

A Structural Analysis of Oil Price Shocks on the Jamaican Macroeconomy



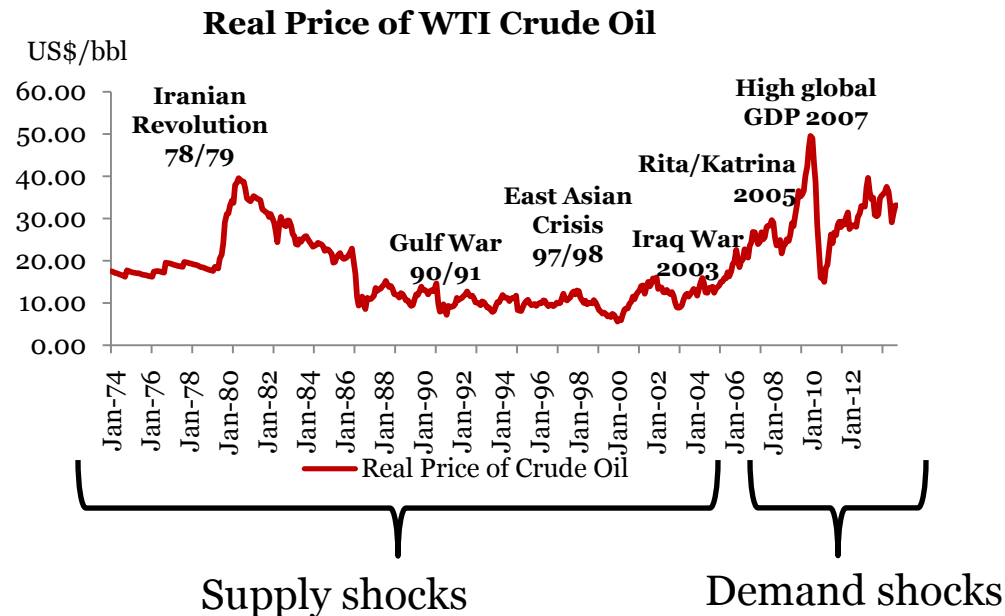
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Outline

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- Motivation of Study
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Introduction

- Historically, oil price shocks were primarily triggered by major political events.
- More recent spikes in oil prices can be ascribed to a global economic expansion.



Introduction

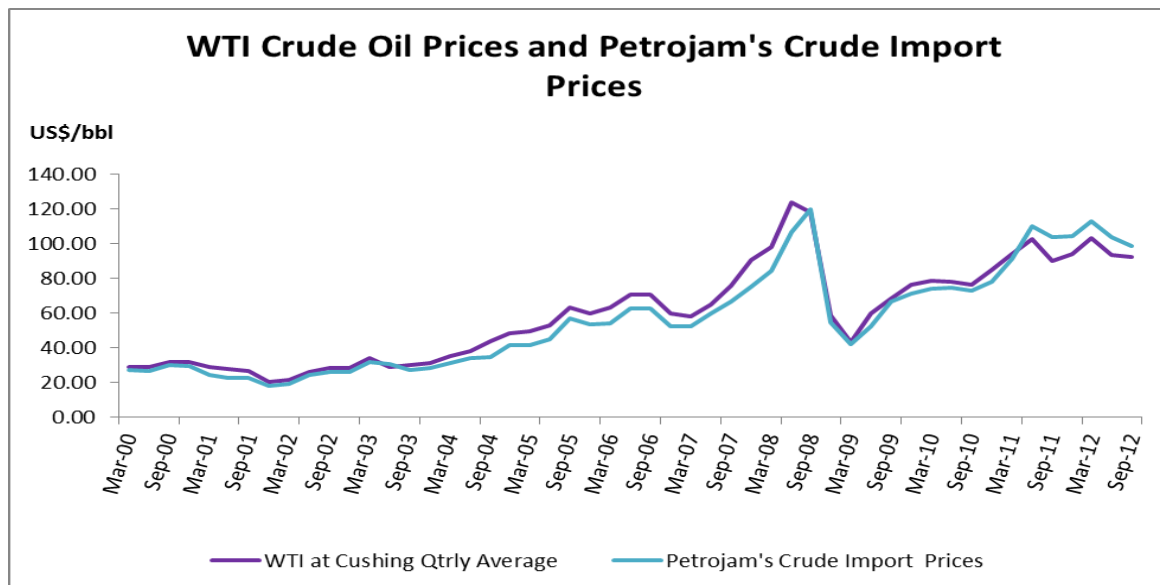
- An oil price shock, as defined in the literature, is a sharp **increase** in the real price of oil.
- Types of oil price shocks
 - Oil supply shock (OS shock)
 - Aggregate demand shock (AD shock)
 - Oil-specific demand shock (OD shock)

