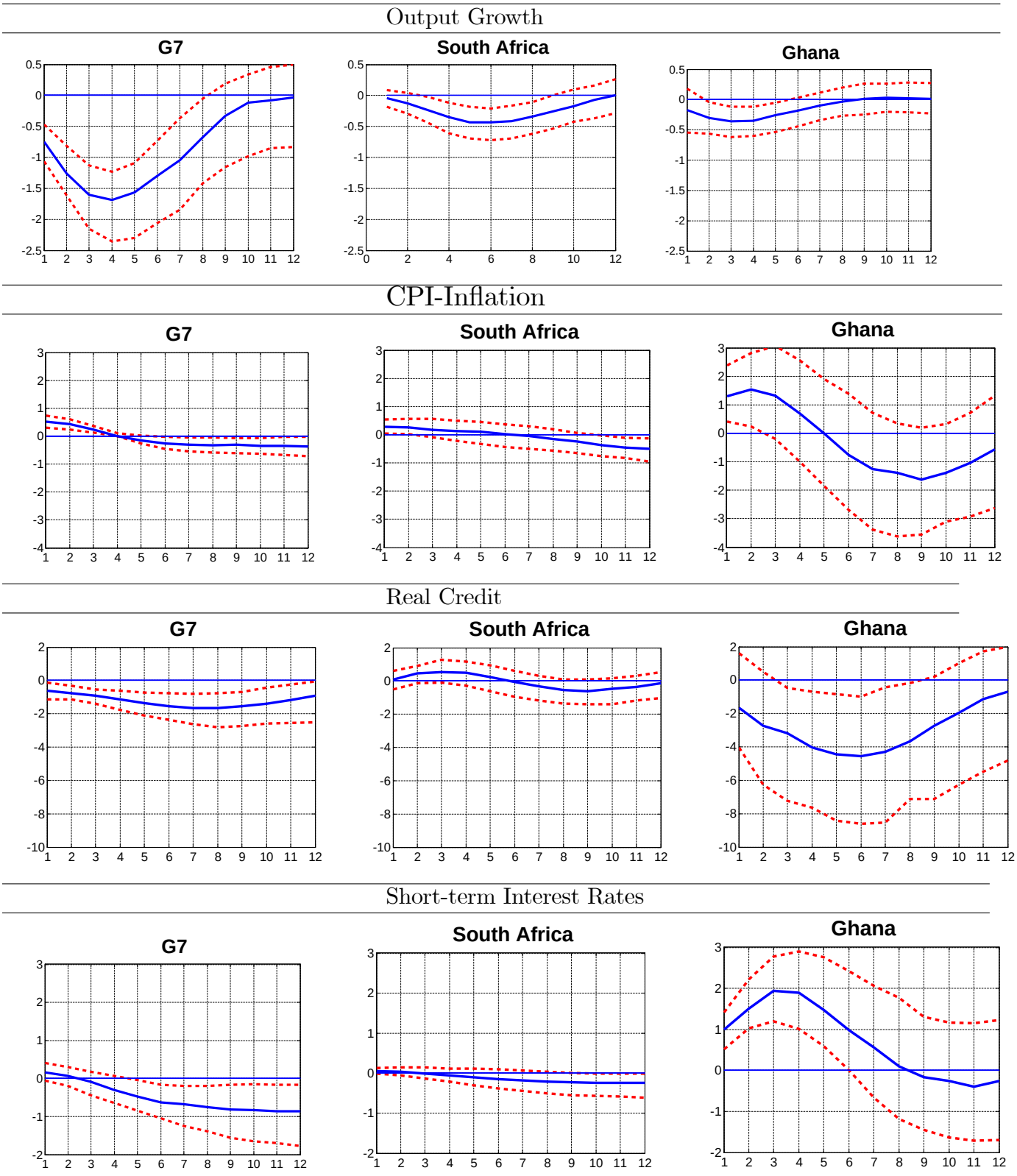


Figure 4: G7 Productivity (Continued)

