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Abstract

The paper investigated the impact of the financial sector development on the macroeconomic stability in Sudan using Johansen approach to co-integration and vector error correction model based on data covering the period 1960-2020. The test for co-integration showed that there is a long run relationship between macroeconomic variables (Real GDP and Inflation) and financial indicators (Money Supply, Credit to Private Sector, and Bank Deposits as ratio of GDP). The empirical results are sensitive to the indicator used. The results show that money supply as a share of GDP has a significant positive impact on real GDP but insignificant negative impact on the inflation while bank deposits have a significant negative impact on real GDP and inflation rate. The results of domestic credit to private sector (PCGDP) indicate insignificant effect to real GDP and inflation rate. This result would be reflective of the fact that most of the credit in the banking sector is channeled to the government and not the private sector

Keywords: Financial Development; Macroeconomic Stability; VECM
JEL Classification: C32, E31, E44, G21, O40

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I. Introduction

Several factors determine and contribute to macroeconomic stability. One of these factors is the development of the financial system. The institutional framework, efficiency and performance of the financial system are important determinants of economic growth as well as the macroeconomic stability. Therefore, vast number of studies have been conducted to examine the relationship between the development of the financial system and the macroeconomic stability, especially following the numerous currency crises that occurred in the 1990s and the financial crisis in 2008.

The turbulences that hit the international economy after the financial crisis caused much damage to the world financial system, and the Sudanese financial system is not an exception. Moreover, the financial system in Sudan has its own challenges and obstacles attributable to other several reasons, such as the economic sanctions imposed by the US in the last two decades, which isolate the Sudan's financial system from the world financial system. In addition, it has been affected by the separation of South Sudan in 2011 in which case, Sudan lost 75% of its oil revenues, and the financial sector lost the main source of resources with negative implications on Sudan's financial system development. Furthermore, the performance of the financial system in Sudan has been affected by the adoption of different institutional frameworks at different time horizons. Sudan had fully fledged Islamic banking system before 2005, which changed to dual banking system after the comprehensive peace agreement in 2005. Sudan reverted back to the Islamic system after the separation with South Sudan in 2011. Since 2019, Sudan has been operating under a dual banking system.

Against this background, this study sought to empirically examine the impact of the financial sector development on the macroeconomic stability in Sudan based on data covering the period 1960-2020. The study utilized co-integration and Vector Error Correction Model (VECM) approaches to address its objectives. It is expected that the outcomes of this study will provide insights that can guide policy makers in strengthening the impact of financial sector on macroeconomic stability.

The rest of the study is structured as follows. Section 2 provides the background on the financial sector in Sudan while section 3 presents the literature review. Section 4 provides the methodology and section 5 reports the empirical results. Section 6 concludes the study and suggests some policy recommendations.

1.1 Background about Financial Sector in Sudan

The financial sector in Sudan dominated by the banking sector. It comprising of 37 commercial banks distributed into three groups according to capital ownership specifically state-owned, joint venture, and foreign banks, regulated and supervised by the central bank of Sudan. The non-bank financial institutions in Sudan's financial system includes 19 currency exchange bureaus, 19 transfer companies, 44 microfinance institutions and 15 insurance companies. All banking operations are supervised by a centralized High Shari'ah Supervisory Board established in 1992 to ensure full

