

Khadan, Jeetendra

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An econometric analysis of energy revenue and government expenditure shocks on economic growth in Trinidad and Tobago

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Jeetendra Khadan

Inter-American Development Bank
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CET@iadb.org

Jeetendra Khadan: jeetendrak@iadb.org

Abstract¹

Energy revenues represent roughly 45 percent of Trinidad and Tobago's GDP and are highly volatile since it is correlated with the price of oil and gas. Hence, sharp changes in energy prices, whether temporary or sustained, can have important consequences for economic growth and overall macroeconomic performance. After the 2014 crash in oil prices, a key challenge that emerged for policymakers in hydrocarbon exporting countries is how to manage fiscal retrenchment in an environment of subdued growth. Using structural vector autoregression, this article examines three questions related to this challenge by focusing on Trinidad and Tobago: (1) what is the asymmetric effect of energy revenue shocks on macroeconomic performance, (2) what is the asymmetric effect of energy revenue shocks on government expenditure (disaggregated by categories), and (3) what is the effect of government expenditure shocks (disaggregated by categories) on economic growth. The results suggest that although positive energy revenue shock increases growth almost immediately, it is not sustained. A negative energy revenue shock is found to have a greater adverse effect on primary expenditure than a positive shock and this largely occurs through a reduction in capital expenditure. Transfers and subsidies, and goods and services are the most sensitive components of current expenditure to positive energy shocks. With respect to the effect of expenditure on growth, transfers and subsidies significantly reduce growth in the short run, whereas other categories of expenditure are found to have a largely positive effect on growth. These findings suggest three important implications for policymakers: the first, is to reduce and or reorient public expenditure away from transfers and subsidies and towards more growth-enhancing areas; the second is the need for clear fiscal rules, and to more effectively balance the role of fiscal policy as a growth stimulus while also performing other social functions; and thirdly, these results bring into sharp focus the effectiveness of the rules of the country's stabilization fund to manage windfall energy revenues.

Keywords: energy revenue shocks; government expenditure, structural vector autoregressive models; Trinidad and Tobago

JEL Classification: E32; E37; Q33

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1. Introduction

Economic growth in resource-dependent countries tends to be highly correlated with changes in commodity prices. Growth in the energy sector typically accelerates during periods of high energy prices and in some cases has an expansionary effect on the nonenergy sector. However, being resource-dependent increases one's vulnerability to external shocks, more so if the resource wealth that is generated during the boom periods is not managed optimally. In energy-dependent countries, fiscal vulnerabilities are further amplified as a result of volatility in energy prices, which translates to unstable revenue flows. In addition, the procyclical nature of fiscal policy induces inflationary pressures in the economy, which can cause an appreciation of the real effective exchange rate (REER) and undermine the competitiveness of the nonenergy sector. The terms of trade and external accounts are highly sensitive to energy price shocks given that energy generally contributes to a significant share of total exports and foreign exchange earnings. Large and long-lasting adverse energy price shocks could further tighten the fiscal space of countries and can potentially widen fiscal deficits and raise public debt levels. Such outcomes can have long-term consequences for sustainable growth and steer countries off their development path.

Marked fluctuations in commodity prices are generally hard to forecast, and this uncertainty constrains development planning from a policymaker's perspective. To mitigate risks associated with volatility in revenue flows, some resource-abundant countries have established stabilization funds. The aim of stabilization funds is usually to smooth consumption, increase savings, and reduce the effect of revenue volatility on the country's fiscal accounts. However, research has shown that the effectiveness of stabilization funds also depends on the quality of institutions and may not itself contribute to greater fiscal discipline (Frankel, Vegh, and Vuletin 2012; Asik 2013).

An important debate in the literature is whether commodity price shocks are asymmetric. Most studies tend to implicitly assume that the effect of energy price shocks on macroeconomic variables is symmetric (see Eltony and Al-Awadi 2001; Ayadi 2005; Husain, Tazhibayeva, and Ter-Martirosyan 2008). Herrera, Lagalo, and Wada (2011) investigated this issue further using a sample of Organisation for Economic Co-operation and Development countries but found very little evidence to concur with previous findings that the response of industrial production to positive and negative energy price shocks is asymmetric. In a study of six energy-exporting developing countries, however, Moshiri and Banihashem (2012) found that fiscal policy is related to the asymmetric effects of energy price shocks. These authors noted that not only do

positive and negative energy shocks take different transmission paths, but that positive energy price shocks do not lead to sustained economic growth, while a negative energy price shock results in economic stagnation in four of the six countries examined. Other studies have concurred with the view that the relation between energy price shocks and gross domestic product (GDP) is asymmetric in nature (see, for example, Mork, Olsen, and Mysen 1994; Bernanke, Gertler, and Watson 1997; Bernanke 2006).

This paper considers the case of a small hydrocarbon-dependent economy, Trinidad and Tobago, to investigate the effect of energy revenue shocks on output and government expenditure and the effect of the latter on economic growth. Trinidad and Tobago is an interesting case study because it has benefited enormously from the 2002–08 commodity boom. Energy revenues during the boom period grew rapidly alongside fiscal expenditure and robust economic growth. Since the 2008 crash in energy prices and the global financial crisis, the economy has been struggling to balance its fiscal accounts and return to pre-2008 growth levels. To further aggravate this situation, in the last quarter of 2014, energy prices plummeted again by more than 55 percent, much below the level required to meet the country's budgetary needs. Although this situation presents an immediate challenge for policymakers, there is another emerging longer term challenge of increased uncertainty in the global energy industry as it relates to competition from shale oil and gas. The realization of such a situation increases the level of volatility in the government's revenues and further exposes the economy to risks associated with revenue shocks.

Hence, one of the main questions facing policymakers is how to manage fiscal retrenchment without compromising growth prospects in an environment of already subdued growth. This paper examines this issue by estimating the following econometric models: first, the effects of positive and negative energy revenue shocks on output, consumer prices, expenditure and the REER using a structural vector autoregressive (SVAR) model; second, the sensitivity of the various categories of primary expenditure to energy shocks are estimated in separate SVARs and third, the paper estimates the effects of different types of expenditure shocks on GDP growth. The findings from these models indicate that fiscal policy is one of the main transmission paths of energy shocks to the macroeconomy. However, the main part of current expenditure (that is, transfers and subsidies), which is also highly sensitive to positive energy shocks, has a negative effect on GDP growth in the short run. The remainder of the paper is outlined as follows: the next section outlines the data and estimation strategy, results, and conclusion.

2. Data and Estimation Strategy

Data

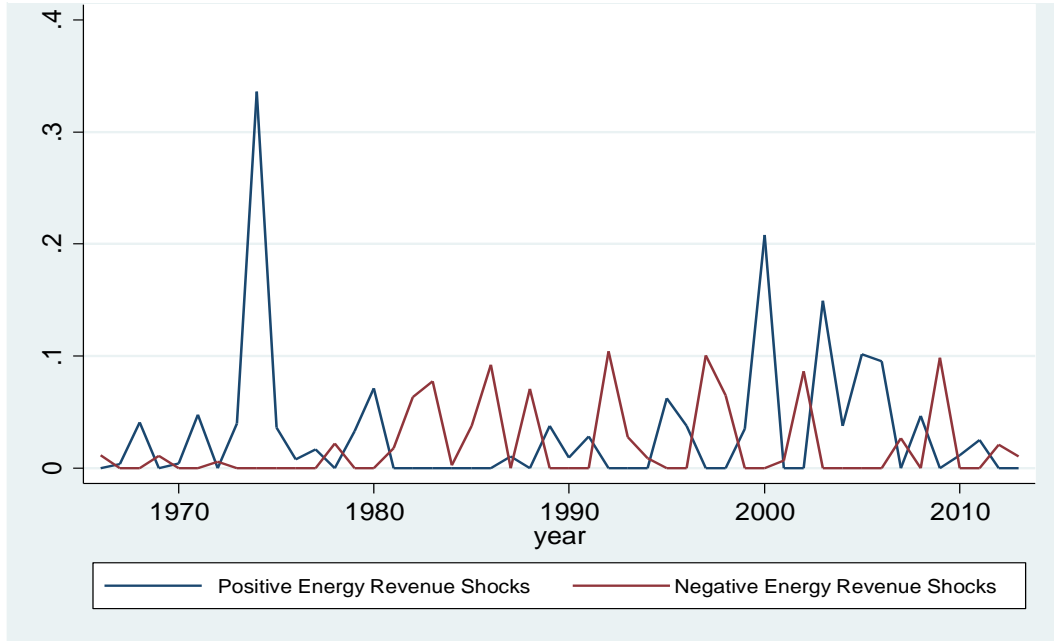
This section describes the data and methods used to estimate the dynamic relation among energy revenue shocks, economic growth and primary government expenditure. The variables included in the model are real positive and negative energy revenue shocks, real GDP, consumer prices, the REER, and the real primary government expenditure. Annual data for the period 1966–2013 are used for the analysis. Data for real energy revenues (which include revenues from the energy sector) and government expenditure were derived from the *Handbook of Key Economic Statistics* for Trinidad and Tobago. The REER, real GDP, and the consumer price index were sourced from the World Bank. The approach developed by Mork (1989) was used to construct measures for positive and negative energy revenue shocks. These measures are defined as follows:

$$poser = \max(0, \Delta \ln rev_t)$$

$$neger = -\min(0, \Delta \ln rev_t)$$

where $\ln rev$ is the natural logarithm of real energy revenue in constant local currency, $poser$ refers to a positive energy revenue shock, and $neger$ refers to a negative energy revenue shock. Figure 1 shows the estimates for the positive and negative energy revenue shocks.