Introduction

- ▶ There are three main benchmarks of oil:
 - ▶ West Texas Intermediate (WTI) is the benchmark for North American oil.
 - ▶ Brent oil is the benchmark for crude oils used in Europe, Africa and the Middle East.
 - ▶ Dubai is the benchmark for Middle East oil supplied to the Asia-Pacific region.

Introduction

- ▶ The prices paid for petroleum products by the Petroleum Corporation of Jamaica have been linked to the WTI price.



Motivation

- This study therefore seeks to examine the impact of oil shocks on selected macroeconomic variables in the Jamaican context.
- Such variables include real GDP, inflation rate, nominal exchange rate, current account deficit and interest rates.

Literature Review

- *Studies on exogenous oil price shocks*
 - Hamilton (1983) highlighted that a sharp increase in crude oil prices was a precursor to seven of the eight post-war US recessions, particularly during the 1948-72 period, based on the statistical significance of the correlation between oil shocks and real GDP.
 - Kilian (2008) focused on the exogeneity of oil shocks since 1973 with a view to ascertaining the means by which shortfalls in oil production resulting from wars and other exogenous political events in OPEC countries affect oil prices.

Literature Review

- *Impact of oil price shocks on real GDP & inflation*
- Kilian (2009) revealed that the real price of oil can be structurally decomposed into three categories, namely : (1) OS shocks, (2) AD shocks and (3) OD shocks. The paper in turn estimated the relationship between these shocks, US real GDP and the US inflation rate using a structural vector autoregression (SVAR).
- Baumeister et al. (2010) examined a set of industrialized economies to determine the economic consequences of oil shocks using a benchmark SVAR. The paper found that AD shocks resulted in a temporary increase in real GDP for industrialized economies. Contrastingly, OD shocks and OS shocks were revealed to contribute to a temporary decline in real GDP.

Literature Review

- *Impact of oil price shocks on External Accounts*
 - Ozlale (2010) and Chuku et al. (2011) both used SVAR models to assess the impact of oil price shocks on the Turkish and Nigerian current account deficits, respectively. The results showed that the current account deficit to GDP ratio increased gradually in response to an oil price shock.
 - Burger et al. (2009) examined the potential for the impact of oil price shocks on external accounts via the external capital structure of Jamaica and Trinidad. The findings demonstrated that both countries had scope for changing the composition of their international portfolio to safeguard against or exacerbate the impact of oil shocks.

Methodology

- Using the methodology of Kilian (2009), the impact of oil price shocks on the Jamaican economy was estimated via two main steps:
 1. The examination of movements in the real price of crude oil in order to determine the underlying demand and supply shocks that affect the crude oil market.
 2. The estimation of the response of Jamaican macroeconomic variables to these shocks.

Methodology

- In undertaking the first step, a multivariate SVAR model was estimated utilizing monthly data over the sample period 1997:01 – 2012:06 for the vector time series:

$$z_t = (\Delta prod_t, rea_t, rpo_t)'$$

- where $\Delta prod_t$ represented the per cent change in the production of crude oil globally.
- rea_t was a measure of global real economic activity in industrial commodity markets.
- rpo_t was the real price of crude oil with rea_t and rpo_t being expressed in logs.