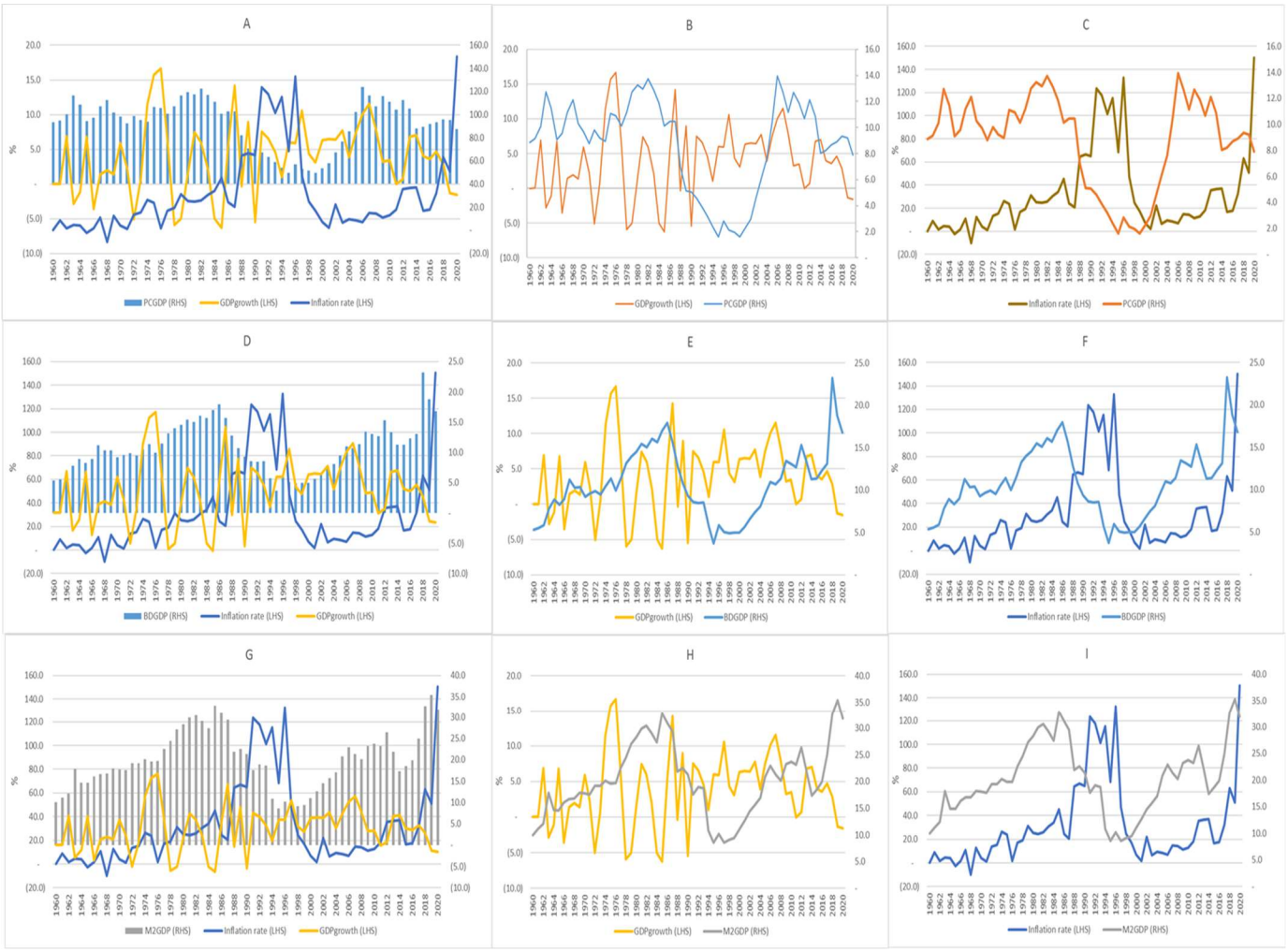
compliance with Shari'ah principles. However, banks are also required to establish in-house Shari'ah supervisory boards.

In addition, the financial markets in Sudan were operating under the umbrella of Khartoum Stock Exchange (KSE) and recently under the umbrella of Capital Market Authority, which provides the operational platform for all financial markets' transactions. Beside the KSE, there is the Sudan Company Financial Services, established by the CBOS and Ministry of Finance and Economic Planning, and is responsible for issuance and management of government securities.

Sudan also operates credit guarantee institutions. These include the deposit guarantee fund and the microfinance guarantee agency. The deposit guarantee fund was established in 1991 to achieve specific goals and objectives represented in guaranteeing deposits in secured banks, protecting the rights of depositors, and redressing damages when they occur, with the cooperation and solidarity of the monetary authorities, banks and depositors themselves. Furthermore, the microfinance guarantee agency "Tayseer" was established in 2013. The agency does not provide financing directly, but rather facilitates microfinance institutions that have the ingredients for success but cannot provide the necessary guarantee to obtain financing from banks, and work to activate cooperation between banks and microfinance institutions in Sudan. The agency also provides guarantee documents to banks and microfinance institutions in accordance with the provisions of the agency law. The agency facilitates

access to banking finance by providing the appropriate wholesale guarantee to small and medium-sized microfinance institutions in Sudan.