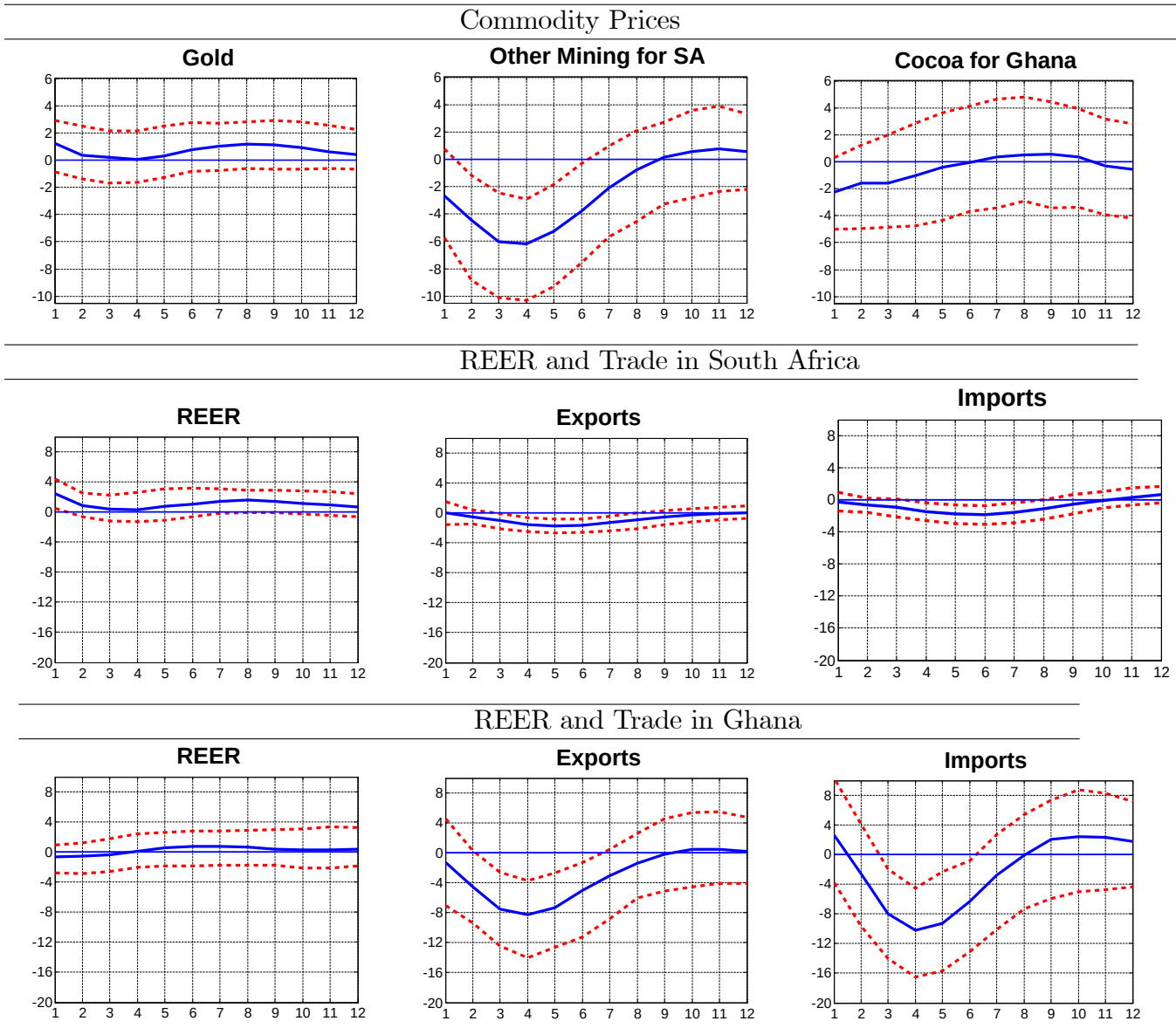
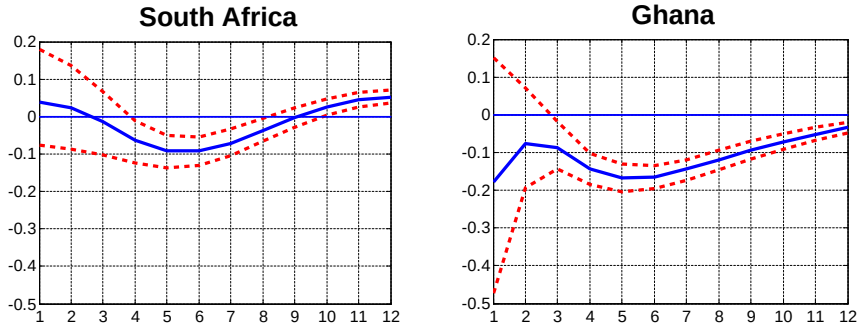
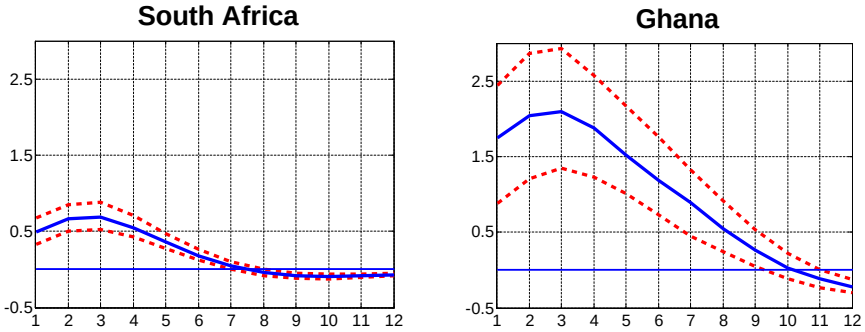