Figure 1. Positive and Negative Energy Revenue Shocks



Source: Author's calculations.

Estimation Strategy: Structural Vector Auto-Regression

A SVAR model is used to estimate the dynamic relation among the variables. A K -variable reduced form VAR model can be written as follows:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t \quad (1)$$

y_t is a $K \times 1$ vector of endogenous variables, $y_t = (\text{POSER}, \text{NEGER}, \text{RPGEXP}, \text{CPI}, \text{RGDP}, \text{REER})$,²

A_i 's are the $K \times K$ coefficient matrices;

p denotes the lag length of the VAR model;

u_t is a $K \times 1$ vector of residuals which follow a white noise process.

The SVAR model, which allows us to identify the structural innovations that induce the effects of structural shocks on the variables in the system, typically takes the following form:

² POSER = positive energy revenue; NEGER = negative energy revenue; RPGEXP = real primary government expenditure; CPI = consumer price index; RGDP = real gross domestic product; REER = real effective exchange rate.

$$Ay_t = A_1^* y_{t-1} + \dots + A_p^* y_{t-p} + \varepsilon_t \quad (2)$$

Equation (2) is premultiplied by A^{-1} to yield the reduced form of (1) where u_t can now be written as a linear combination of structural shocks, which relates the reduced form residuals u_t to the underlying structural shocks ε_t :

$$u_t = A^{-1} \varepsilon_t = B \varepsilon_t$$

To determine the unknowns in matrix B, $K(K-1)/2$ additional restrictions are required. Economic theory is used to impose a set of overidentifying restrictions on B. Considering that the model has six variables; the restrictions on matrix B are outlined in the following equations:

$$b_{13} \varepsilon^{CPI} = b_{14} \varepsilon^{REER} = 0$$

$$b_{21} \varepsilon^{RGDP} = b_{23} \varepsilon^{CPI} = b_{24} \varepsilon^{REER} = 0$$

$$b_{31} \varepsilon^{RGDP} = b_{34} \varepsilon^{REER} = 0$$

$$b_{41} \varepsilon^{RGDP} = b_{42} \varepsilon^{RPGEXP} = 0$$

$$b_{51} \varepsilon^{RGDP} = b_{52} \varepsilon^{RPGEXP} = b_{53} \varepsilon^{CPI} = b_{54} \varepsilon^{REER} = b_{56} \varepsilon^{NEGER} = 0$$

$$b_{61} \varepsilon^{RGDP} = b_{62} \varepsilon^{RPGEXP} = b_{63} \varepsilon^{CPI} = b_{64} \varepsilon^{REER} = b_{65} \varepsilon^{POSER} = 0$$

The first equation shows that in energy-exporting economies, output shocks, government expenditure shocks, and energy shocks have large effects on growth, so restrictions are imposed on the REER and the consumer price index. The second equation refers to government expenditure: zero restrictions are placed on output, consumer price index, and the REER. For the consumer price index equation, restrictions are imposed on output and the REER. For the REER index equation, restrictions are placed on government primary expenditure and output. Positive and negative energy shocks specifications are introduced as exogenous variables, that is, none of the variables can affect the energy shocks. By these restrictions, we have an overidentified SVAR.

$$B = \begin{bmatrix} b_{11} & b_{12} & 0 & 0 & b_{15} & b_{16} \\ 0 & b_{22} & 0 & 0 & b_{25} & b_{26} \\ 0 & b_{32} & b_{33} & 0 & b_{35} & b_{36} \\ 0 & 0 & b_{43} & b_{44} & b_{45} & b_{46} \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix}$$

3. Empirical Results

Unit Root Test without Structural Breaks

The use of time series estimators requires that the properties of each variable be examined for stationarity, which will have an influence on the choice of estimator. Knowledge of whether a variable is stationary or not is important in time series analysis, since a shock to a stationary series will die out gradually, but a shock to a nonstationary series may have an infinite effect (Cochrane 2005). The unit root tests used in this paper are the Augmented Dickey–Fuller (ADF) test (1979), Phillips–Perron (PP) test (1989), the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test (1992), the Zivot and Andrews test (1992), and Clemente and colleagues (1998) test to account for structural breaks.

The ADF and PP test statistics test a null hypothesis that the variable has a unit root (see Phillips and Perron 1988, and Dickey and Fuller 1976). On the other hand, the KPSS test examines a null hypothesis that the series follows a stationary process around a deterministic trend. The critical values of the KPSS test statistic are provided in Table 1 of Kwiatkowski and colleagues (1992, p. 166). A rejection of the null hypothesis implies that the time series is characterized as having a unit root with a constant. The results of these tests are provided in Table 1 and show that each variable has a unit root, except for positive and negative energy revenue shocks.

Table 1. Unit Roots Without Structural Breaks

Variables	ADF (Levels)	ADF (First Difference)	PP (Levels)	PP (First Difference)	KPSS (Levels)	KPSS (First Difference)
Real energy revenue	−1.69 I(1)	−5.88 I(0)	−1.81 I(1)	−5.88 I(0)	0.11 I(0)	0.11 I(0)
Positive energy revenue shock	−6.03 I(0)	−9.00 I(0)	−6.00 I(0)	−21.49 I(0)	0.09 I(0)	0.06 I(0)
Negative energy revenue	−7.07 I(0)	−7.51 I(0)	−7.07 I(0)	−27.31 I(0)	0.39 I(0)	0.21 I(0)

shock

Primary government expenditure	-1.42 I(1)	-7.37 I(0)	-1.42 I(1)	-7.36 I(0)	0.81 I(1)	0.10 I(0)
Consumer price index	-1.59 I(1)	3.00 I(0)	-0.21 I(1)	-2.90 I(0)	0.86 I(1)	0.15 I(0)
Real GDP	-0.56 I(1)	-4.28 I(0)	-1.00 I(1)	-4.09 I(0)	0.87 I(1)	0.09 I(0)
REER	-0.87 I(1)	-6.18 I(0)	-1.21 I(1)	-6.18 I(0)	0.29 I(0)	0.14 I(0)

Note: The results of the ADF, PP, and KPSS test statistics were compared with the critical value of each test at the 5 percent level under the assumption of trend only, and trend and intercept. ADF = Augmented Dickey–Fuller; GDP = gross domestic product; KPSS = Kwiatkowski-Phillips-Schmidt-Shin; PP = Phillips–Perron; REER = real effective exchange rate.

Source: Author's calculations.

Unit Roots with Structural Breaks

The presence of structural breaks in a time series can influence the results of unit root tests. Structural breaks in a series can occur because of some unique economic event such as institutional, legislative, or technical change, economic policy or some large economic shock (Nilsson 2009 and Glynn, Perera and Verma, 2007). In this section, two endogenous structural break tests are applied to the variables in the model. These include the Zivot and Andrews and the Clemente, Montañés, and Reyes tests.

Zivot and Andrews (1992) proposed a structural break test, which allows for the testing of a unit root with one endogenously determined structural break. The Zivot and Andrews test is a sequential test that uses the full sample of information and different dummy variables for each possible break date. The test considers three potential alternatives where a structural break impacts the intercept only, the trend only and both trend and intercept. This tests a null hypothesis that the series contains a unit root without a structural break against the alternative where the series is stationary, which includes a one-time break at an unknown time. The objective of the test is to locate a break point that most supports the alternative hypothesis. The break point is determined where the evidence against the null hypothesis is the strongest, that is, where the t statistic from the ADF test is at a minimum.

The results from the Zivot and Andrews tests are presented in the Table 2. For each variable, the null hypothesis of a unit root cannot be rejected despite the inclusion of a break in the series. With respect to energy revenues, the Zivot and Andrews test selected the break date under the assumption of intercept only and intercept and trend null hypothesis as 1985 and 1982, respectively. This period relates to the major oil price crash, which occurred when the price of oil declined from US\$30 per barrel in 1983 to US\$15 dollars per barrel in 1989. Under

the trend assumption, the break date was selected as 1998 which coincided with the oil price crash of 1998 (30 percent fall year-on-year) and saw oil prices reach their lowest levels since 1986 at that time. These adverse shocks to oil prices have had a major effect on the macroeconomy of Trinidad and Tobago. Real growth and other key macroeconomic indicators during those periods were adversely affected. It is not surprising that the Zivot and Andrews tests identified possible breaks to the other variables in the model during that same period. Although possible break points were identified, it was found that under the three assumptions, there was insufficient evidence to reject the null hypothesis of a unit root.

Table 2. Zivot-Andrews Unit Root Test with One Structural Break

	Intercept		Trend		Intercept and Trend	
	<i>t</i>	Break Point	<i>t</i>	Break Point	<i>t</i>	Break Point
Real energy revenue	-2.83	1985	-2.15	1998	-2.99	1982
RGDP	-4.37	1983	-3.17	1994	-4.49	1983
RPGEXP	-3.51	1986	-2.75	1999	-3.60	1983
REER	-3.04	1986	-2.09	2005	-3.52	1986
CPI	-2.88	1974	-4.08	1984	-3.78	1987
Critical value (5%)	-4.48		-4.42		-5.08	

Note: CPI = consumer price index; REER = real effective exchange rate; RGDP = real GDP; RPGEXP = real primary government expenditure, *t* = *t*-statistic.