Figure 1: Performance of some Macroeconomic and Financial Indicators



The above graph shows the performance of the indicators included in the study. Figure 1 shows that, the period covered in the study can be categorized in three phases. The first phase is before 1990, characterized by a stable performance of key economic indicators while some instability marked with the deterioration of most economic indicator was experience during the 1990s. For instance, the period post 1990 witnessed high inflation rate, decrease in the credit to the private sector, reduction in the banks' deposits and slowdown in the GDP. In contrast, the performance of the economy improved between (2000 – 2011) reflecting the oil period in Sudan. However, the economy deteriorated again after the separation of the South Sudan in 2011 and Sudan lost 75% of the oil revenues.

II. Literature Review

The impact of the financial sector development on macroeconomic stability is intensively discussed in the literature, at different level in the advanced, emerging and developing counties and no consensus exists on the financial development and the macroeconomic stability relationship. Some studies indicated a positive relationship between financial development and macroeconomic stability. The studies used various indicators of financial development and data from advanced economies, Asia and Africa to show a positive relationship between financial development and economic growth (Prochniak & Wasiak, 2017; Noorhamizah, 2017; Creel et al., 2015; Manu et al., 2011; Estrada et al., 2010). Furthermore, Abdelbaki, (2013), investigated the relationship between macroeconomic variables and Bahraini stock market development based on the Autoregressive Distributed Lag model. The result showed that, the development of a financial market is closely related to the overall development in the national economy. However, some studies in Africa, Europe and emerging markets established a negative relationship between the financial system development and the macroeconomic stability, (Kapaya, 2020; Sajo & Li, 2017; Petkovski & Kjosevski, 2014; Naceur & Ghazouani, 2007; Ardic & Damar, 2006).

Other studies using data from African countries focused on the impact of financial development on aspects of growth such as investment and capital flows rather than the direct effect of financial development on growth. Notably, Coulibaly, (2015) investigated the causality between remittances and financial sector development in Sub-Saharan African (SSA) countries, using annual data over the 1980–2010 period for 19 SSA countries. The results show that, based on liabilities as a proxy for financial sector development, remittances positively influence financial development only in four countries (Niger, Senegal, Sierra Leone and Sudan) and financial development positively affects remittances only in Gambia. In the same study, the results show that remittances positively affect financial development only in Sudan and financial development does not influence remittances in any country when credit growth is used as a measure of financial depth. On financial development-investment nexus, Boateng et al., (2017) examined the interactive effect of financial development and foreign direct investment (FDI) inflows on domestic investment in sub-Sahara Africa (SSA). The results showed that financial development complements FDI inflows to augment domestic investment in SSA. Yinusa et al., (2020) however assessed the nexus between institutional quality, financial development and inclusive growth in Nigeria for the period 1984-2017. The study concluded that institutional quality and financial development are crucial variables that influence inclusive growth in Nigeria.

There is no consensus on the relationship between financial development and macroeconomic stability from a few studies that have focused on Sudan. For instance, Sirag et al., (2018) investigated the relationship between financial sector development, foreign direct investment (IFD) and economic growth in Sudan and found evidence supporting the existence of positive and significant effects of financial system development on economic growth. Similarly, Arabi, (2014) investigated the dynamic relationship between financial development and economic growth in Sudan during 1970–2012. The

study used Johansen approach to Co-integration and Vector Error Correction Model (VECM) to find out the long and short run effects of the financial sector development on economic growth. The findings showed a marginal positive effect of financial sector development on economic growth in Sudan. Similarly, Hussein et al., (2020) investigated the influence of banking sector on economic growth in Sudan and found positive linkages. Contrastingly, other studies found a weak and limited role for the financial sector development in macroeconomic stability in Sudan. Using both banking sector and stock market indicators, the studies showed limited impact of financial development on economic growth, (Elhassan & Braima, 2020; Mohamed, 2008).