Figure 5: Domestic Credit Shocks

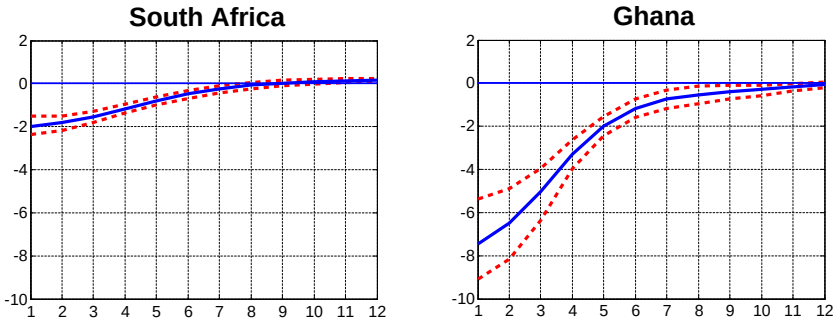
Output Growth



CPI-Inflation



Real Credit



Short-term Interest Rates

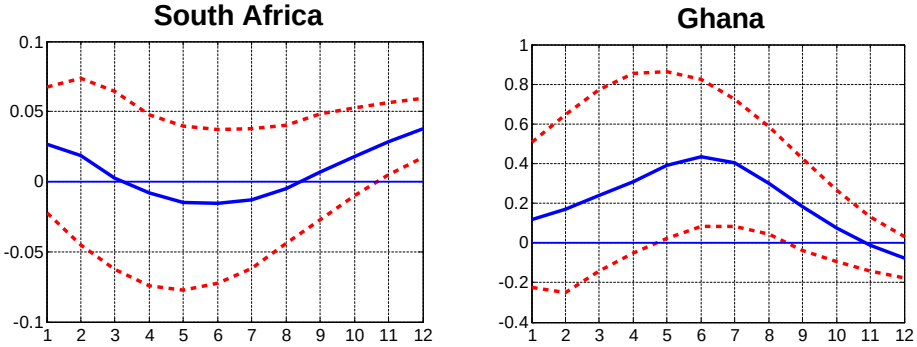
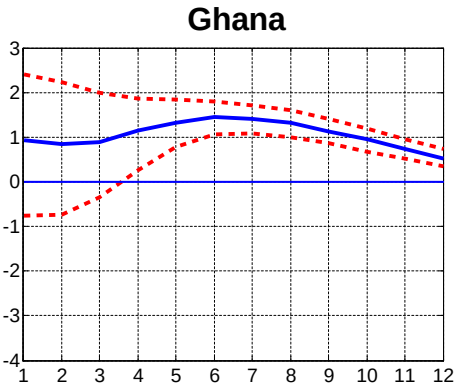
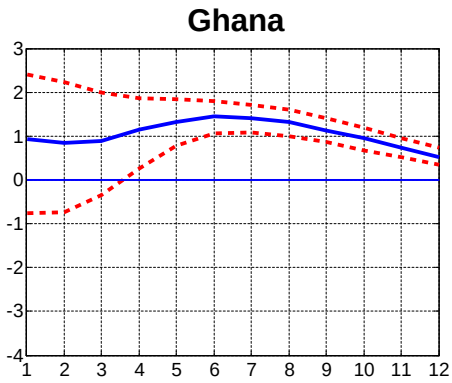


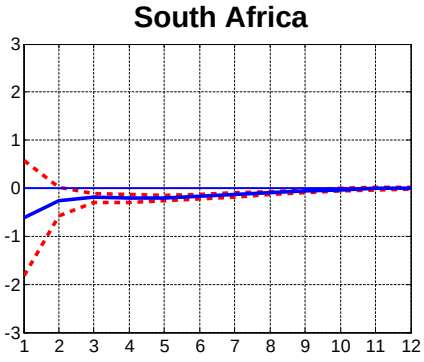
Figure 5: Domestic Credit Shocks (Continued)