Source: Author's calculations.

Table 3. Unit Root Test with Two Structural Breaks

	Additive Outlier Model		Innovative Outlier Model	
	<i>t</i>	Break Point	<i>t</i>	Break Point
Real energy revenue	-2.372	1987, 2002	-2.959	1983, 2001
RGDP	0.135	1983, 2009	-2.732	1974, 2000
RPGEXP	-2.579	1980, 2009	-3.493	1972, 1981
REER	-3.572	1985, 2003	-3.789	1986, 2006
CPI	-2.509	1981, 1995	-4.738	1971, 2004
Critical value (5%)	-5.49		-5.49	

Note: CPI = consumer price index; REER = real effective exchange rate; RGDP = real gross domestic product; RPGEXP = real primary government expenditure, *t* = *t*-statistic.

Source: Author's calculations based on Clemente et al. (1998).

The CMR (1998) tests for one and two structural breaks using two models. The first model assumes that the structural break takes effect instantaneously, that is, a sudden shift in the mean of the series, known as the additive outlier model. The other model, which is referred to as the innovative outlier assumes that there is a gradual shift in the mean of the series. Both models test a null hypothesis that the series has a unit root with structural break(s) against the alternative that they are stationary with break(s). The results in Table 3 show that although the tests identify potential structural breaks, there is insufficient evidence to reject the null hypothesis of a unit root. The additive outlier model identified breaks for real energy revenues at 1983 and 2009, the years that represented the end of the two energy booms experienced by Trinidad and Tobago. In 2009, oil prices plummeted by more than 36 percent from the previous year, which marked the end of the 2002–08 commodity boom. The first break was in 1983, which also marked the end of the 1973–82 commodity boom. Similarly, government expenditure breaks were identified for the years 1980 and 2009. In 1980, oil prices reach the highest level of US\$36 dollars (US\$102 in 2012 dollars) following the 1973 and 1979 energy crises. Potential break dates for the REER were identified in 1985 and 2003, while for the consumer price index it was identified in 1971 and 2004.

Optimal Lag Length and Post Estimation Tests

The optimal lag length for each variable in the VAR (p) model is determined by various model selection criteria identified in the literature. Five of these procedures are used to derive an optimal lag length for the VAR models: the sequential modified likelihood ratio test statistic, the final prediction error, the Akaike information criterion, the Schwarz information criterion, and the Hannan-Quinn information criterion. The optimal lag length for each variable in the VAR models is determined by various lag length selection tests and model diagnostics. Three lags were chosen for the underlying SVAR (see Table 4).

Table 4. Optimal Lag Length

Lag	Likelihood	Final Prediction Error	Akaike	Hannan-Quinn	Schwarz
	Ratio Test Statistic		Information Criterion	Information Criterion	Information Criterion
0		9.0E-16	–17.62	–17.52	–17.37*
1	97.18	5.2E-16*	–18.19*	–17.77*	–17.78
2	59.50	7.5E-16	–17.90	–16.73	–14.74

3	77.01*	8.7E-16	-18.02	-16.30	-13.39
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*Optimal lag length based on the respective test.

Source: Author's calculations.

Because the SVAR is overidentified, the validity of the overidentifying restrictions is tested using a likelihood ratio test which tests a null hypothesis that any overidentifying restrictions are valid. The results indicate that the null hypothesis cannot be rejected with $p = 0.533$ ($\chi^2(4) = 3.15$). The matrix of contemporaneous coefficients is subsequently provided. The results show that the effect of a negative energy revenue shock on the growth is negative, as expected, and has a larger effect when compared with a positive energy revenue shock; however, in both cases, they are statistically nonsignificant. In contrast, energy revenue shocks to real expenditure are positive and statistically significant. The results show that the effect on real expenditure is larger for negative shocks than positive shocks.

$$\begin{bmatrix} 0.022*** & 0.015*** & 0 & 0 & 0.001 & -0.008 \\ 0 & 0.058*** & 0 & 0 & 0.024*** & -0.041*** \\ 0 & -0.008 & 0.019*** & 0 & 0.007*** & 0.002 \\ 0 & 0 & 0.04 & 0.062*** & -0.005 & -0.008 \\ 0 & 0 & 0 & 0 & 0.042*** & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.027*** \end{bmatrix}$$

Source: Author's calculations.

5.4 Results from Structural Impulse Response Functions

This section examines the dynamic effects of energy revenue shocks on output, expenditure, prices, and the REER through structural impulse response functions (SIRFs) and forecast error variance decompositions (FEVDs). Panel A shows the effect of positive energy revenue shocks, and panel B shows the results of negative shocks.

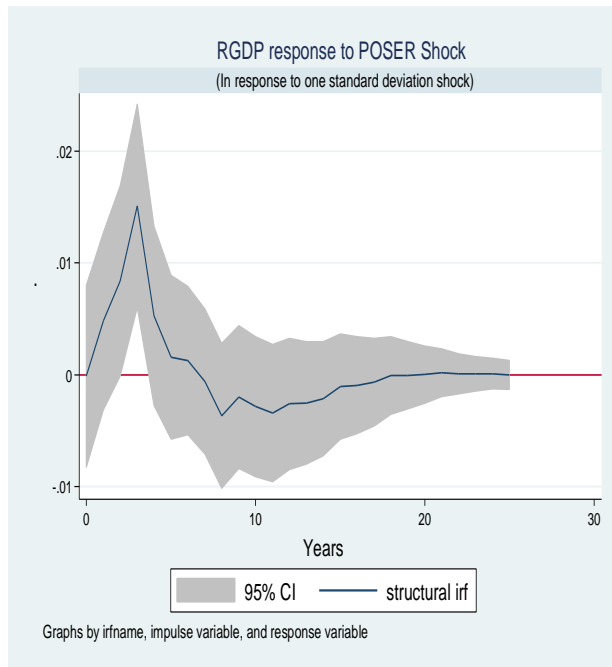
5.4.1 SIRFs: Effect of Energy Shocks on Output, Expenditure, Prices, and the REER

Positive energy revenue shocks to an energy exporting-dependent economy are generally considered to be beneficial because it increases the government's revenue, expenditure, and

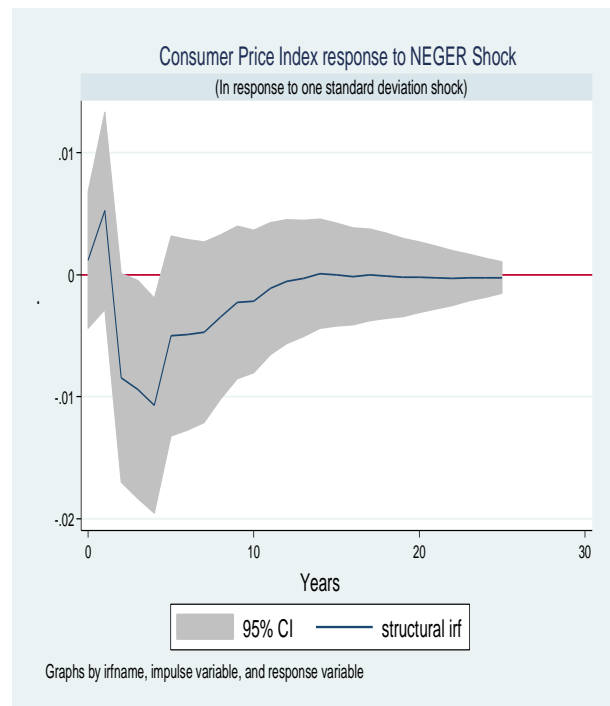
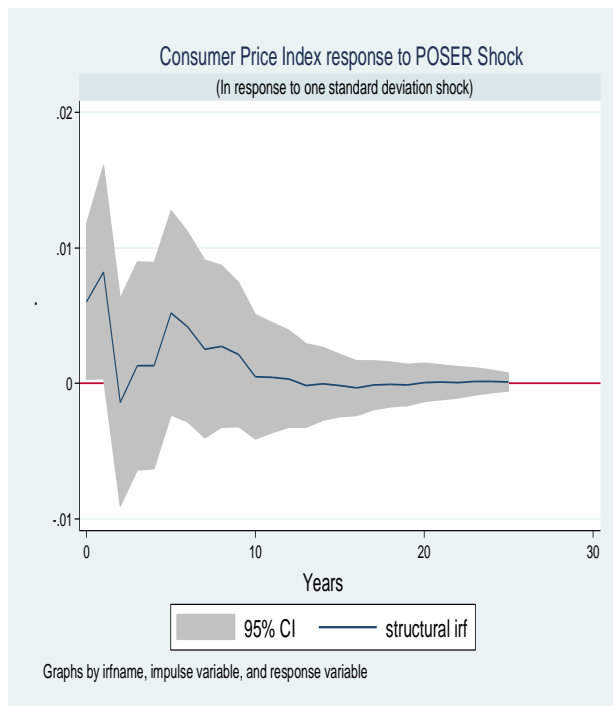
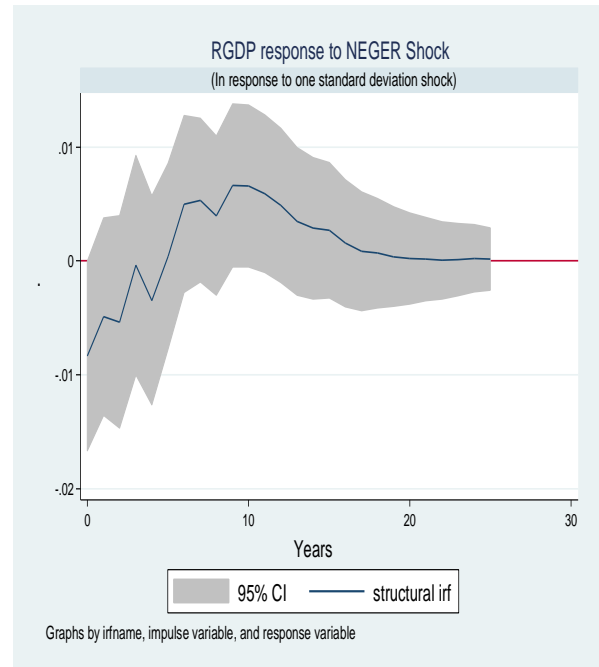
economic activity. For Trinidad and Tobago, the results show that a one standard deviation positive energy revenue shock has a sharp and almost immediate effect on economic activity, with growth increasing by as much as 1.5 percentage points in the third year after the shock. This effect is statistically significant but declines sharply after the third year. With respect to a negative energy revenue shock, the effect on output is statistically nonsignificant but negative for about six years.