III. Data and Econometric Methodology

The study used annual data covering the period 1960–2020. It utilized three measures of financial system development. The first measure is money supply-GDP ratio (M2GDP) which measures the degree of monetization in the economy as well as the depth of the financial sector. The second measure is the ratio of domestic credit to private sector to GDP (PCGDP) and the third is banks deposit liability to GDP (BDGDP). The real GDP and inflation rate were used as macroeconomic stability indicators. The paper used the cointegration procedure and vector error correction model (VECM) to test the long run equilibrium and short run relationship among the variables. According to Granger representation theorem, if the series are co integrated, the dynamic relationship involving the variables could be examined within VECM framework.

$$\Delta Z_t = \alpha\beta' Z_{t-1} + \sum_i^{p+1} \Gamma_i \Delta Z_{t-i} + \delta\emptyset + E_t$$

Where $\alpha\beta' Z_{t-1}$ represents the long-run information on the process of Z_t. Specifically, the rows of β' are explained as the distinct cointegrating vectors and the rows of α indicate the speed of adjustment of the dependent variables towards the long-run equilibrium state. The specific form of the VEC model is given as:

$$\Delta LGDP = \beta_{1j} + \sum_{p=1}^{m} \beta_{11ip} \Delta LGDP_{it-p} + \sum_{p=1}^{m} \beta_{12ip} \Delta inflation_{it-p} + \sum_{p=1}^{m} \beta_{13ip} \Delta M2GDP_{it-p} + \sum_{p=1}^{m} \beta_{14ip} \Delta PCGDP_{it-p} + \sum_{p=1}^{m} \beta_{15ip} \Delta BDGDP_{it-p} + \gamma_{1i} ECT_{1t-i} + e_{1it}$$

Where, Δ represents lag operator and p stands for lag length in the above VECM framework. The above framework allows for causality direction. ECT shows error correction term. The ECT coefficient i.e. γ_{1i}, quantity tendency of each variable to return towards equilibrium position.

IV. Empirical Results

The study conducted unit root tests reported in Annex 2 and found that all the variable were non-stationary in levels but stationary in first difference. The Johansen Co-integration test as reported in table 1 indicates that there is one co-integrating equations, implying a long run relationship between

GDP and inflation rate as macroeconomic stability indicators and all the financial susyem development indicators.

The Johansen Co-integration test is presented in table (2) indicates that there is one co-integrating equations, implies a long run relationship between GDP and inflation rate as macroeconomic stability indicators and money supply-GDP ratio, the ratio of domestic credit to private sector to GDP and banks deposit liability to GDP as the financial development proxies.

Table 1: Johansen Co-integration Test

Null Hypothesis	Alternative		95% Critical	Prob.
λtrace tests		**λtrace value**		
$r = 0$	$r > 0$	103.8228***	88.80380	0.0027
$r \leq 1$	$r > 1$	59.74684	63.87610	0.1060
$r \leq 2$	$r > 2$	34.10155	42.91525	0.2839
$r \leq 3$	$r > 3$	17.17323	25.87211	0.4021
$r \leq 4$	$r > 4$	7.368103	12.51798	0.3077
λmax tests		**λmax value**		
$r = 0$	$r = 1$	44.0759***	38.33101	0.0098
$r = 1$	$r = 2$	25.64529	32.11832	0.2504
$r = 2$	$r = 3$	16.92832	25.82321	0.4638
$r = 3$	$r = 4$	9.805131	19.38704	0.6397
$r = 4$	$r = 5$	7.368103	12.51798	0.3077

Notes: The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively. Trace test indicates 1 co-integrating eqn(s) at the 0.01 level and Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.01 level.

Since the variables were integrated of same orders, they could be co-integrated and thus we could proceed to construct a vector error correction model (VECM). An appropriate optimal lag length was found to be two based on Final prediction error (FPE), sequential modified LR and Akaike Information Criteria (AIC). The VECM results based on inflation as an indicator of macroeconomic stability are shown in annex 3.