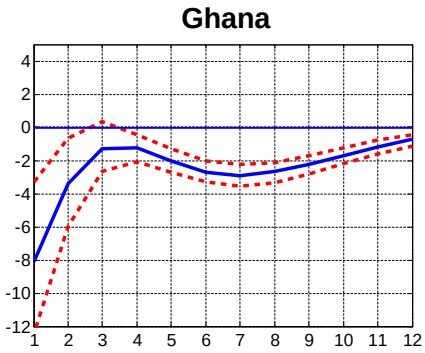
Real Effective Exchange Rates



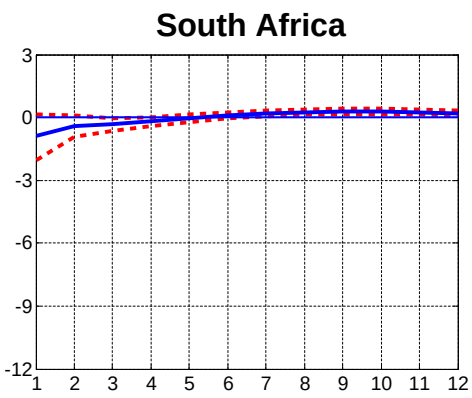


Exports





Imports



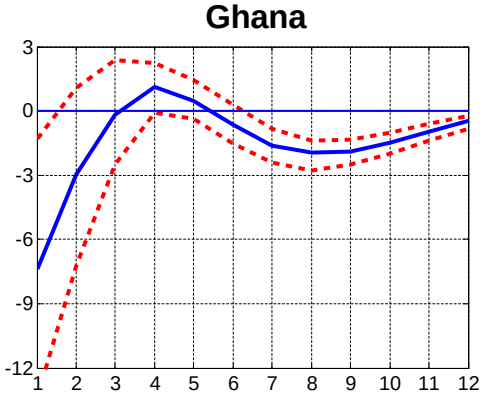
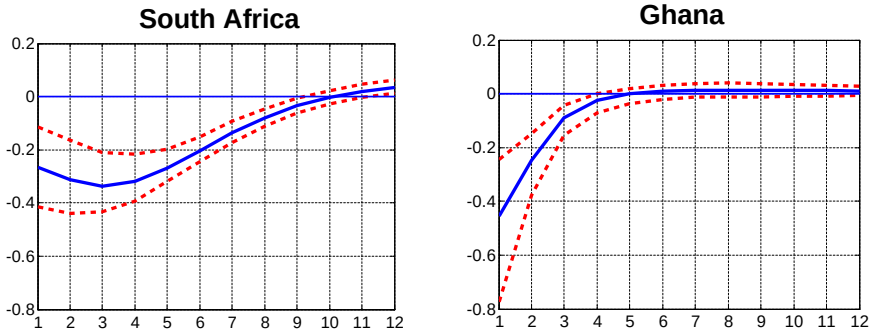
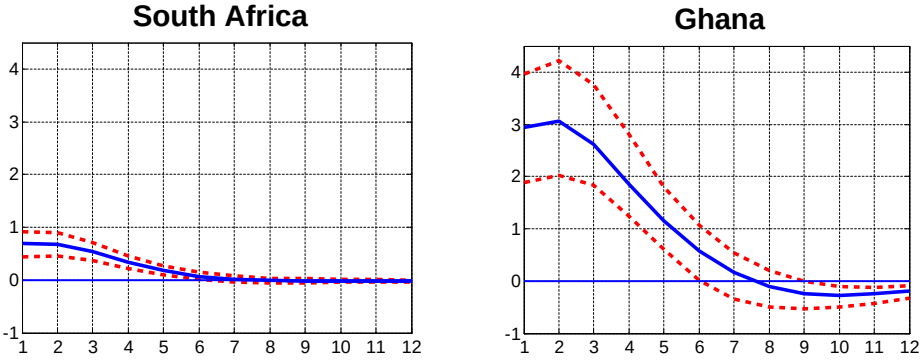


Figure 6: Domestic Productivity Shocks

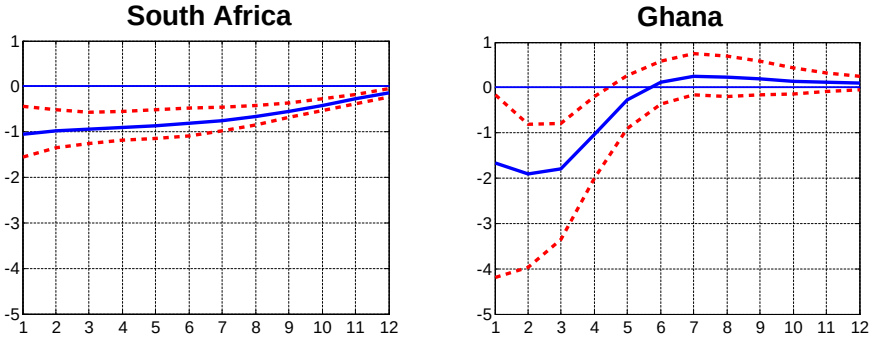
Output Growth



CPI-Inflation



Real Credit



Short-term Interest Rates

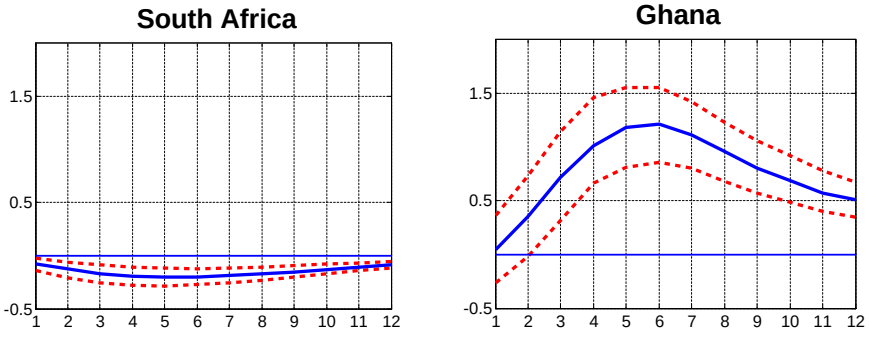
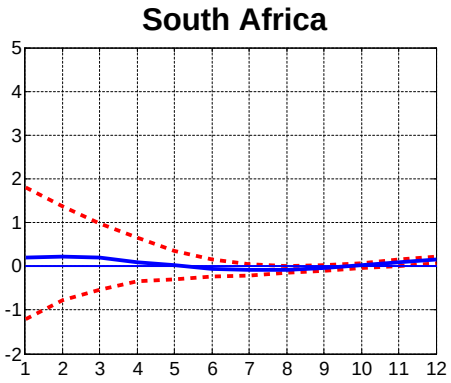
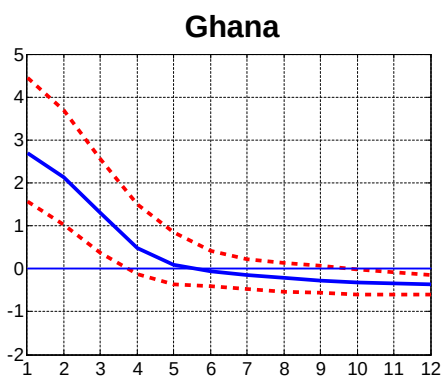