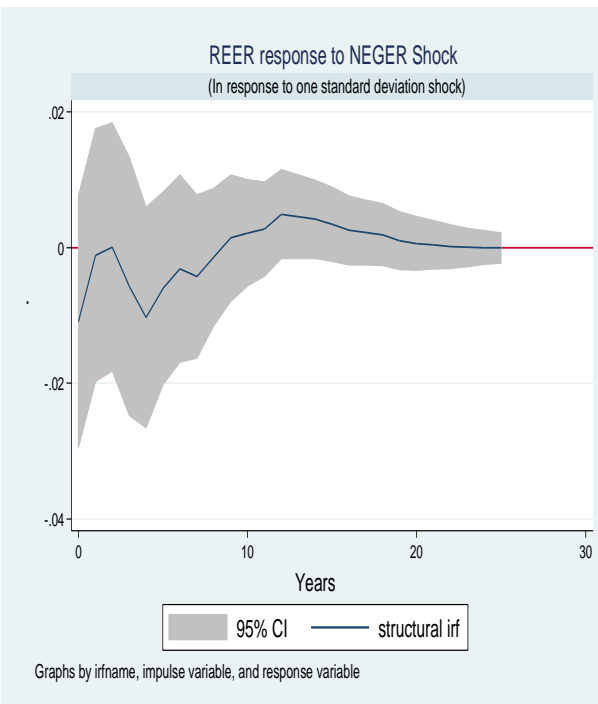
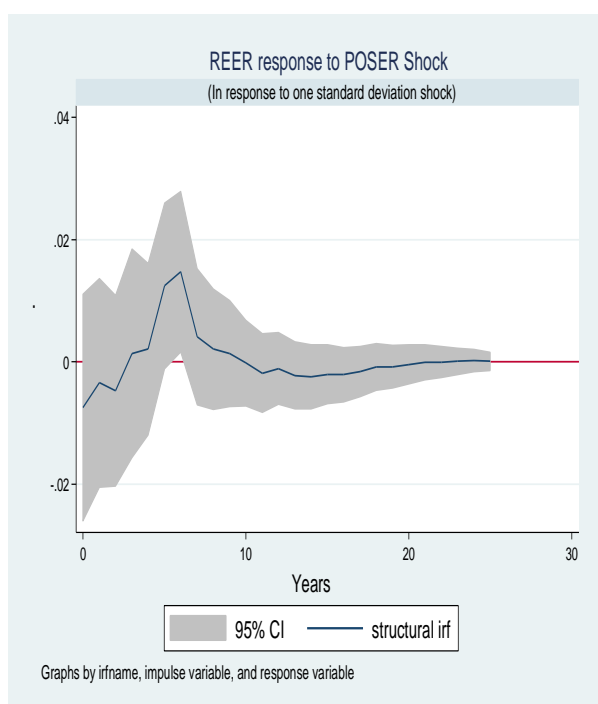
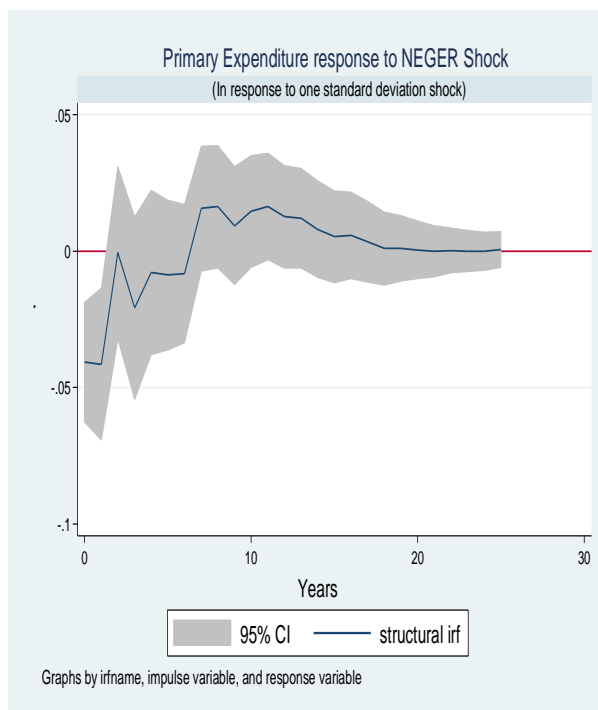
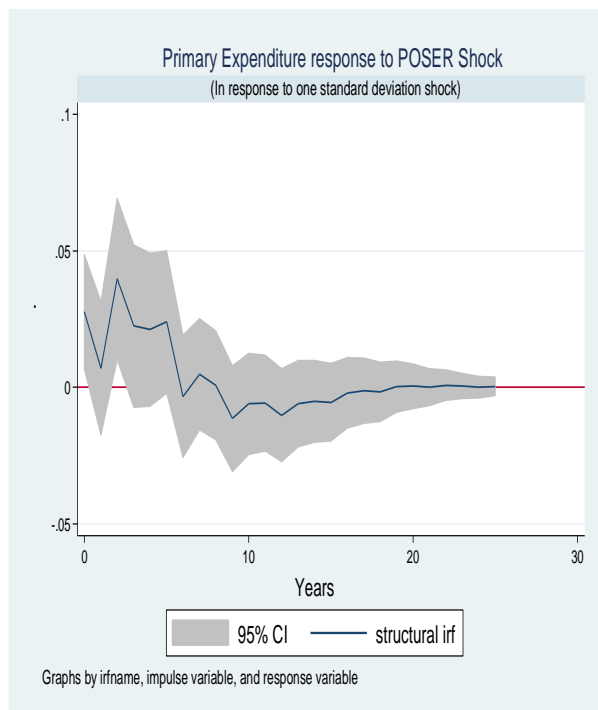
Rising energy prices contribute to inflationary pressures in energy-exporting developing countries (Habermeier et al. 2009). This trend is partly explained by the expansionary fiscal policy stance taken by governments during commodity booms. This paper finds that inflation responds with an immediate and sharp increase after a positive energy revenue shock. A one standard deviation shock increases inflation by 0.8 percentage points with the response remaining positive and statistically significant for the first two years. The rise in inflation resulting from an increase in energy revenue can be explained within the resource movement and spending effect framework espoused by Corden (1984). The resource movement effect relates to the movement of factors of production (particularly labor because of its mobility) between the nonenergy and energy sectors. The spending effect occurs when higher energy revenues lead to increases in wages and purchasing power of consumers, which translates into higher aggregate demand. Because the prices of nontradables are determined within the domestic economy (the price of tradables are assumed to be determined exogenously), the increase in demand for nontradables because of the wealth effect from a positive energy revenue shock pushes up inflation. In contrast, a negative energy revenue shock also increases inflation by 0.5 percentage points in the first year but declines by as much as one percentage point in the fourth year and remains negative for the balance of the period. This suggests that consumers may not be able to adjust their consumption levels instantly to changes in energy revenues, which leads to a disequilibrium in the domestic market that places upward pressure on prices.

Panel A



Panel B





Fiscal policy is one of the main transmission mechanisms of international energy price shocks in energy-producing economies. During periods of rising energy prices, government revenues and expenditures tend to increase rapidly over a short period, but energy revenue declines sharply once energy prices normalize while expenditure tends to remain elevated. In

this context, the procyclicality of fiscal policy in energy-producing countries intensifies the effect of energy price volatility and reduces long-term growth (see Sturm et al. 2009). In the case of Trinidad and Tobago, it is not surprising that a positive energy revenue shock immediately raises real primary expenditure. Primary expenditure responds with an immediate increase of 2.8 percentage points and increases by four percentage points two years after a shock. This effect is, however, only statistically significant in the first, third, fourth, and fifth years. The evidence shows that with respect to primary expenditure, a negative energy revenue shock decreases government spending by 4.2 percentage points one year after a shock, which is highly significant in the first two years and remains negative until the eighth year.