Table 2: Vector Error Correction Model

Vector Error Correction Estimates: Sample (adjusted): 1963 2020:
Included observations: 58 after adjustments

Dependent Variable: D(LGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-0.399315	0.088075	-4.533808	0.0000
D(LGDP(-1))	0.545077	0.121933	4.470300	0.0001
D(LGDP(-2))	-0.001298	0.119190	-0.010887	0.9914
D(BDGDP(-1))	-0.016030	0.005113	-3.135231	0.0030

D(BDGDP(-2))	-0.015262	0.005380	-2.836766	0.0068
D(M2GDP(-1))	0.011311	0.004375	2.585365	0.0130
D(M2GDP(-2))	0.016256	0.004022	4.041393	0.0002
D(PCGDP(-1))	-0.001129	0.005462	-0.206697	0.8372
D(PCGDP(-2))	-0.004775	0.004945	-0.965562	0.3393
D(Inflation(-1))	0.000101	0.000274	0.366158	0.7159
D(Inflation(-2))	5.75E-05	0.000273	0.210299	0.8344
C	0.013285	0.008936	1.486648	0.1439
R-squared= 0.553, adjusted R-squared=0.446; Breusch-Godfrey Serial Correlation LM = 12.39298 (0.0884), Breusch-Pagan-Godfrey heteroscedasticity test =20.3637 (0.1584), Jarque-Bera=2.2567 (0.32356), F-Statistics=5.179 (0.000031) *Values in bracket are probability values.				

The results of some selected variables from VECM estimates are presented in table 2. The results show that financial deepening (M2GDP), deposit liability (BDGDP) were significant at 1 percent with expected sign implying a 1% rise in financial deepening (M2GDP) lead an increase in real GDP growth by 0.011, while deposit liability (BDGDP) lead decrease in real GDP growth by 0.016 during the study period. However, the impact of domestic credit to private sector is insignificant. This would be explained by the weak capital base of Sudanese banks, high public sector share in domestic credit and the absence of an appropriate investment climate required. Similarly, the results in annex 3 indicate that the financial deepening (M2GDP), deposit liability (BDGDP) and domestic credit to private sector (PCGDP) are insignificant impact on the inflation rate.

The results further show that there is a causal relationship between financial development indicators and Macroeconomic indicators. The vector error-correction term ECM (-1) provides the evidence of a long-run linkage between real GDP growth and financial sector indicators. The results in table 2 show that about 40% of disequilibrium is corrected annually. Diagnostic tests show that the VECM is stable, has no serial correlation, has no heteroscedasticity and the residuals are multivariate normal The financial sector indicators (M2GDP; PCGDP; BDGDP) have expected signs and results in the study are in line with findings in some developing economies. For instance, Mohamed (2008) found evidence supporting the weak relationship between financial intermediaries and economic growth in Sudan. These results may be attributed to the inefficient allocation of the banks' resources.

Long-run exclusion tests

Each of the variables was tested for long-run exclusion test, i.e., testing whether (or not) a corresponding variable can be excluded from the estimated long-run relation. This was achieved by imposing zero restrictions on each of the β′s, in turn. If accepted, the variable is redundant to the long-run relations and so can at most have a short-run impact. Results from long-run exclusion tests showed that no variables can be excluded from the long-run while the BDGDP can be excluded in short run.

Table 3: VEC Granger Causality/Block Exogeneity test

Dependent variable: D(LGDP)			
Excluded	Chi-sq	df	Prob.
D(BDGDP)	9.782414	2	**0.0075**
D(M2GDP)	16.61877	2	**0.0002**
D(PCGDP)	1.843397	2	0.3978
D(INFLATION)	0.251134	2	0.8820
All	21.06413	8	0.0070
Dependent variable: D(INFLATION)			
Excluded	Chi-sq	df	Prob.
D(LGDP)	5.143976	2	0.0764
D(BDGDP)	7.389154	2	**0.0249**
D(M2GDP)	0.351395	2	0.8389
D(PCGDP)	2.189127	2	0.3347
All	21.31475	8	0.0064

Note: The null hypothesis of the test, in part, is that individually, variable i is excludable from any of the system equations, and that collectively, all system variables are excludable from each of the system equations.

We find unidirectional causation, with influences running from BDGDP to RGDP growth i.e., BDGDP → RGDP growth (**D(LGDP**) block); and from M2GDP to RGDP growth, i.e., M2GDP → RGDP growth (**D(LGDP**) block). We find unidirectional causation, with influences running from BDGDP to Inflation rate i.e., BDGDP → Inflation rate (**D(Inflation**) block.