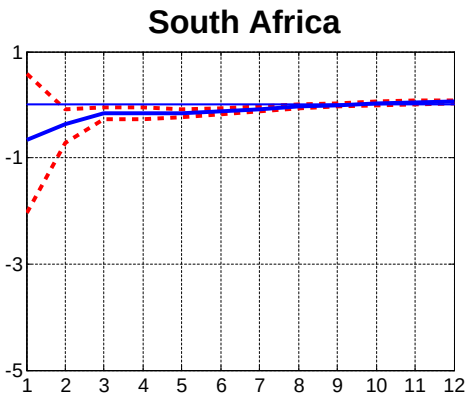
Figure 6: Domestic productivity Shocks (Continued)

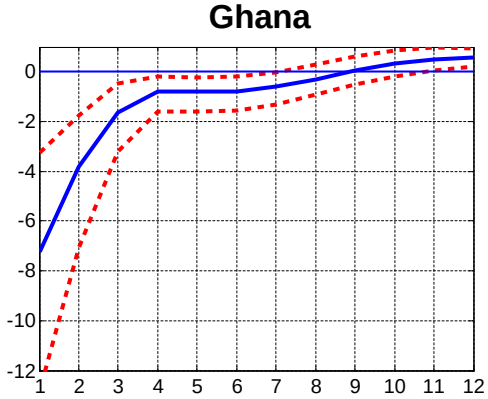
Real Effective Exchange Rates



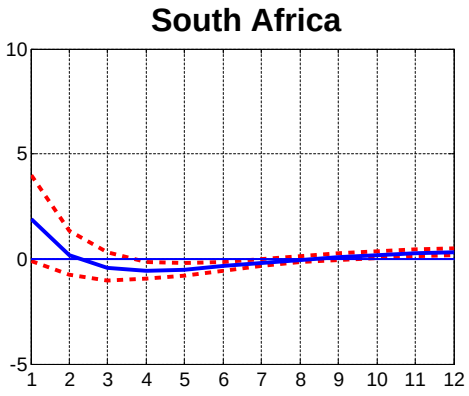


Exports





Imports



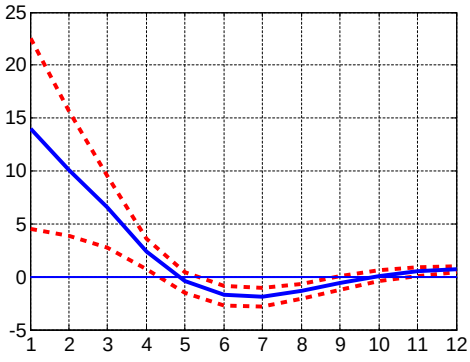


Figure 7: Commodity Price Shocks

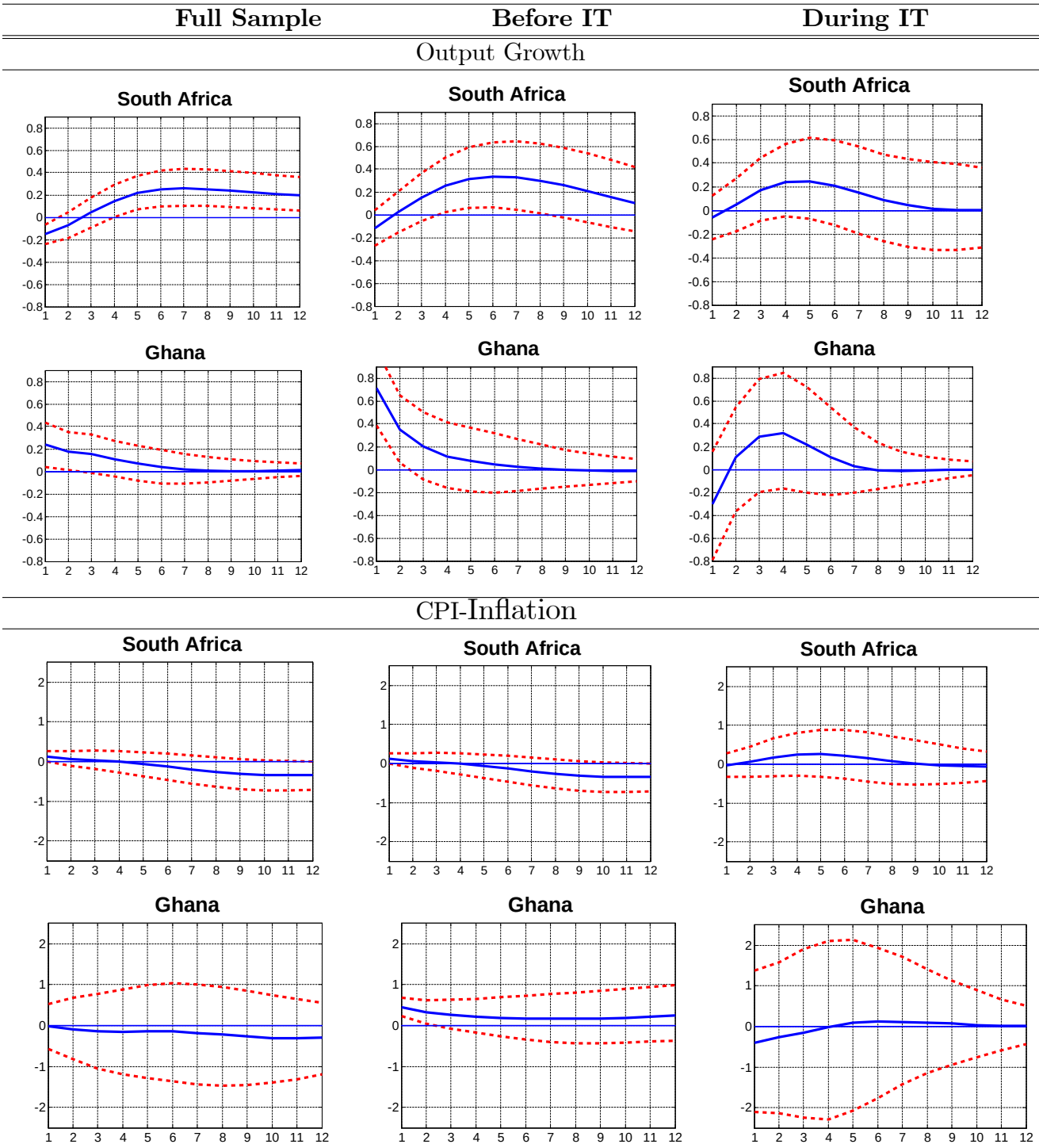


Figure 7: Commodity Price Shocks (Continiued)