A positive energy revenue shock initially reduces the REER, but after the third year it causes a sharp appreciation, increasing the REER by 1.5 percentage points in the sixth period where the effect becomes statistically significant. This can be explained by the spending effect associated with commodity booms. Higher energy revenues lead to a wealth effect created through higher wages in resource-based and other sectors. With higher incomes, aggregate demand for domestic goods and services increases, which, in turn, pushes up domestic prices as observed previously. The relative increase in domestic prices puts upward pressure on the REER.

These results suggest that the government's policy of saving part of the energy revenues in the Heritage and Stabilization Fund (HSF) since 2007 may not be the most effective mechanism for managing windfall energy revenues (see Williams 2012). A more effective approach could be to use fiscal rules alongside the HSF during periods of positive energy revenue shocks. In this way, the adverse effects of rising domestic prices and REER associated with positive energy revenue shocks can be mitigated.

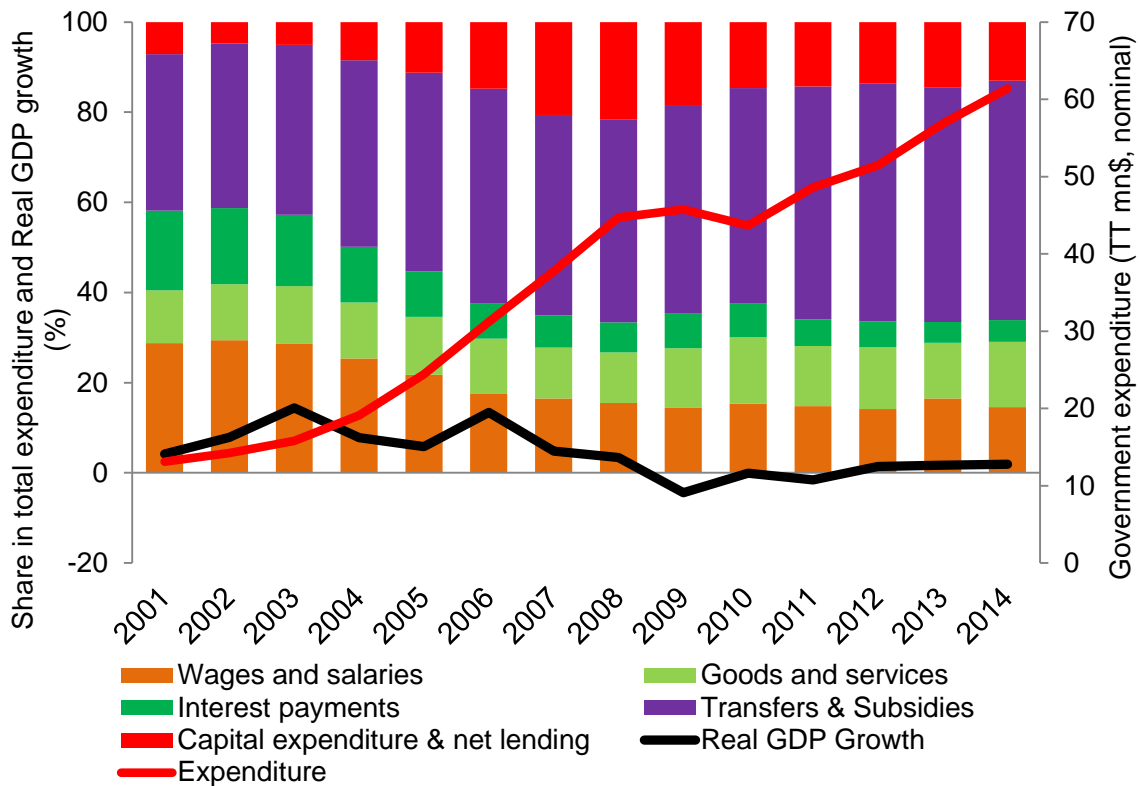
5.4.2 SIRFs: Effect of Energy Shocks on Different Categories of Expenditure

There are two broad categories of government expenditure: capital and current expenditures. *Current expenditures* include wages and salaries, transfers and subsidies, goods and services, and interest payments on debt. *Capital expenditures* refer to government spending on investment goods. Current expenditures are generally sticky downwards as they are required to maintain new and existing investments. For many energy-exporting countries, current expenditure tends to increase rapidly when energy revenues increase; however, when energy revenues normalize, fiscal authorities find great difficulty in reducing current expenditure. In the case of Trinidad and Tobago, data show that the growth in government expenditures since 2002

has been heavily skewed toward transfers and subsidies (see Figure 2). Other categories of expenditure have experienced a decline, particularly capital expenditure and wages and salaries. This general observation shows how vulnerable Trinidad and Tobago's fiscal position is to negative energy revenue shocks because fiscal authorities cannot easily adjust current spending, especially for social functions.

To examine the dynamic effects of energy revenue shocks on the structure of Trinidad and Tobago's government spending, five SVAR models are estimated in this section. The various components of expenditure examined are current expenditure, capital expenditure, transfers and subsidies, goods and services, and wages and salaries. The structural impulse response functions show that capital expenditure decreases more than current expenditure following a negative energy revenue shock. Specifically, a one standard deviation negative energy revenue shock reduces capital expenditure by nine percentage points, while a positive shock increases capital expenditure by six percentage points. A negative energy shock reduces current expenditure by 2.8 percentage points, while a positive energy shock increases it by 0.6 percentage points immediately, and this effect increases by 2.4 percentage points four years after the shock.

Figure 2. Changing Composition of Government Expenditure



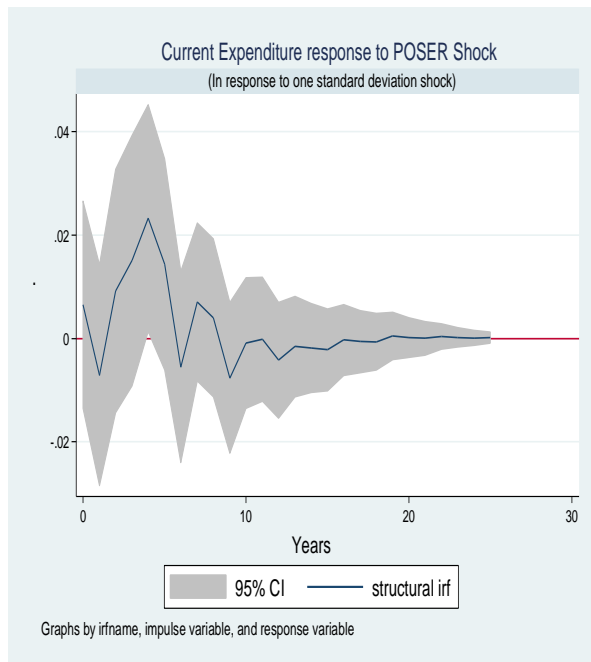
Source: Central Bank of Trinidad and Tobago.

An important transmission mechanism of energy revenue shocks in Trinidad and Tobago is expenditure on transfers and subsidies. In the recent commodity boom, almost 50 percent of the increase in government expenditure was related to transfers and subsidies. Results in panels C and D show that for Trinidad and Tobago, a positive energy shock increases transfers and subsidies by 3.2 percentage points, while a negative energy shock reduces it by 2.4 percentage points. The immediate decline in transfers and subsidies to a negative energy shock can be explained partly by the mechanics of the country's fuel subsidy policy and the nature of transfers. For expenditure on good and services, a positive energy revenue shock raises expenditure by five percentage points, while a negative shock reduces it by two percentage points but increases thereafter and remains largely positive for the balance of the period. The response of wages and salaries to a positive energy revenue shock takes at least two years to increase.

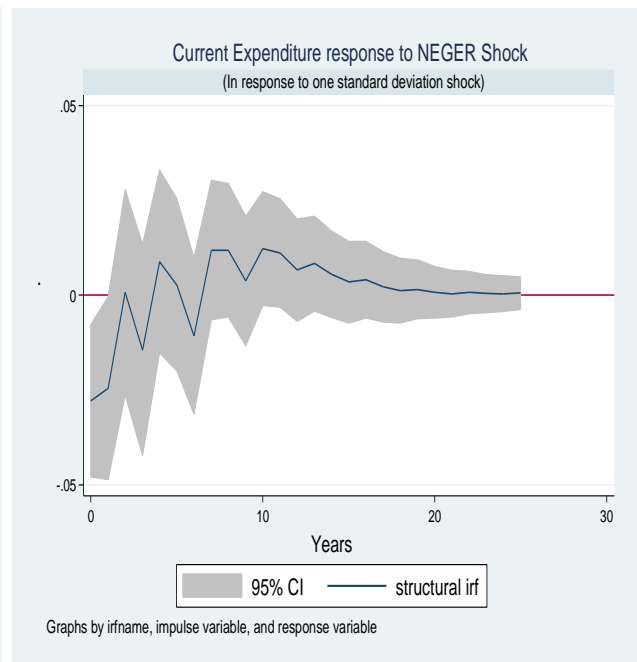
Given the stickiness of the various components of current expenditure, these findings have important policy implications. The evidence implies that while an adverse energy revenue shock may not significantly affect current expenditure and the government's social functions, it can induce macroeconomic risks in the form of fiscal deficits and higher levels of public debt.