Methodology

- The SVAR representation of the model consisting of a vector of serially and mutually uncorrelated structural innovations, ε_t , may be seen below:

$$A_0 z_t = \alpha + \sum_{i=1}^2 A_i z_{t-i} + \varepsilon_t$$

- Fluctuations in the real price of oil were underpinned by three structural shocks:
 - ε_{1t} , which captured OS shocks
 - ε_{2t} , which denoted AD shocks
 - ε_{3t} , which represented OD shocks

Methodology

- Additional restrictions were imposed on A_0^{-1} as follows:
 - $a_{12} = 0$ and $a_{13} = 0$ impose the restrictions of no response from crude oil production to AD shocks and OD shocks, respectively, within the same month.
 - $a_{23} = 0$ assumes that an increase in the real price of oil emanating from OD shocks will not reduce global real economic activity in industrial commodity markets within a month.
- The foregoing assumptions yielded a model with reduced form errors, $e_t = A_0^{-1} \varepsilon_t$ of the form:

$$e_t = \begin{pmatrix} e_t^{\Delta prod} \\ e_t^{rea} \\ e_t^{rpo} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \varepsilon_t^{oil\ supply\ shock} \\ \varepsilon_t^{aggregate\ demand\ shock} \\ \varepsilon_t^{oil-specific\ demand\ shock} \end{pmatrix}$$

Methodology

- Quarterly shocks were constructed by averaging the monthly structural innovations implied by the VAR model for each quarter in order to maintain the identifying assumptions.

$$\hat{\zeta}_{jt} = \frac{1}{3} \sum_{i=1}^3 \hat{\varepsilon}_{j,t,i}, \quad j = 1, \dots, 4$$

where $\hat{\varepsilon}_{j,t,i}$ refers to the estimated residual for the j th structural shock in the i th month of the t th quarter of the sample.

- Subsequent to the identification of structural innovations, the effects of crude oil demand and crude oil supply shocks on the Jamaican macroeconomy were determined based on impulse responses of selected macroeconomic variables to the structural innovations.

Methodology

- The dynamic effects of the shocks on Jamaican macroeconomic aggregates were examined based on quarterly regressions of the form and lag length selection criteria:

- $\Delta y_t = \alpha + \sum_{i=0}^1 \phi_i \hat{\zeta}_{jt-i} + u_t, \quad j=2, \dots, 4$

- $\pi_t = \delta + \sum_{i=0}^1 \psi_i \hat{\zeta}_{jt-i} + v_t, \quad j=2, \dots, 4$

- $XR_t = \beta + \sum_{i=0}^1 \varphi_i \hat{\zeta}_{jt-i} + w_t, \quad j=2, \dots, 4$

- $IR_t = \gamma + \sum_{i=0}^1 \omega_i \hat{\zeta}_{jt-i} + z_t, \quad j=2, \dots, 4$

- $CA_t = \theta + \sum_{i=0}^1 \rho_i \hat{\zeta}_{jt-i} + x_t, \quad j=2, \dots, 4$

- where

- Δy_t = real GDP;
- π_t = inflation rate
- XR_t = the nominal exchange rate between the US dollar and the local currency
- IR_t = the 180-day Treasury Bill yield;
- CA_t = the current account balance
- $\phi_h, \psi_h, \varphi_h, \omega_h$ and ρ_h = the respective impulse response coefficients.
- $\hat{\zeta}_{jt-i}$ = a serially uncorrelated shock
- u_t, v_t, w_t, x_t, z_t = residual error terms