VEC Granger Causality in the VECM were also conducted as reported in Table 3. VEC Granger Causality results reveal unidirectional causation, with influences from bank deposit liability to real GDP growth and from money supply as a share of GPD to real GDP growth. Similarly, the results showed a unidirectional causation from bank deposit liability to inflation.

V. Conclusion

The paper investigated the impact of the financial sector development on the macroeconomic stability in Sudan based on data covering the period 1960-2020. The study used Johansen approach to co-integration and vector error correction model. The short-run results show that bank deposits have a significant negative impact on real GDP and inflation rate. Additionally, the results showed that financial deepening proxied for by money supply affects has a positive and significant impact on real

GDP but negative and insignificant impact on the inflation rate. The results further show that domestic credit to private sector results indicate an insignificant effect to real GDP and inflation rate.

On the other hand, the long-run results indicate that, the bank deposits have a positive and significant impact on real GDP but a negative effect on inflation rate. In contrast, the financial deepening indicator has a significant negative impact on real GDP and positive impact on the inflation rate. The domestic credit to private sector has a positive impact on real GDP and a negative effect on inflation rate.

In terms of policy implications, there is need for Sudan to strengthen and enhance the impact of financial sector on macroeconomic stability by continuing the implementation of financial reforms including banks structural reforms, institutional reforms and Sudan's financial inclusion strategy. It is also recommended that the government develops policies that encourage bank credit to private sector, and limit the government crowding out for the private sector.

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Annexes

Annex 1: Definitions and Sources of Data used in the Analysis

Variable	Variable	Source
Real Gross domestic product	Log RGDP	Central Bureau of Statistics
I*nflation rate*	Inflation	Central Bureau of Statistics
M*oney supply-GDP*	M2GDP	World bank database
D*omestic credit to private sector to GDP*	PCGDP	World bank database
B*anks deposit liability to GDP*	BDGDP	World bank database

Annex 2: Unit root tests results

Variable	Level		First difference		Comment
	ADF	PP	ADF	PP	
Log RGDP	-2.505	-2.230	-5.635***	-5.026***	I(1)
Inflation	-2.064	-2.138	-9.356***	-9.343***	I(1)
M2GDP	-1.952	-1.808	-6.195***	-6.206***	I(1)
PCGDP	-2.339	-1.791	-3.456**	-5.895***	I(1)
BDGDP	-1.888	-1.890	-7.764***	-7.764***	I(1)

Notes: The lag lengths are selected according to Schwartz information criterion (SIC). The critical values for the ADF are based on Mackinnon (1996). ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively.

Annex 3: Vector Error Correction Model_ D(Inflation)

Vector Error Correction Estimates: Sample (adjusted): 1963 2020:
Included observations: 58 after adjustments
Dependent Variable: D(Inflation)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	137.4310	46.47249	2.957255	0.0049
D(LGDP(-1))	-132.5831	64.33758	-2.060741	0.0450
D(LGDP(-2))	-14.94315	62.89038	-0.237606	0.8132
D(BDGDP(-1))	-4.567730	2.697837	-1.693108	0.0972
D(BDGDP(-2))	2.207615	2.838755	0.777670	0.4407
D(M2GDP(-1))	-0.748145	2.308484	-0.324085	0.7473
D(M2GDP(-2))	-0.842576	2.122367	-0.396998	0.6932
D(PCGDP(-1))	2.527854	2.882053	0.877102	0.3850
D(PCGDP(-2))	1.644377	2.609178	0.630228	0.5317
D(Inflation(-1))	-0.184299	0.144832	-1.272500	0.2096
D(Inflation(-2))	0.035239	0.144174	0.244419	0.8080
C	9.544290	4.715106	2.024194	0.0488

R-squared= 0.521, adjusted R-squared=0.407; Breusch-Godfrey Serial Correlation LM = 6.1254 (0.5252), Glejser heteroskedasticity Test =24.27679 (0.0605), Jarque-Bera= 10.4277 (0.00544), F-Statistics=4.549 (0.000120) *Values in bracket are probability values.