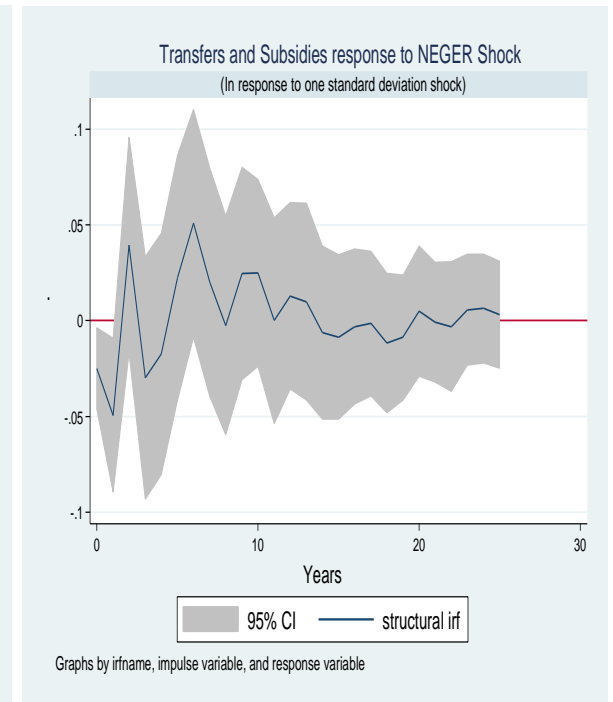
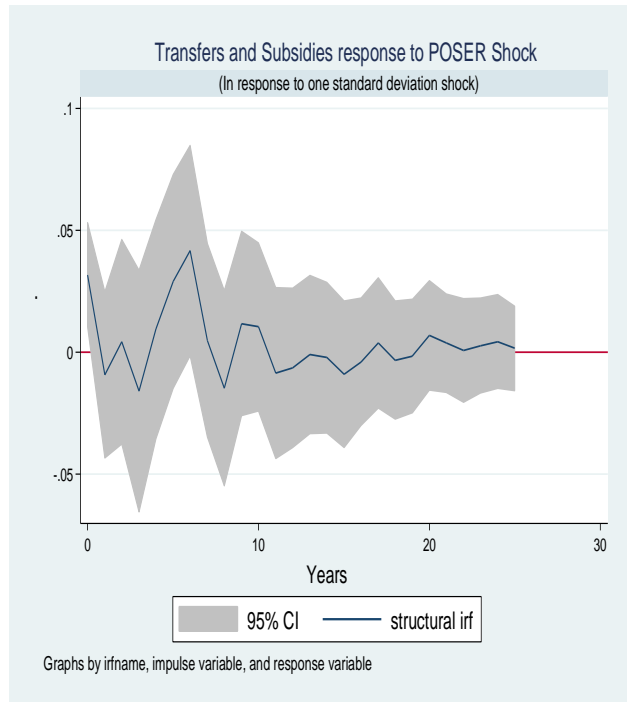
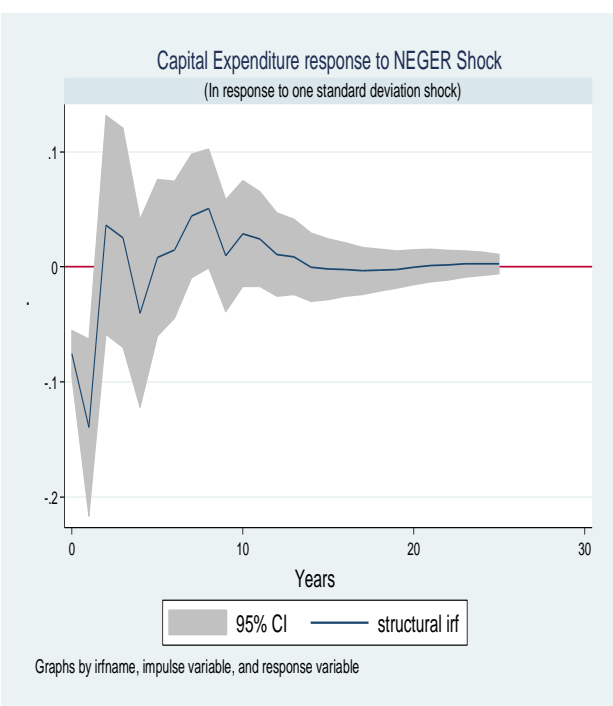
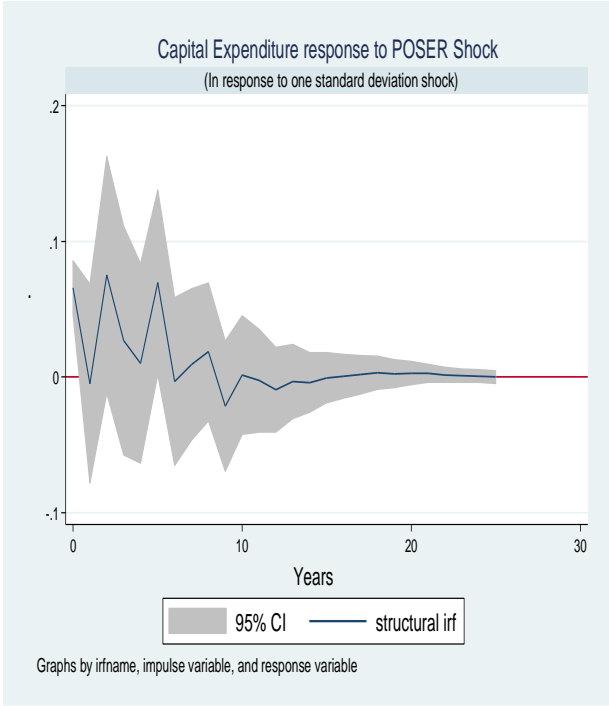
Also, the decline in capital expenditure is very large and has the potential to weaken the country's growth prospects.

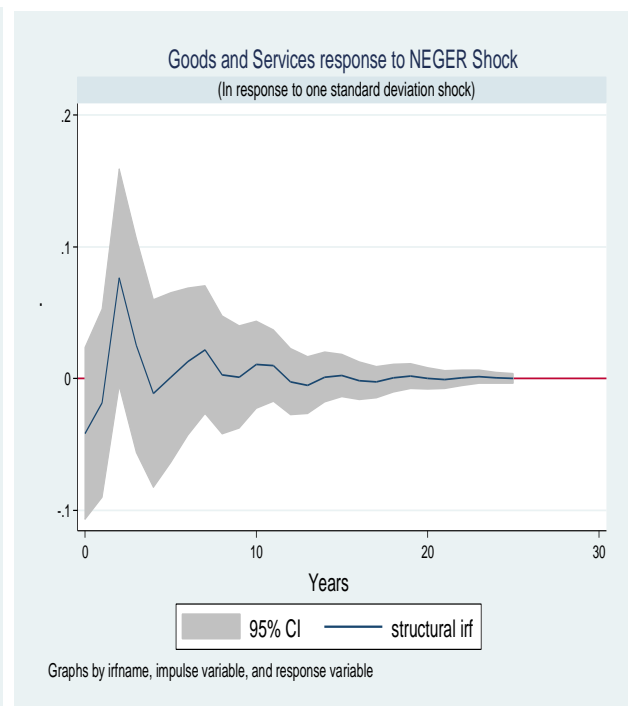
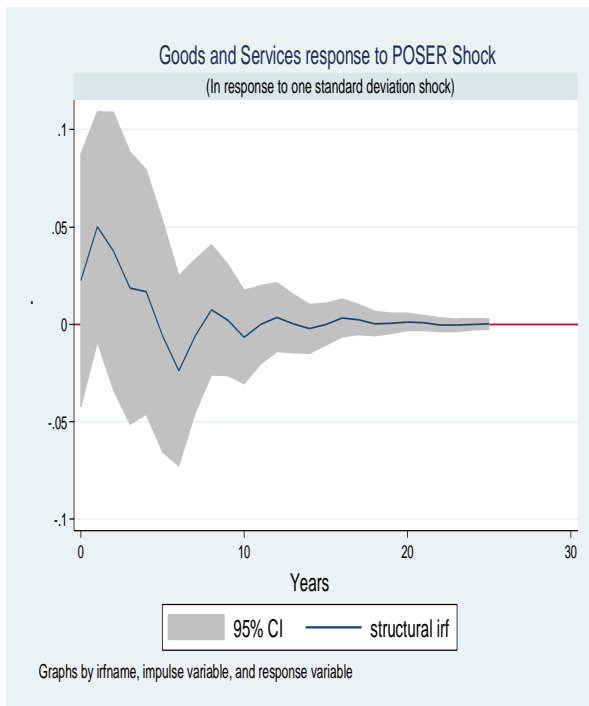
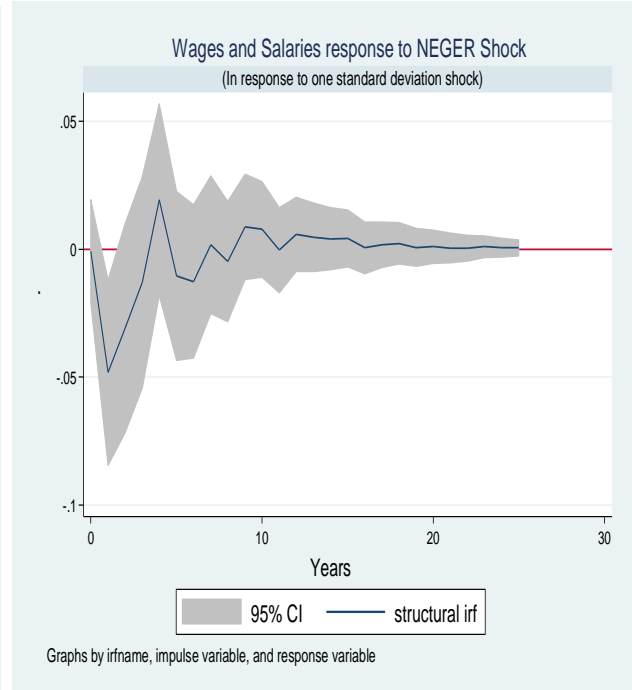
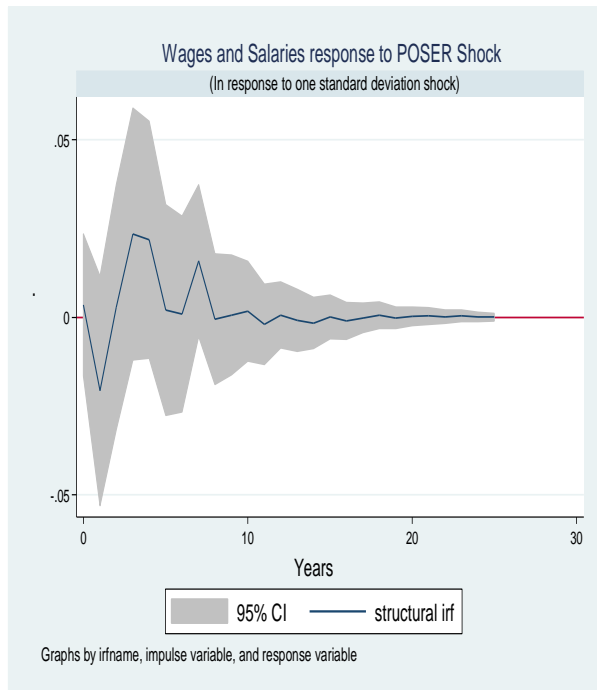
Panel C