Discussion of Results

Figure 1: Response of real GDP

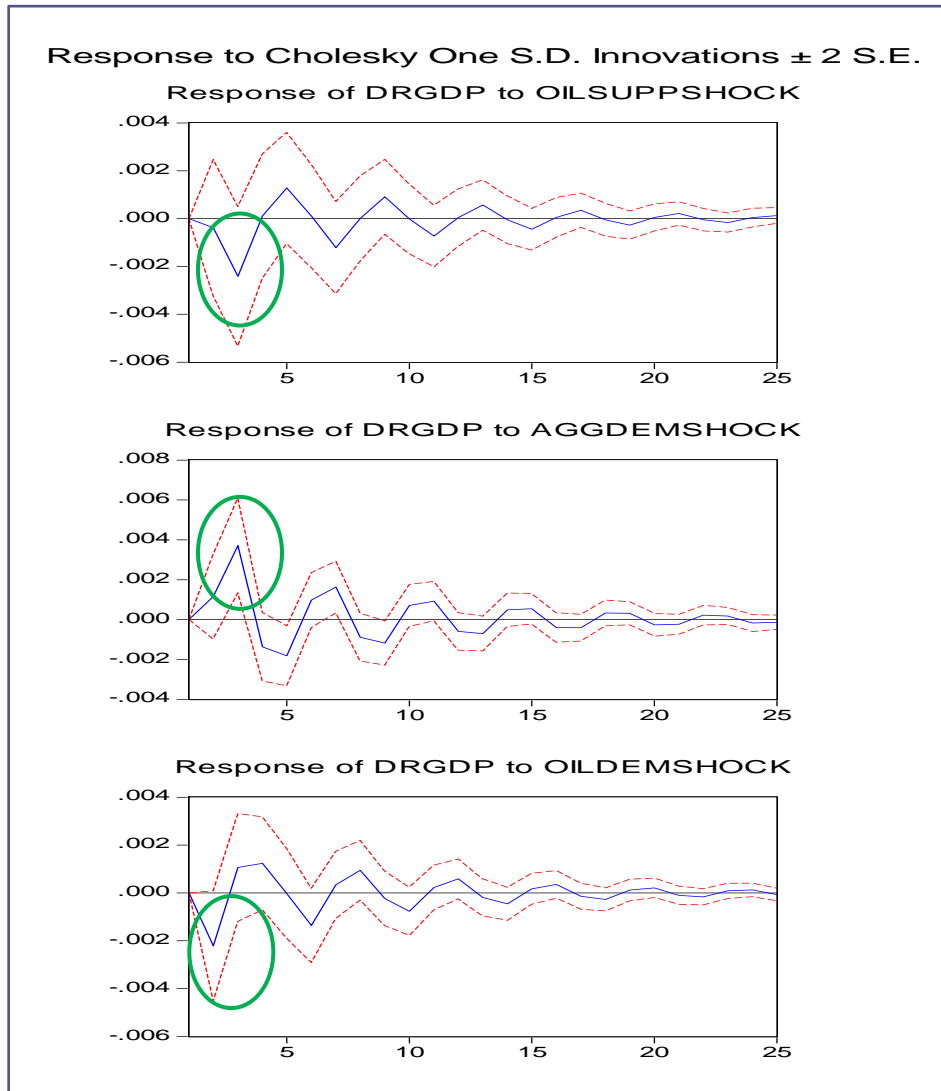
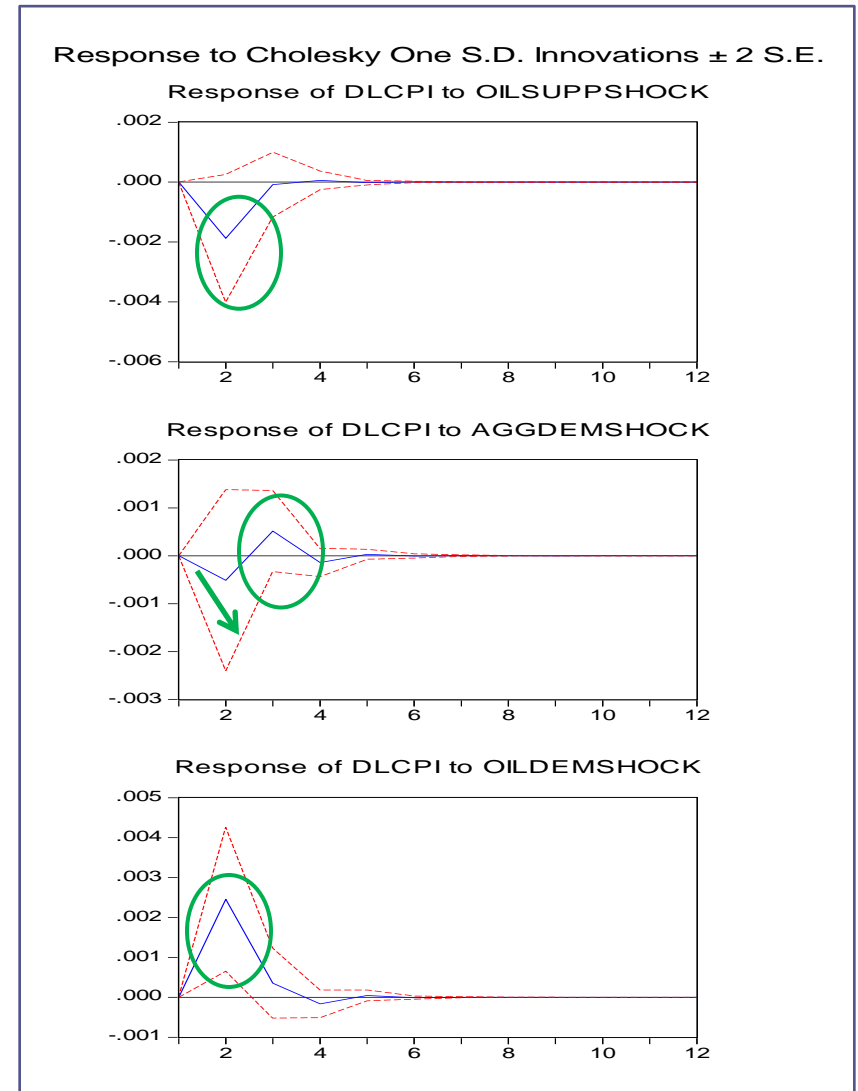