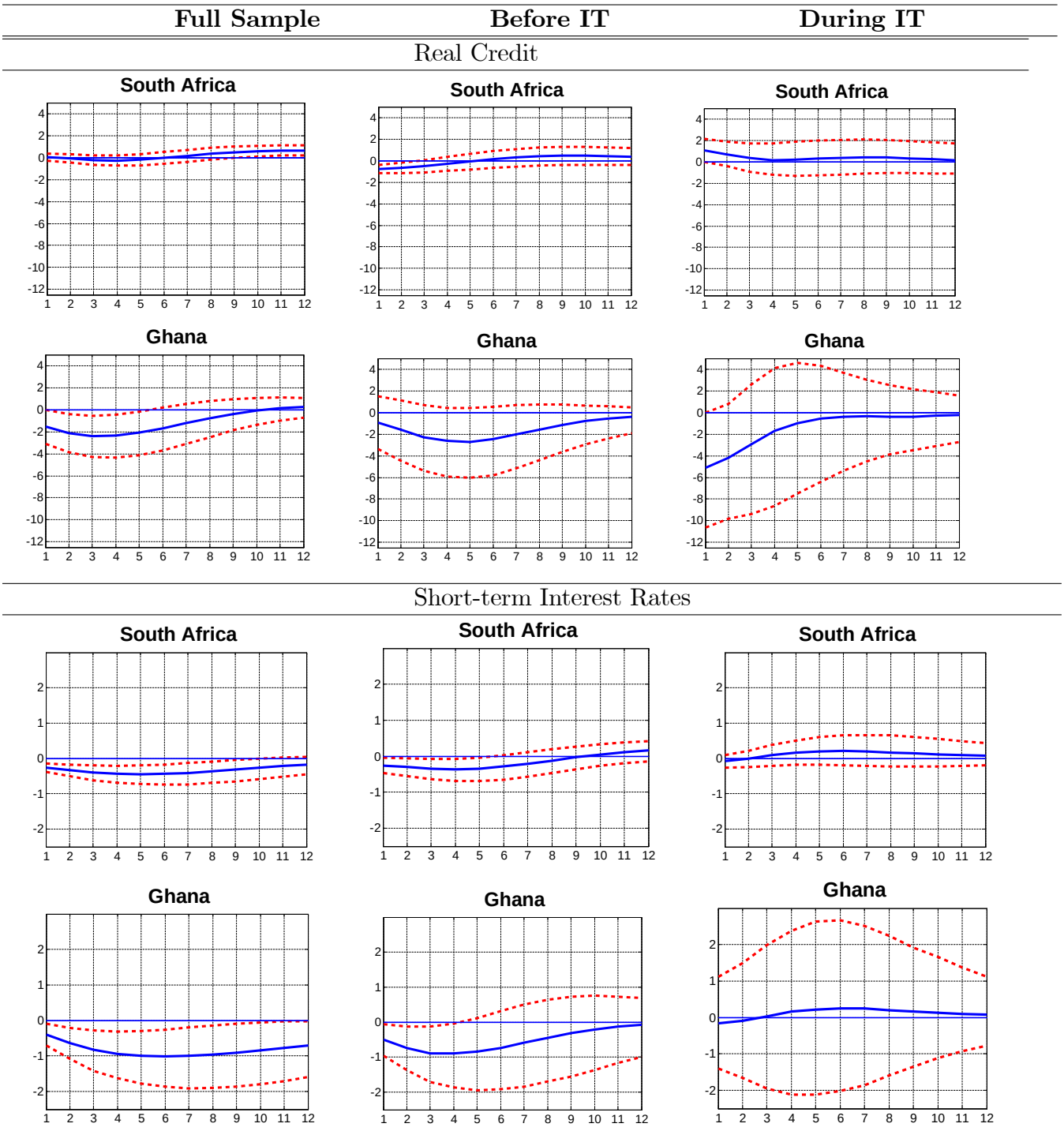


Table 1: **Data**

Part A

	Output	**Real Credit**	**Short-run interest rates**	**CPI**
trans.	**year to year**	**year to year**	**level**	**year to year**
Canada	OECD, Gross domestic product, volume, market prices	IFS, CLAIMS ON PRIVATE SECTOR	IFS, TREASURY BILL RATE	
France	OECD, Gross domestic product, volume, market prices	IFS, CREDIT TO PRIVATE SECTOR	IFS, TREASURY BILLS:3 MONTHS	IFS, CPI: 108 CITIES
Germany	OECD, Gross domestic product, volume, market prices	IFS, CLAIMS ON OTH RESSID SECTOR	IFS, TREASURY BILL RATE	GDS, Consumer price index
Italy	OECD, Gross domestic product, volume, market prices	IFS, CLAIMS ON OTHER RESIDENT SECTORS	IFS, TREASURY BILL RATE	IFS, CPI:ALL ITALY
Japan	OECD, Gross domestic product, volume, market prices	IFS, CLAIMS ON PRIVATE SECTOR	IFS, FINANCING BILL RATE	IFS, CPI:ALL JAPAN-485 ITEMS
UK	OECD, Gross domestic product, volume, market prices	IFS, CLAIMS ON PRIVATE SECTOR	IFS, TREASURY BILL RATE	IFS, CPI: ALL ITEMS
USA	OECD, Gross domestic product, volume, market prices	IFS, CLAIMS ON PRIVATE SECTOR	IFS, TREASURY BILL RATE	IFS, CPI All ITEMS CITY AVERAGE
G7	First principal component	First principal component	First principal component	First principal component
South Africa	SARB, Gross Domestic Product (SAAR, Mil.2005.Rand)	SARB, Credit extension: Domestic Private Sect Claims (SA, EOP, Mil.Rand)	Treasury Bill Tender Rate, 91-Days	CPI: All Items
Ghana	GSS, Gross Domestic Product (SA, Mil.2006.Cedis) Backcast data from 1990-2005	IFS, Claims on Private Sector	Treasury Bills Discounted	IFS, CPI National