Panel D







5.4.3 SIRFs: Effect of Different Categories of Expenditure Shocks on Growth

The literature on the relation between expenditure and economic growth takes two opposing views. On the one hand, the Wagner hypothesis states that public expenditure is an

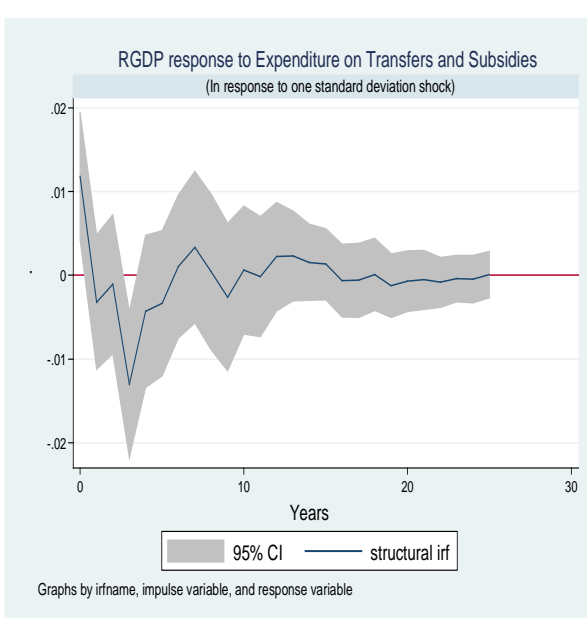
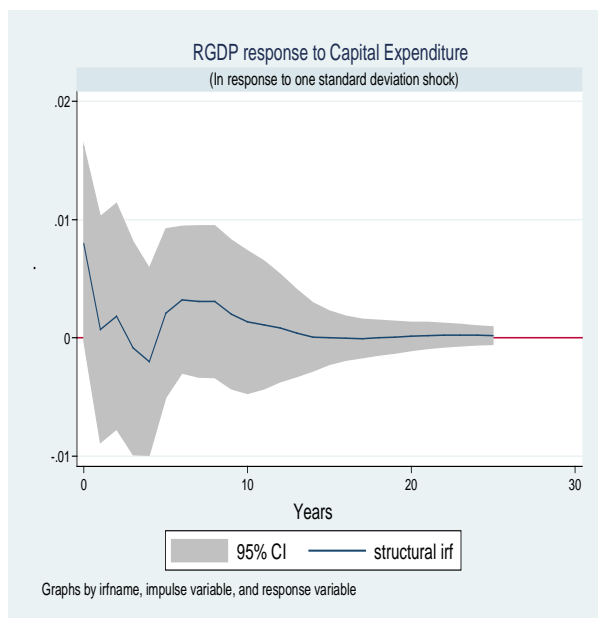
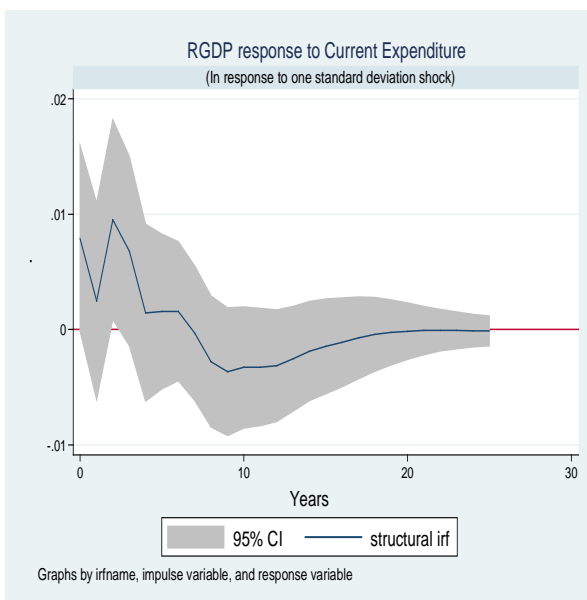
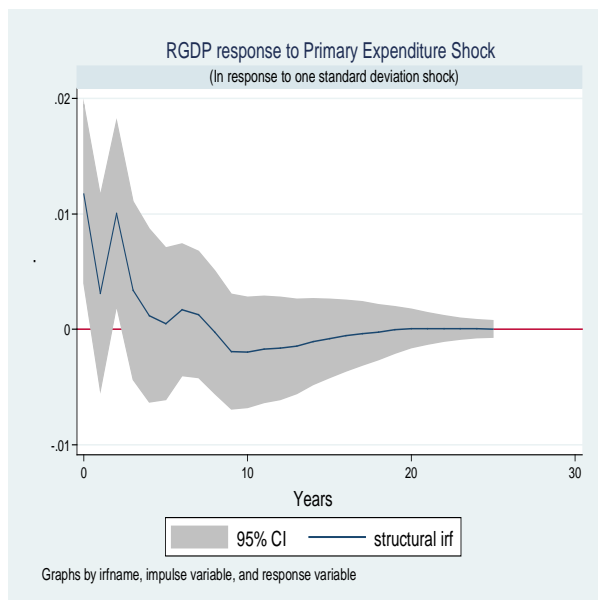
endogenous factor that is positively influenced by economic growth. In contrast, Keynes hypothesized that public expenditure can be an exogenous instrument to stimulate economic growth through its multiplier effect on aggregate demand (Tang, 2008). Although many studies have estimated the relation between public expenditures and economic growth, there is no clear consensus among these studies on the exact relation between these two variables, (see for example, Baum and Lin, 1993; Devarajan et al. 1996; Belgrave and Craigwell, 1995; and Mungroo, Ooft and Sim-Balker, 2013). For Trinidad and Tobago, although government expenditure has grown rapidly over the past decade, growth has remained subdued. Against this backdrop, it is unclear how the dynamics of government outlays affects the country's economic performance. Thus, given the changing composition of government spending observed in the previous section, an important question that arises is how different types of expenditure shocks (which are largely influenced by energy revenue shocks) affect GDP growth.