Figure 2: Response of inflation



Discussion of Results

Figure 3: Response of exchange rate

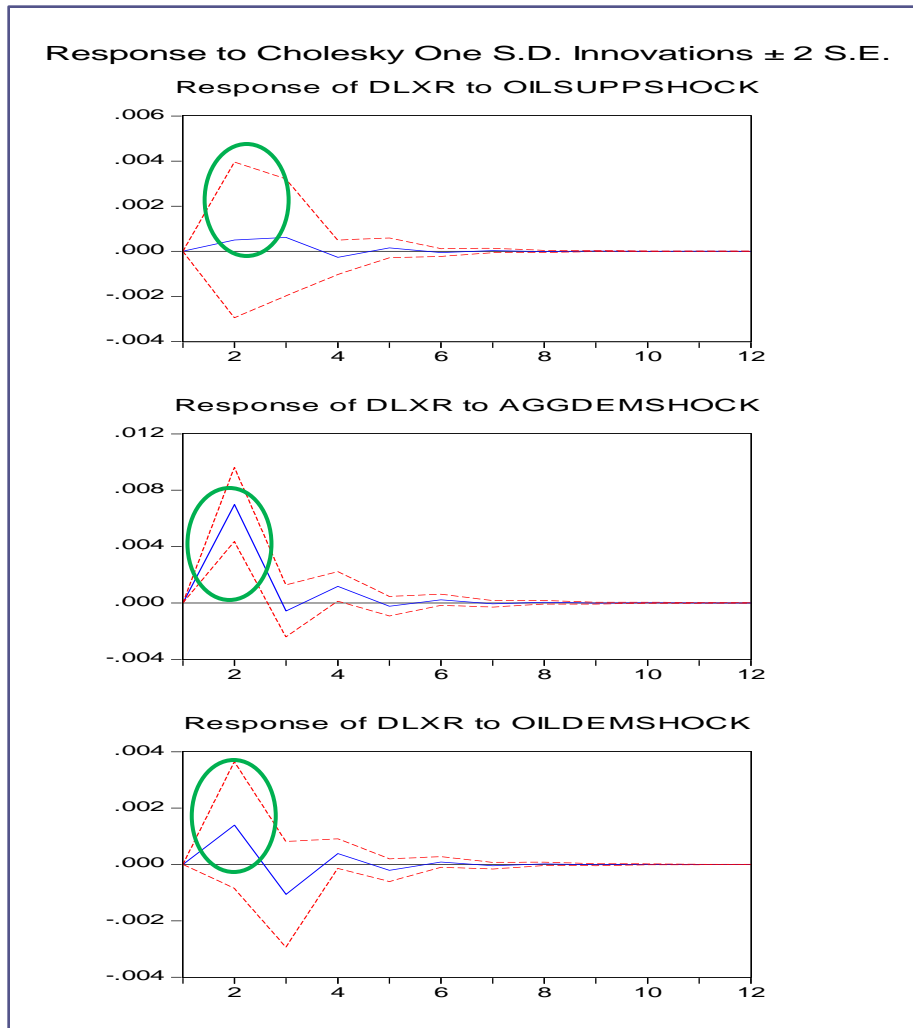
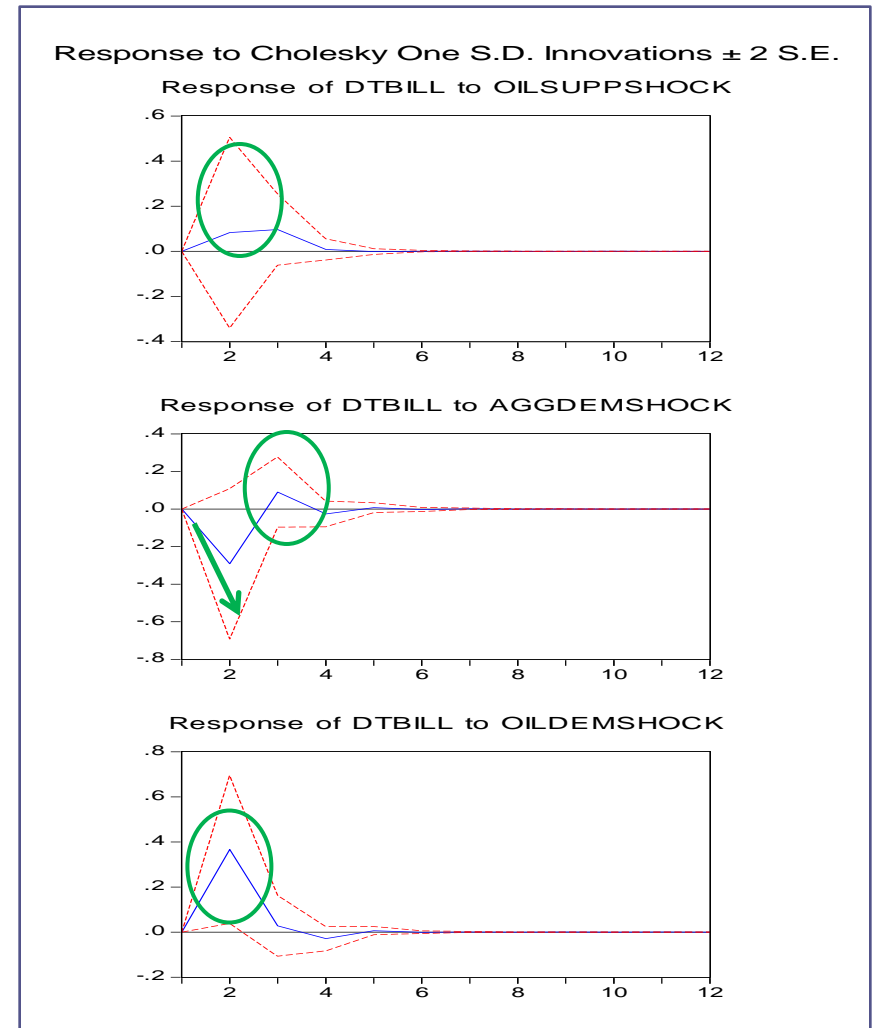
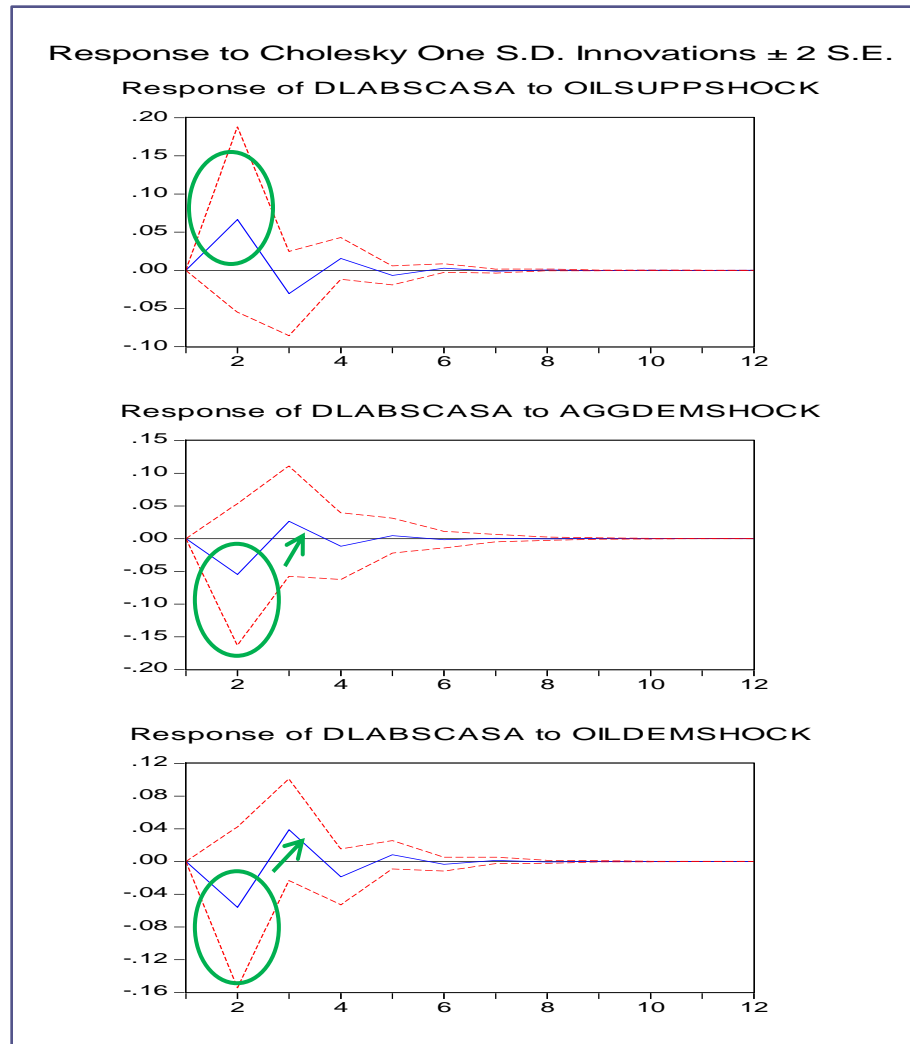


Figure 4: Response of interest rate



Discussion of Results

Figure 5: Response of current account



Discussion of Results

	Real GDP	Inflation	Interest Rate	Exchange rate	Current Account Deficit
Oil Supply shock	↓	↓	↑	↑	↑
Aggregate demand shock	↑	↑	↑	↑	↓
Oil-specific demand shock	↓	↑	↑	↑	↓

Concluding Remarks

- Given the exposure of the Jamaican economy to oil price shocks, an analysis of the impact of these disturbances on the major macroeconomic indicators was deemed important.
- Changes in oil prices stemming from increased global aggregate demand generally led to an improvement in domestic macroeconomic variables.
- OS shocks and OD shocks result in an overall deterioration in Jamaica's economy.
- The impact of oil price shocks on the Jamaican macroeconomy were largely temporary.

Policy Implications

- Policy actions should be implemented to augment the impact of an AD shock to oil prices.
- The study recommends that monetary policy initiatives aimed at curtailing the adverse effects of OS and OD shocks be implemented if the policy objectives are threatened.