Part B

	credit spreads	**default**	**Real Effective exchange rate**	**Commodity prices**	**Export of goods**	**Import of goods**
	level	**year to year**	**year to year**	**year to year**	**year to year**	**year to year**
USA	Macrobond, baa-aaa on US corporate bond yields	Gilchrist et al. (2009), distance to default transformed to inverse distance				
South Africa	SARB, Spreads between Eskom bond yield and US-baa bond yield	South Africa Statistics, Insolvencies (Number)	IFS, Real Effective Exchange Rate of the Rand	IFS, gold other mining: aluminium, coal, platinum	OECD MEI, Exports of Goods And Services , SA, Index	OECD MEI, Import , Goods and Services Volume Indices
Ghana	SA credit spreads	SA default rates	IFS, Real Effective Exchange Rate Based on Relative CPI	IFS, cocoa, gold	IMF DOTS Exports of Goods And Services	IMF DOTS Imports of Goods and Services

Table 2: **Indentification Restrictions**

N°	Indicators	G7-aggregate		Domestic (SA or GHA)	
		Credit	Productivity	Credit	Productivity
1	G7-Real GDP		−	0	0
2	G7-Inflation		+	0	0
3	G7-Real Credit	−	−	0	0
4	G7-Tbil			0	0
5	US-Credit Spread	+	+	0	0
6	US-Default	−	+	0	0
7	(SA or GHA)-Real GDP				−
8	(SA or GHA)-Inflation				+
9	(SA or GHA)-Real Credit			−	−
10	(SA or GHA)-Tbil				
11	SA-Credit Spread			+	+
12	SA-Default			−	+
13	(SA or GHA)-Commodity Price			0	0
14	REER of the rand or the GHS				
15	(SA or GHA)-Export				
16	(SA or GHA)-Import				

Notes: The sign restrictions were imposed on the first quarters.