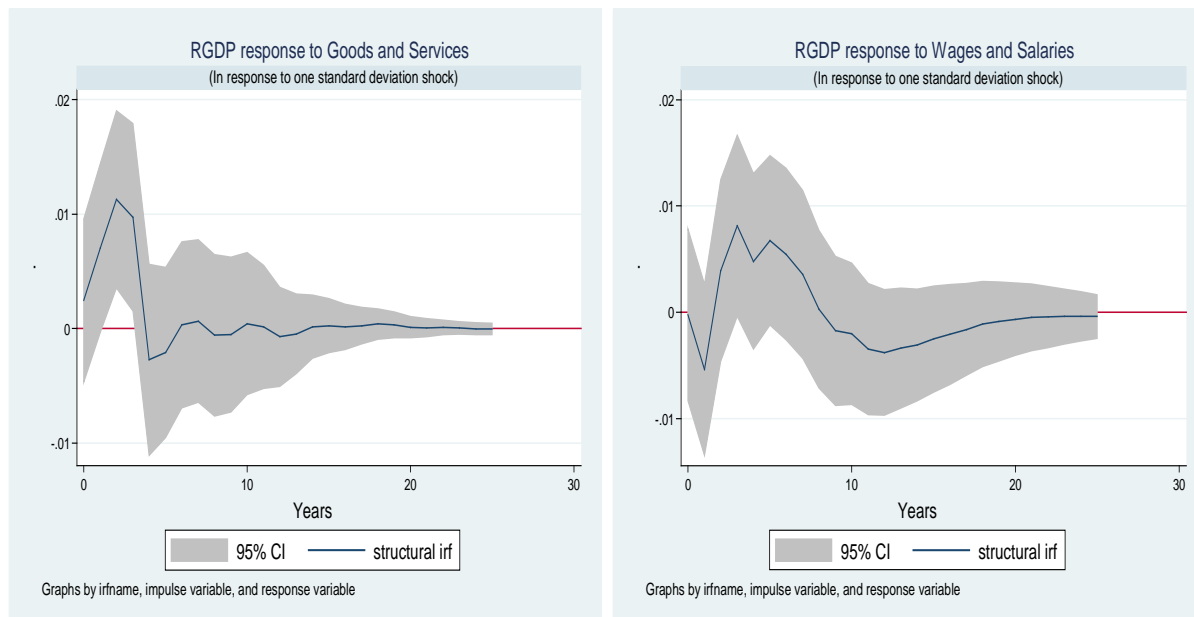
To examine the different types of expenditure shocks on growth, this paper disaggregates total primary expenditure into capital and current, and further separates current into expenditure on transfers and subsidies, wages and salaries, and goods and services. The results suggest that both capital and current expenditure have a positive effect on GDP growth of similar magnitude. However, a shock to expenditure on transfers and subsidies has a positive effect on growth only in the immediate period while leading to a negative effect on growth in the first year after the shock. Specifically, a shock to expenditure on transfers and subsidies leads to an immediate increase in growth by 1.2 percentage points but this effect quickly turns negative and by the third year after the shock it reduces growth by as much as 1.3 percentage points. The immediate increase may be due to increased household incomes and subsequent spending in the retail and distribution sector, but it is not sustained, perhaps because consumption mostly consist of imported goods and services. A shock to capital expenditure raises growth by 0.8 percentage points, and this effect remains largely positive thereafter. The effect of a shock to current expenditure also increases growth by 0.8 percentage points and remains positive for six years. A shock to expenditure on goods and services increases growth by 1.2 percentage points in the second year after the shock.

The evidence obtained from the SVARs have important policy implications as it indicates that the area where the government ramps up expenditure as a result of a positive energy revenue shock (that is, transfers and subsidies) has a negative effect on growth in the short term. This means that a country's fiscal response to a positive energy shock is not growth-enhancing as it is skewed toward unproductive activities. Moreover, the negative externalities

associated with transfers and subsidies on labor productivity and productive economic activities can also set back growth prospects.

Shocks and Simulation results: Expenditure Shocks on Growth





5.5 Forecast Error Variance Decomposition

The forecast error variance decomposition (FEVD) measures the relative contribution of each random shock to other variables in the SVAR and shows how much of the variance of the forecast error is attributable to a specific shock at a given horizon. The FEVD is obtained using the vector moving average representation of the standard VAR. Results from the variance decomposition for RGDP, primary expenditure, consumer price index, and the REER are summarized in Table 5.

Evidence shows that a positive energy revenue shock has a greater effect on RGDP than does a negative energy revenue shock. For example, only 8.4 percent of the variation in RGDP is explained by a negative energy revenue shock in the first year, increasing to almost ten percent in the fifth year after the shock. A positive shock, in contrast, accounts for about 23 percent of its variation in the fifth year, much higher than a negative shock. The difference between both shocks is relatively large and highlights the asymmetric effect of energy shocks on growth. The effect of the REER and inflation accounts for an increasing share of the variation in the RGDP, while the effect of primary expenditure on growth reduces after the third year of the shock.

A negative energy shock accounts for a larger variation in primary expenditure when compared with a positive shock. Initially, a positive energy shock accounts for 11 percent of the variation in expenditure, which decreases to 8 percent in the second year after the shock. A

negative shock, however, initially accounts for 24 percent of the variation in expenditure and increases to 35 percent in the second year before declining marginally thereafter to 25 percent in the fifth year. Positive energy revenue shocks initially account for about 9 percent of the variation in inflation and decreasing slightly to 8 percent five years after shock, while a negative shock accounts for about 22 percent of its variation in the fifth year. With respect to the REER, only a small share of its variation is explained by other variables in the model. Negative energy shocks account for about five percent of its variation five years after the shock, while positive energy shocks account for two percent of its variation.

Table 5. Forecast Error Variance Decomposition

	Real GDP (%)	Primary Expenditure (%)	CPI (%)	REER (%)	Positive Energy Revenue Shock (%)	Negative Energy Revenue Shock (%)
Real GDP						
1	74.91	16.66	0.00	0.00	0.00	8.43
2	71.71	15.56	0.13	0.27	2.44	9.89
3	59.60	20.80	0.72	0.81	7.82	10.25
4	49.16	17.71	1.79	1.02	21.95	8.36
5	48.04	17.06	2.06	1.20	22.84	8.80
Real Primary Government Expenditure						
1	0.00	65.45	0.00	0.00	10.92	23.63
2	5.75	47.59	0.04	3.80	8.31	34.51
3	12.24	36.29	5.49	2.95	17.81	25.22
4	11.89	34.24	5.46	3.19	19.49	25.73
5	11.50	33.84	5.42	3.26	21.26	24.71
Consumer Price Index						
1	0.00	26.17	64.27	0.00	9.20	0.36
2	6.61	18.63	55.11	4.22	12.08	3.36
3	5.61	15.97	54.50	3.58	10.45	9.89
4	6.05	14.56	49.06	4.74	9.27	16.31
5	6.49	13.94	42.89	6.23	8.04	22.40
Real Effective Exchange Rate						
1	0.00	0.02	0.06	95.62	1.37	2.93
2	1.62	0.66	0.07	93.28	1.57	2.80
3	2.37	0.80	0.25	91.77	2.05	2.75
4	9.94	5.15	0.22	79.83	1.82	3.04
5	10.23	5.09	0.39	77.46	1.84	4.98

Source: Author's calculations.

6. Conclusion and Policy Implications

This paper looked at three issues related to energy revenue shocks, expenditure and growth for the Trinidad and Tobago economy. These include; (i) the asymmetric effect of energy revenue shocks on output, prices, primary expenditure and the real effective exchange rate; (ii) the asymmetric effect of energy revenue shocks on different categories of expenditure and (iii) the effect of expenditure shocks (disaggregated by categories of expenditure) on economic growth. The methodology employed to conduct the various analyses is a structural VAR model.

The main findings show that a positive energy revenue shock increases growth, domestic prices, primary expenditure and the real exchange rate in the short term. On the other hand, a negative energy revenue shock is found to reduce growth, primary expenditure and the real exchange rate in the short term, but increase domestic prices at least in the first two years after the shock.

This paper finds that capital expenditure is more sensitive than current expenditure to energy revenue shocks. A disaggregation of the various components of current expenditure shows that a positive energy revenue shock increases expenditure on transfers and subsidies and goods and services, more than the reduction observed following a negative shock. On the other hand, a positive energy revenue shock marginally increases expenditure on wages and salaries in the immediate period, followed by a decline in the second year and then an increase thereafter, compared to a negative energy revenue shock which sharply reduces expenditure on wages and salaries in the immediate period through the third year.

With respect to growth, a primary expenditure shock is found to increase growth but the effect of its components varies. Capital and current expenditure shocks increases growth by a similar magnitude in the short run. However, a shock to transfers and subsidies, although increasing growth in the immediate period, has a relatively large and statistically significant negative effect on economic growth. Similarly, a shock to wages and salaries reduces growth in the immediate period and the subsequent year, but it becomes positive thereafter, while a shock to expenditure on goods and services is positive and statistically significant.

The evidence assembled in this paper has important implications for a key policy challenge facing Trinidad and Tobago and by extension many energy exporting countries- i.e. managing fiscal retrenchment in a time of declining energy revenues and low growth. The evidence from the SVARs suggests that although primary expenditure increases growth, some categories of components are less growth-enhancing and hence these present a viable option for fiscal adjustment, without doing too much harm to growth prospects.

From a policy perspective, three important implications are identified. The first is for a detailed assessment of the various components of primary expenditure with the objective of reducing and or reorienting expenditure, particularly the “unproductive” parts such as transfers and subsidies, towards growth-enhancing areas. The extent to which such adjustments adversely affect the household welfare should be part of policy considerations. The second is the need for clear fiscal rules, and for the authorities to balance more effectively the role of fiscal policy as a growth stimulus. An important concern though, on the effectiveness of such Keynesian type policy, is the extent to which government expenditure stimulates import-based household consumption. If the latter effect is dominant, then growth effects may be small, but with adverse effects on the external accounts. This paper did not consider this issue but it is an area of forthcoming research. Thirdly, the country’s stabilization fund, which was designed to manage windfall energy revenues, should be revisited to make withdrawal and deposit rules more explicit and effective during periods of commodity booms.

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Annex A. Time Series Plots of Selected Macroeconomic Variables