Table 3: Variance Decomposition for Credit and Productivity Shocks

		G7-Credit	**G7-Productivity**	**Dom.-Credit**	**Dom.-Productivity**
	Horizons		Output Growth		
	1	3.08	2.25	0.68	8.35
	4	6.65	6.46	1.32	5.73
South Africa	8	9.38	10.40	1.47	3.97
	12	10.10	11.24	1.26	3.07
	1	2.86	2.78	1.24	4.41
Ghana	4	5.43	6.16	1.13	3.51
	8	6.84	7.32	1.50	3.10
	12	7.81	8.04	1.41	2.98
			CPI-Inflation		
	1	3.02	3.20	11.50	18.37
	4	4.06	4.02	9.36	14.46
South Africa	8	6.24	6.08	5.96	8.76
	12	8.62	8.08	3.86	5.58
	1	3.13	3.28	7.21	19.70
Ghana	4	4.07	4.56	6.95	16.41
	8	6.92	6.83	4.83	9.50
	12	8.48	8.00	3.72	7.58
			Short-term Interest Rates		
	1	3.82	4.03	1.21	1.46
	4	5.54	5.74	1.54	2.03
South Africa	8	8.59	8.80	1.41	1.81
	12	9.79	10.28	1.15	1.38
	1	4.05	4.81	1.46	0.84
Ghana	4	6.45	8.61	2.51	2.24
	8	8.30	8.85	3.40	2.76
	12	8.99	9.55	3.18	2.25
			Real Credit		
	1	2.39	2.27	16.38	6.71
	4	5.09	5.65	12.72	5.53
South Africa	8	7.41	8.09	9.32	4.44
	12	8.74	9.41	7.66	3.96
	1	3.34	2.28	12.25	1.74
Ghana	4	5.78	4.53	9.01	2.57
	8	8.29	7.79	6.41	2.47
	12	9.27	8.78	5.37	2.12
			Real Effective Exchange Rates		
	1	5.11	5.97	2.25	2.25
	4	6.38	6.32	2.34	2.32
South Africa	8	8.03	7.57	2.07	2.09
	12	9.39	8.58	1.79	1.80
	1	3.10	3.25	1.91	2.49
Ghana	4	4.77	4.59	1.84	2.39
	8	7.02	6.36	2.06	2.77
	12	8.27	7.77	1.99	2.56

Table 4: Variance Decomposition for Commodity Price Shocks

		Full Period	**Before IT**	**During IT**
	Horizons		Output Growth	
	1	3.68	2.18	2.58
	4	4.11	6.13	8.43
South Africa	8	10.62	12.61	13.18
	12	13.88	14.66	16.32
	1	2.07	11.01	6.15
Ghana	4	4.62	13.19	19.44
	8	5.99	15.25	25.08
	12	6.37	15.86	25.96
			CPI-Inflation	
	1	1.41	11.36	2.35
	4	1.70	7.26	6.36
South Africa	8	3.66	8.23	12.74
	12	6.22	9.37	16.04
	1	0.59	1.22	4.42
Ghana	4	1.45	3.14	12.45
	8	3.22	7.57	19.02
	12	4.80	9.84	20.83
			Short-term Interest Rates	
	1	5.91	4.01	3.12
	4	9.36	9.15	6.60
South Africa	8	13.54	13.04	12.70
	12	15.14	14.46	16.32
	1	2.27	2.83	4.19
Ghana	4	5.74	6.00	9.86
	8	9.71	8.84	16.11
	12	12.25	11.05	18.08
			Real Credit	
	1	0.57	9.58	5.84
	4	1.97	7.68	9.14
South Africa	8	4.21	10.28	12.72
	12	8.31	12.35	15.35
	1	1.56	1.32	11.13
Ghana	4	5.01	4.90	19.59
	8	7.97	9.85	24.39
	12	8.66	11.08	26.13
			Real Effective Exchange Rates	
	1	3.66	9.06	2.60
	4	5.26	10.37	7.31
South Africa	8	10.60	14.04	12.92
	12	11.76	15.27	14.63
	1	8.38	11.14	17.43
Ghana	4	7.30	13.99	23.81
	8	9.23	16.29	30.10
	12	10.22	17.34	31.23

Table 5: Data used in the Nowcasting

Series	**Frequency**	**Sources**
Goods Exports (NSA, Mil.Rand)	Monthly	IMF, DOTS
Goods Imports (NSA, Mil.Rand)	Monthly	IMF, DOTS
Commodity exports	Monthly	Bank of Ghana
Commodity imports	Monthly	Bank of Ghana
Sales	Monthly	Bank of Ghana
Port Harbour Operations	Monthly	Bank of Ghana
Domestic VAT	Monthly	Bank of Ghana
Gross Domestic Product (SA, Mil.2006.Cedis)	Quarterly	Ghana Stat. Service
Real GDP growth	Yearly	IMF, WEO